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Mirroring the City

Toward Web-Based Technologies to Support City Stakeholders in the Orchestration of Local Development Actions

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Declaration

I hereby declare that the contents and organisation of this thesis constitute my own original work and does not compromise in any way the rights of third parties, including those relating to the security of personal data.

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Lucia Lupi
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Credits logo design in the cover page: *Arch. Elena Lucia*

To all phoenixes

on their path

to reborn.

Resist. Fight.

Survive. Burn. Heal.

Rise again, brighter. Thrive.

And never forget.

ABSTRACT

Despite massive investments and high expectations, information technologies are not yet driving radical changes in the way city activities are planned, managed and governed, and even less in the way people interact in cities to address shared challenges collectively. In this landscape, smart city technologies limit their scope to monitoring physical phenomena in urban environments without directly supporting the social dynamics of local development processes. Differently, web-based technologies have profoundly revolutionised our experience of the city at an individual level, but they still struggle in infrastructuring the support to local actions that require continuous negotiation and mutual arrangements among public, private and third sector organisations in everyday activities, initiatives, services and projects in cities. The **limited impact of smart city technologies and the under-exploitation of the potentialities of web-based technologies in local development actions** are rooted in a disconnection between these technologies and the nature and quality of city dynamics, strongly tied to fluid relationships among different stakeholders affecting the definition of the priorities, constraints and applications of information technologies in urban settings.

This disconnection concerns:

a) the **model of the user** of such technologies, still focused on a customer-centred framing, ignoring the multiplicity of social structures, norms, relationships regulating city life

b) the **model of the city** as a physical background or a mosaic of activities instead than a system of systems working ecologically

c) the **roles and forms of support provided by technology** as an instrument, intermediary, or enabler of local actions, beyond its use as a communication amplifier.

This work addresses the problem of realigning the models of users, city and technology to city dynamics for exploring **how to design web-based technologies that could support city stakeholders in the orchestration of local development actions**. I focused on web-based technologies because of their potential to instantiate post-smartness city visions and the gulf between their technological readiness and socio-political readiness. I considered as city stakeholders: local governments, public agencies, business sector, non-profit organisations, knowledge cluster, and capital holders. I used the concept of orchestration to unite the forms of technological support to coordinative, cooperative or collaborative practices at intra and inter-level among different stakeholders into the city context.

Specifically, this work investigates the aspects to be considered for pursuing the **"political soundness"** of technology, intended as the technology capability of defining a pluralistic and fluid virtual space for different stakeholders. For this reason, the work focuses on the **collective experience** of cities and technology in local development actions. The research had been oriented by the design proposal of the **"City Mirror"**, as a meta-model for city-oriented web-based technologies recomposing the three disconnection issues mentioned above. This work analyses and discusses:

- the **factors to be considered in the design of city technologies that could facilitate the coexistence of different local stakeholders** with divergent or conflicting goals, and different practices, constraints, discourses in a shared virtual environment, as they actually do in urban environments and in local development processes
- how **city stakeholders could interact with/in/through this digital shared environment,** overcoming part of the limitations of current web-based technologies applied in urban activities
- the **implications of design choices and solutions for web-based technologies intended to support local development processes in a multi-purpose, multi-stakeholder, and multi-scalar environment** mirroring the interdependence among city systems, social structures and local actions.

The research had been developed within a **transdisciplinary research framework** in which design-driven explorations and analytic activities are intertwined to construct a better understanding of city dynamics by intervening in the context through prototypes and concepts instantiating alternative models of users' representations and relationships, connections among city activities, applications and purposes of web platforms. Within this research framework, a subset of urban and informatics disciplines had been used as disciplinary roots for the study by leveraging on their complementarity. They include **Urban Planning**, **Urban Design**, and **Urban Studies** on the one hand, **Computer-Supported Cooperative Work**, **Human-Computer Interaction Design**, and **Information Systems** on the other hand. The bridge among these disciplines had been built through the:

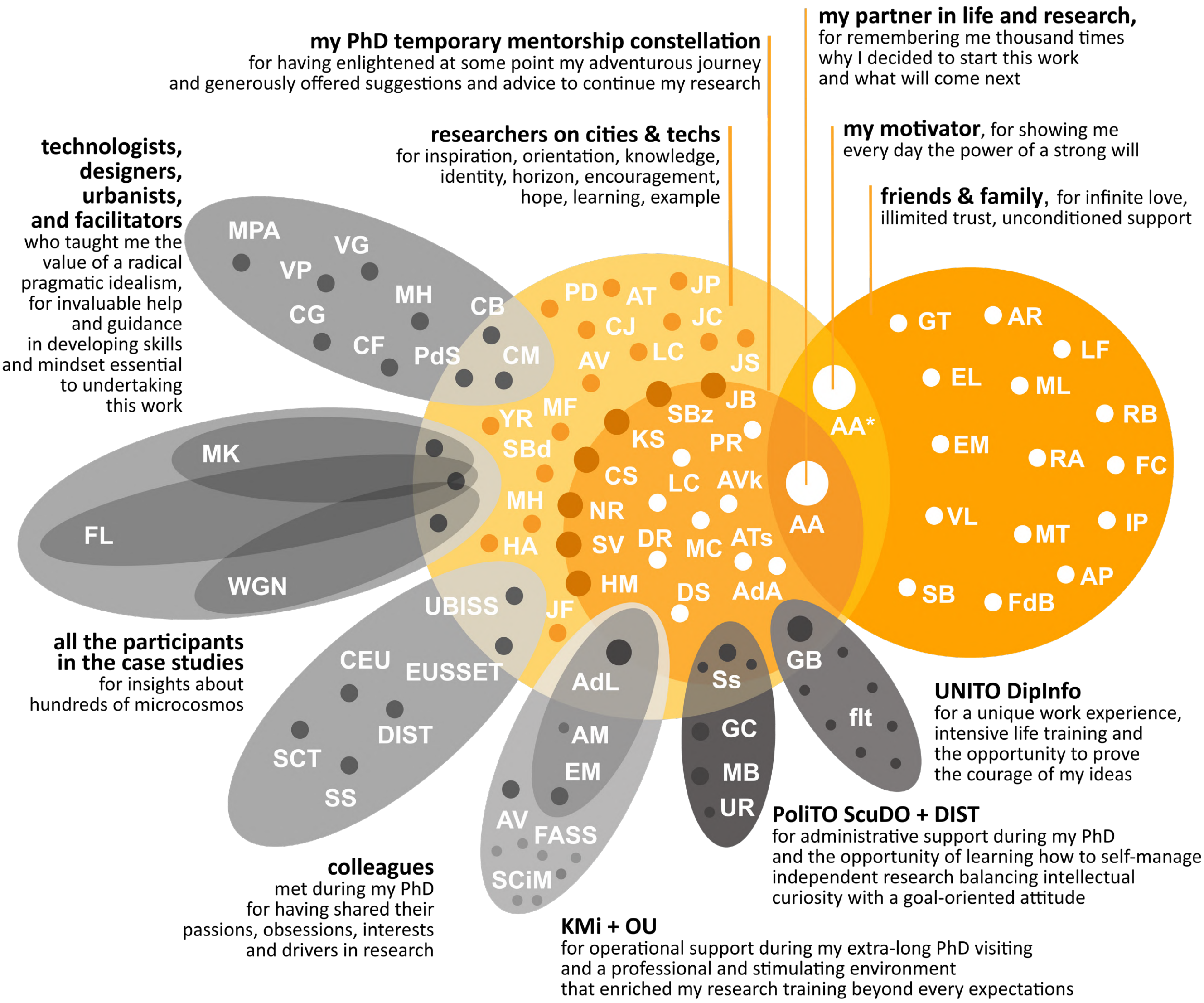
1. **hybridisation of concepts and theories**, used for developing the core models of the user, city systems, and forms of technology support to local actions, holistically reflecting the dynamics of urban environments
2. **hybridisation of methods and techniques**, implemented by considering and readapting approaches and tools to design and research activities recurring in both sets of disciplines
3. **production of technological artefacts** designed as negotiated digital urban infrastructures and used as boundary objects in research explorations.

The analysis and progressive conceptualisation of the pre-conditions for having a platform shared among multiple stakeholders, the technical characteristics to support local development actions and the implications of design choices intended to pursue this aim had been elaborated throughout three years of field activities. **Three case studies** covered the design process of three examples of web platforms intended to be multi-stakeholder, multi-purpose, and multi-scale, according to the design proposal of the City Mirror. The three case studies present, analyse and critically reflect on the potentialities, applications, and constraints of a **civic social network,** a **cooperative urban governance platform**, and a **city data open portal** as instantiations of the City Mirror proposal. Within this operational framework, Action Research methods combined with Participatory Design or Co-Design techniques have been applied in each case study to highlight the contextual and social constraints of real working environments in different domains of urban activities, as well as for elaborating a rich set of **applicative scenarios** for city technologies covering various types of local development processes. These experiences guided and informed the preliminary definition of a set of functional and non-functional **requirements** for implementing a meaningful, acceptable, and useful shared digital space under the perspective of the different classes of stakeholders involved into the design process of the three prototypes. In parallel, intervening in several different urban settings and local activities with prototypes of technologies built on logics contrasting the ones of the existing tools provided the opportunity to **reflect on the effects and implications of specific design choices** to enable city stakeholders in understanding better the complex context of their actions, making better decisions on the use of local resources, and activating synergies among urban initiatives. The insights and lessons learned across the three case studies had been progressively systematised, stratified, and consolidated by using procedures informed by Grounded Theory Methods and expressed in the form of a set of testable propositions.

The **output of the research process is a design theory of the capabilities of web-based technologies mirroring the city**, built by reintegrating and connecting the three core models of users, city, and role of technology under the light of the findings emerged from the empirical and applied research activities. The design theory presented along the entire thesis includes: the definition of the purpose and scope of city mirror technologies as design and research objects (Chapters 1 to 4); the conceptual constructs organising the underlying knowledge for their development (Chapter 5); the implementation principles and examples of instantiation of the theory corresponding to the three case studies (Chapters 6 to 9); and a set of testable propositions transferable to other settings through new technological artefacts informed by the models associated with the City Mirror proposal (Chapter 10).

ACKNOWLEDGEMENTS

I am grateful to all the people who accompanied me in the last years to bring this thesis to light.
I want to thank especially:



FOREWORDS

For planners and urban researchers. **This thesis is not about how to use existing digital technologies to support current planning practices.** It is the other way around. This thesis is about how to use the theoretical and practical knowledge coming from radical practices in city planning to inform the design of future web-based technologies to support local development processes in cities. The focus of this work is not on technology itself, but on people, their activities, their relationships. All those things that constitute what cities are and what should also be considered the core of technologies for cities. Unfortunately, many in the planning domain are nowadays fascinated by those technology-driven regressive utopias promising to make cities safer and cleaner, easy to predict and control. This thesis is driven instead by the profound belief that city planning is not about predicting what is probable. Planning is about shaping what is possible by interpreting city dynamics for acting, for changing the present, for building the future, and sometimes even fostering a better future for people. Planning is about envisioning this future by designing institutions, processes and strategies to make it possible, sometimes in impossible situations. That knowledge usually informs plans, projects and policies for cities dealing with their amazing complexity and vitality, without denying their nature. I am genuinely convinced that the same kind of knowledge has the potential to open new trajectories in the design of technologies to get cities flourishing even more than now, in the century of cities. It is worthy of giving it a try.

For technology developers and researchers in informatics. **This thesis does not include the computational notation of the models reported here.** That is one of my potential action plans for the next years. Do you want to help? Meanwhile, you could have a look at the way I decided to approach a kind of technologies for which the main matters of concern are not their performances, functionalities, or usability. What implies to embrace the vision of information systems embodied in the system of social norms of cities? How to render the dynamic continuous negotiations characterising social interactions in city technologies? There is some chance to concretely support inter-organisational and cross-networks collective actions through technology? I have not yet definitive answers, but I will keep searching for them. This is the start. I hope not the end.

For designers and design researchers. **This thesis is not strictly about the design of digital products and services, nor design methods and approaches.** In this work, design principles and practices are just instrumentally used to bridge distant domains, and to explore everyday activities in cities and the potentialities of web-based technologies from an intervention-oriented perspective. At the same time, this thesis is a strange design experiment of building a glass box around a self-organising mind that could appear as a black box from outside (but it is not), as C. J. Jones would say. Enjoy!

In the end. **This thesis is about crafting a thin surface between the two worlds of planning and technology through design.** More than one asked in the past years: “Why trying to do something so risky during a PhD?”. Because I am an adventurous person, maybe. But mostly because the kind of intellectual freedom you can benefit during a PhD programme (like the one I pursued) is something absolutely exceptional in academia (as I fully realised only later). I wanted to use this freedom in the best way I could imagine, for a few years. Now, I have the rest of my life (demographic statistics suggest over 40-50 years) to make this surface thicker and possibly find other people accompanying me in this journey.

TABLE OF CONTENTS

KEYWORDS

local development

cityness

post-smartness

collective actions

city complexity

institutional complexity

political soundness

power negotiation

deep design problem

systemic design

multi-stakeholder system

multi-purpose platform

multi-scale interactions

design theory

city mirror

web-based technologies

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LIST OF ACRONYMS

LG	Local Governments
PA	Public Agencies
BS	Business Sector
CH	Capital Holders
KC	Knowledge Cluster
NPO	Non-Profit Organisations
TD	Transdisciplinarity
TIPS	Transdisciplinary Integrated Planning and Synthesis
TIDS	Transdisciplinary Integrated Design and Synthesis
IS	Information Systems
CSCW	Computer Supported Cooperative Systems
HCI	Human Computer Interaction
HCID - HCI/d	Human Computer Interaction Design
UP	Urban Planning
US	Urban Studies
UD	Urban Design
PESTLE	Political Economic Social Technological Legal Environmental context analysis
ESTPOL	Economic Socio-cultural Technological Political Organisational Legal context analysis
SWOT	Strengths Weaknesses Opportunities Threats framework
SWOT+[ND]	Strengths Weaknesses Opportunities Threats + Needs and Desiderata framework
3Cs	Coordination, Cooperation and Collaboration
FL	FirstLife
WGN	WeGovNow
MKiO	MK Intelligence Observatory
DR	Research for Design indicated as Design Research
RtD	Research through Design
AR	Action Research
GT	Grounded Theory
PD	Participatory Design
CSN	Civic Social Network
QBINA	Question-Based Information Needs Aggregator
CCIS	Contested Collective Intelligence Systems
CPD	City Data Plan
OGD	Open Government Data
OD	Open Data
AOD	Actionable Open Data

NOTES TO THE READER

Reading options. The thesis had been prepared to support different ways and levels of engagement with the text, based on the time constraints and interests of readers.
In yellow, the suggested parts for different reading experiences taking from half an hour to a few days.
In grey, the suggested additional chapter components to smoothly move to the next level.

		CHAPTERS COMPONENTS							
Reader's profiles	**Reader's contingencies**	Detailed Tables of contents	Chapters Overview	Chapter Highlights	images + captions	titles + bold texts	tables + diagrams	some chapters + recap	Thesis text
reluctant reader	no time - no interest	*Max 30'*							
casual reader	no time - little interest		*Max 45'*						
sceptical reader	little time – checking compatibility			*Max 1h*					
flying reader	little time - general interest in key concepts				*2-3 h*				
neutral reader	little time – scanning option					*4-5 h*			
focused reader	little time – very specific concerns						*6-7 h*		
generous reader	limited time and strong interest in a few chapters only							*Flexible 8 to 80 h*	
committed reader	time, interest and commitment to read the thesis								*My Estimate 80 h*

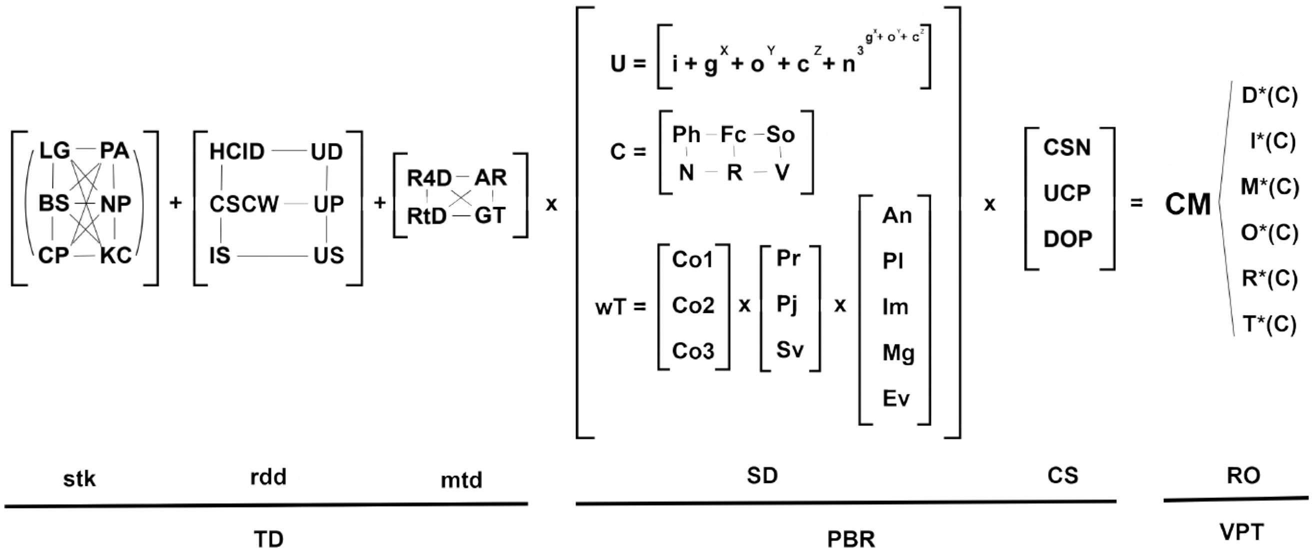
The thesis had also been written for a diversified audience belonging to two macro-communities. In the hope of fostering future dialogue, there is the attempt to create a common ground by defining key concepts or methods and always explaining them from both perspectives (and this attempt made the thesis longer than I expected…). Empathising with potential readers, if any, I tried to make up for this issue by structuring the chapters to facilitate the efficient navigation of the text. The reader can focus only on what considered familiar or approaching something coming from "the other side" as I wish.

Orientation code. If visual-only options were acceptable options for a thesis, I would have certainly opted for them, but apparently it is necessary to stick to ordered sequences of words. At least, contents thematically or operationally related are consistently associated with a specific colour code helping the reader to follow them across and within the various chapters.

City Mirrors model	
Research aspects	
Design aspects	
City stakeholders	
Technology Providers	

Users	
Cities	
Technology	
Case study 1	
Case Study 2	
Case study 3	

Alchemical Option. For those preferring spatial arrangements of contents (like me), the thesis is also summarised in this pseudo-formula schema. Just as an alternative to the previous reading options. It contains almost everything anyway, but in a different form.



CM: City Mirror; **TD**: Trandisciplinarity; **stk**: city stakeholders; **LG**: Local Government; **PA**: Public Agencies; **KC**: Knowledge Cluster; BS: Business Sector; NP: Non Profit organisations; **CP**: Capital; **rdd**: relevant disciplinary domains; **CSCW:** Computer Supported Cooperative Work; **HCID:** Human Computer Interaction Design; **IS**: Information Systems; **UP**: Urban Planning; **UD**: Urban Design; **US**: Urban Studies; **mtd**: research methods: **R4D**: Research for Design; **RtD**: Research through Design; **AR**: Action Research; **GT**: Grounded Theory; **SD**: Systemic Design; **U**: User; **i**: individuals; **g**: groups; **o**: organisations; **c**: communities; **n**: networks; **C**: City; **Ph**: Physical System; **Fc**: Functional System; **So**: Social System; **N**: Needs; **R**: Relationships; **V**: Values; **wT**: web-based Technologies; **Co1**:Coordination; **Co2**:Cooperation; **Co3**: Collaboration; **Pr**: Programme; **Pj**: Project; **Sv**: Service; **An**: Analysis; **Pl**: Planning; **Im**: Implementation; **Mg**: Management; **Ev**: Evaluation; **PBR**: Practice-Based Research; **CS**: Case Studies; **CSN**: Civic Social Network; **UCP**: Urban Collaborative Platform; **DOP**: Data Open Portal; **VPT**: Very Provisional Theory; **RO**: Research Output; **CM capabilities** > **D*(C)**: Dialoguing with the City stakeholders; **I*(C)**: Interpreting City dynamics; **M*(C)**: Maintaning the City; **O*(C)**: Observing the City changing; **R*(C)**: Reading the City; **T*(C)**: Transforming the City.

CHAPTER 1.

INTRODUCING THE PROBLEM

CHAPTER 1. OVERVIEW

Chapter 1 introduces the problem addressed by this work and the overall research questions that oriented the research process. Chapter 1 is organised into six sections, as follows.

- Section 1.1 **delineates the two intertwined problems** of the marginality of smart city technologies in city activities and the under-exploitation of web-based technologies to support these activities at a collective level. These two problems prevent information technologies from meeting the expectations associated with their role as a driver of local development processes, refusing to address the centrality of collective actions in cities by taking explicitly into account the political assumptions and visions leading to the development of specific technological solutions.

- Section 1.2 focuses on the **reasons for the under-exploitation of web-based technologies in cities** by looking at the aims, theories and practices informing their design from the perspective of city planning (as a domain grounded on the understanding of urban dynamics and specifically oriented toward local development goals).

- Section 1.3 **points out that the nature of the problem** of rethinking the scope and functionalities of web-based technologies to make them supporting collective actions in the city is a deep design problem. This problem requires to combine research and design experimentation to translate city dynamics in digital technologies providing alternatives to current solutions. The main research questions are then formulated based on the previous analysis and the nature of the problem.

- Section 1.4 **specifies the definitions of the key concepts** mentioned in the overall research question and recurring throughout the dissertation, such as web-based technologies, city stakeholders, local development actions, and orchestration.

- Section 1.5. states the aspects defining the **novelty and originality of the work**.

- Section 1.6 presents **the outline** of the volume by anticipating the goals and contents of each chapter.

This chapter provides the foundations for the following chapters. In particular, Chapters 2 is going to present the research framework configured in this work for addressing the stated problem. Then, Chapter 3 deepens the analysis of the problem introduced in Chapter 1, with the aim of converting the *"real-world problem"* of the limited impact of web-based technologies in structuring collective actions in the city into a *"knowledge problem"* that can be investigated through research. Chapter 4 outlines the state of the art of web-based technologies having urban applications by discussing their underlying models and assumptions.

CHAPTER 1. DETAILED TABLE OF CONTENTS

1.1 INTRODUCTION

1.1.1. PROBLEM STATEMENT

Information technologies are increasingly burdened by the **highest expectations** as regarding the growth of cities, their future sustainability and the improvement of their socio-economic resilience. Indeed, **information technologies applied in urban contexts are often considered as the potential solution to address:**

- **social challenges** associated with the on-going demographic and cultural transformations
- **political challenges** due to the tension between democratisation and control
- **economic challenges** determined by the interdependence between local and global phenomena
- **environmental challenges** related to sustainable use of available resources.

Nevertheless, information technologies are **not yet driving radical changes** in the way city activities are planned, lived, managed and governed, and even less in the way people interact in cities to collectively address these shared challenges. **Information technologies are still marginal in all the types of collective actions determining the functioning of cities and the quality of city life, and more in general local development processes.** The collective actions I refer include, for instance:

- running public and private services
- setting up and operating local productive activities
- planning and implementing programmes, projects and initiatives at the local scale
- organising the transformation of the built environment
- making and implementing policies toward new urban governance models
- orienting economic investments on local businesses in a glocal perspective
- working on community development to consolidate social innovation processes
- generating actionable knowledge to address local issues by composing efforts and resources
- building pluralistic visions for the future of the city.

As I am going to specify later in this chapter, **the distance between expectations and reality is the result of a status quo characterised by the predominance of commercial and governmental technologies excluding the "collective dimension" from the range of supported actions in urban environments.** As will be analysed in the next chapters, this gap can be linked to the fact that the functioning of cities and the dynamics of local development are based on actions collectively undertaken by composing the diverse instances of a plurality of subjects acting within, with and across highly structured and spatialised social entities. However, these social entities do not find their representation and operational support in current commercial and governmental technologies.

The **choice of excluding this collective dimension from the ones supported by current technologies for cities** (despite its centrality in city dynamics) **is, first of all, contingent**. Thus, this choice can be subjected to potential changes in the near future. In other terms, it is a choice due to a series of provisional constraints that can be contested, overcome, addressed, or circumvented for **reorienting these technologies** to better meet the general expectations mentioned above [see Chapters 3 and 4], as long as **potential alternatives become economically viable from a business perspective**. Most importantly, **the exclusion of the collective**

dimension from current technologies for cities is a political choice[1], implicitly or intentionally instantiated in specific technological products.

Political choices can be seen as choices among conflicting alternatives in the vision of the world [Mouffe 2005]. In this sense, in the perspective driving this work, **the choice of not focusing technology support on collectivities is seen as the result of a preference accorded to a specific vision of the urban reality**[2] **and not the consequence of intrinsic capabilities or limitations of technologies for cities**. The adopted perspective, explicitly expressed and discussed throughout this thesis, is equidistant both from outdated techno-solutionist tendencies and nostalgic anti-technology longings. I keep my distance from these extreme positions, as nowadays required for a pondered understanding of technology that can enlighten its underlying assumptions on the context in which it is intended to be used and the effects of technology itself on that context [Harbers 2005].

On this ground, **I have decided to investigate how information technologies can better target collective actions in cities**. Firstly, by **overcoming the current constraints in the forms of support** provided through existing technologies and dealing with unavoidable political choices. And then, by exploring **new conceptual models for technology solutions** intentionally aimed at enhancing, amplifying, composing the diverse instances characterising city dynamics in local development processes.

1.1.2 SMART CITY TECHNOLOGIES AND WEB-BASED TECHNOLOGIES AS URBAN AND CITY TECHNOLOGIES

When we refer to information technologies for cities, it is essential to clarify the distinction between smart city technologies and web-based technologies in order to better understand the different reasons of their current marginality in local development processes [see Fig. 1.1.].

Smart city technologies include applications based on Internet of Things (IoT) devices, sensors, big data analytics, geographic information systems, virtual reality [Lim & Maglio 2018a]. Recently, smart city technologies are increasingly including artificial intelligence solutions [Allam & Dhunny 2019]. These technologies are primarily oriented to "***connect things to people***" [Lim & Maglio 2018b]. Their capabilities range from collecting data about the context, to automatically elaborating data through computation, from transferring data within a system or among multiple systems to making data accessible to users through web services. The web services associated with the deployment of smart city technologies do not necessarily rely on online platforms accessible via web to the public. Usually, the full access to these services is closed or reserved to the owners/clients of technology products and supply contracts. The main goal of smart city technologies is **monitoring the urban fabric** (i.e. the physical environment of the city) through solutions developed in the areas of smart home, smart energy, smart security, smart transport, and smart logistic [Lim & Maglio 2018a].

This characterisation of smart city technologies is also reflected by the nature of smart city initiatives. These initiatives are still focused on *"hard domains"* such as resource management, mobility, energy, building, instead than *"soft domains"* such as living, government, education, economy and culture [Neirotti et al.

[1] Several authors across a number of disciplines provided their own definitions of what is "the political" and what is "the politics". What is relevant for this work is clarifying that the adjective "political" is never used here in relation to the mechanisms of politics in democratic and/or representative forms of government, but as a dimension to which we refer for identifying collective formations and their actions in society [see also Barry 2001, Mouffe 2013 for further clarifications on this use of the term "political"].
[2] Analysed and discussed in Chapters 3, 4 and 5.

2014]. While the research (and the public discourse) on smart cities moved already toward new people-centred paradigms [see e.g. Concilio & Rizzo 2016, Lara et al. 2016, Schaffer et al. 2011], smart city technologies still do not provide support to communities, governance arrangements, well-being and local development. Nevertheless, these themes constitute fundamental axes of all recent smart city frameworks [e.g. Nam & Pardo 2011, Lee et al. 2014, Joshi et al. 2016, Fernandez-Anez et al. 2018, Yigitcanlar et al. 2018].

The self-confinement of smart city technologies in a set of narrow domains is certainly one of the causes of their marginality in city life. On one side, **smart city technologies are not engaged in processes oriented to generate local development**, enhance city identities, reinforce quality and value of the urban innovation system [Han & Hawken 2018]. Their application is simply instrumental in improving the management of physical and infrastructural urban resources. On the other side, the **intrinsic technical limitations** of smart technologies prevent their support to complex social dynamics. Monitoring the urban fabric and elaborating data on physical phenomena traceable by sensors can possibly provide evidence of facts and some trends. But the limited range of data that can be extracted from the context in which these technologies are deployed only indirectly enable people to communicate for activating, infrastructuring, managing local development processes.

Differently from smart city technologies, **web-based technologies** already had a profound impact on the way people live in city, organise their own activities and made individual decisions [Aurigi 2016, Finck & Ranchordas 2016, Kumar 2014]. Web-based technologies include a wide range of information systems such as sharing platforms (e.g. AirB&B, Uber), social networking sites (e.g. Facebook, Twitter), location-based services (e.g. Google Maps), community forums, but also e-gov services, voting tools, self-organisation applications and so on. The point in common among all these web-based technologies is that they are explicitly meant to **connect people through information exchange**, enable people to learn, initiate relationships, organise shared activities, facilitate the discovery and fruition of places and services.

Nevertheless, web-based technologies are still marginal in the smart city technology market, even though this situation is recently starting to change[3]. The overlapping between web-based technologies and smart city initiatives is usually limited to the axes of *"smart government"* and *"smart citizenship"* [defined in the framework of Nam & Pardo 2011]. In these cases, the adjective "smart" is simply adopted as a new label for standard e-government tools aimed at simplifying the access to basic public services or the evaluation of public decisions.

Interestingly, web-based technologies specifically designated for citizens engagement under smart city paradigms usually have a quite limited number of users, even in cities with millions of inhabitants and a potential vast user basin (see also Chapter 4). This situation contrasts with the fact that successful commercial web-based technologies have millions of users, or even billions in some cases. It is evident that using existing web-based technologies in association with smart city initiatives is not enough to get them working as well as they do in other domains (e.g. logistic, online commerce, social networking). As a result, web-based technologies are still deeply under-exploited to implement people-centred smart city visions, despite their focus on connecting people and their enormous potentialities in terms of versatility, flexibility, pervasiveness and accessibility.

[3] The major ICT company providing web services in the world, Google, started to be engaged in the smart city sector with the ambition and means to revolutionize it. https://www.sidewalklabs.com/

Summarising:

- **smart city technologies** virtually enable the urban fabric *"talking to us"* by monitoring consistence and functioning of urban resources and infrastructures. At the same time, smart city technologies render very marginally local activities, without providing support to their direct implementation by facilitating the communication among people.
- **web-based technologies**, designed to enable communication among people, have already a deep impact on individuals' lives in urban contexts. Still, web-based technologies struggle in scaling up their forms of support from services targeted on individuals' needs to services tailored on the collective challenges in cities.

In this sense, **smart city technologies** can be considered primarily as **"Urban Technologies"** (focused on the physical environment of cities), whilst **web-based technologies** have the potential for becoming **"City Technologies"** (focused on social dynamics and local activities of cities). Urban Technologies tend toward reductionist visions of the city and generalisations of the urban environment flattened and selectively restricted to a few components, such as mobility infrastructures and utilities. **City technologies** ideally embrace the complexity of cities and the fact that their essence is the **negotiation** in a myriad of social settings [Bertuglia e Vaio 2019]. More in general, the distinction between Urban and City Technologies simply reframes the consolidated double vision of the city in its materiality and as a socio-political entity, respectively indicated with the two Latin terms of *"Urbes"* and *"Civitas"* [Cacciari 2004].

In this work, I have decided to concentrate my attention on City Technologies, and thus on web-based technologies. I refer to **City Technologies as the ones focused on the city as the context of people's actions and technology as a medium, instrument, intermediary, or enabler of these actions within the vision of the City as a socio-political entity.** As specified in the previous section, the choice of targeting collective actions in this work imposes to explicitly dealing with the link between technology capabilities and the account of the political assumptions and implications of their use in the city context.

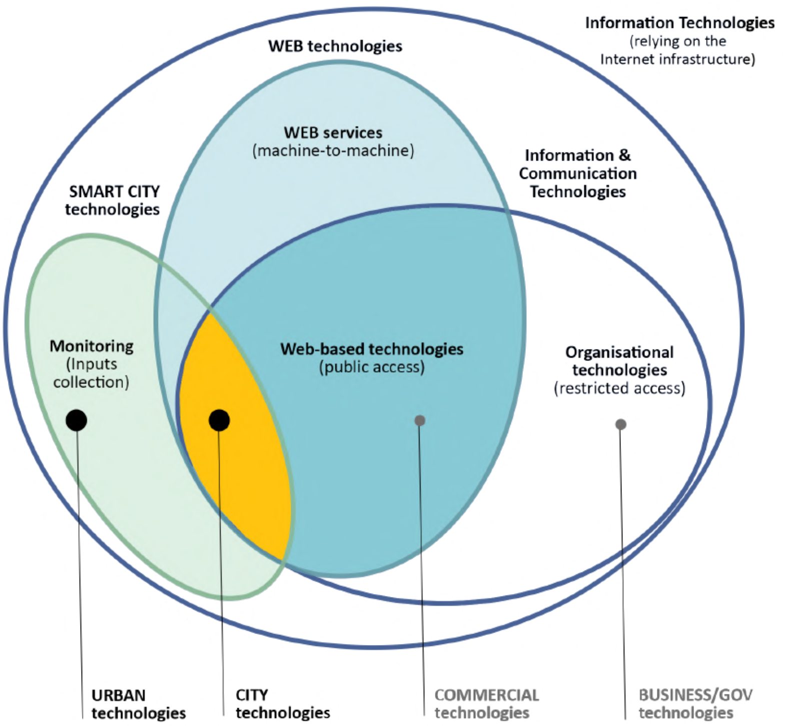


Fig 1.1. Smart and web-based technologies in the information technologies landscape

1.1.3 RELEVANCE OF THE PROBLEM

The expectations associated with information technologies applied in city activities are currently not met by the **limited capabilities of smart city technologies**. They also remain unaddressed because of the **under-exploitation of web-based technologies capabilities.** This misalignment between expectations and current technological solutions for cities is a critical problem for effectively sustaining future local development processes and exploiting new technologies.

The **relevance of investigating how information technologies could meet the expectations of improving local development** is because their current marginality and under-exploitation have direct negative consequences at an economic, socio-political, and cultural level.

Economic aspects. Information technologies in cities are supposed to support and improve the management of tangible and intangible local resources. However, **resource allocation and optimisation issues cannot be adequately addressed by relying only on information related to the urban fabric's monitoring because resource allocation and optimisation issues preponderantly pertain to social arrangements to put resources in use**. The lack of significant and comprehensive information about these social arrangements in city activities prevent technologies from providing solutions to improve synergies and collective actions, maximise development opportunities, helping in the sustainable use of local resources. It is essential to point out that the appropriate solutions for each context cannot even be designed without a clear understanding of what kind of information we need for these purposes.

It must also be considered that the **smart city market** (intended as the market sector of information technologies for cities) is becoming one of the biggest fast-growing sectors related to ICTs in the world. This market is expected to pass the symbolic revenue threshold of 2.5 trillion by 2025, well beyond the one related to the global arms trade[4]. This crude comparison helps to keep in mind that spending in ICTs solutions for cities more than in arms (as it is already happening) imposes to critically reflect on the chance of turning these investments toward development outcomes or turning smart city technologies in arms themselves. Besides that, from an economic perspective, it is important to consider that the smart city market is still fed primarily by public sector investments, widely intended to be used for generating collective benefits because linked to the direct and indirect tax levy. **Investing massive public funds in ineffective smart city solutions or technologies that do not bring positive effects for the collectivity is increasingly becoming less acceptable.** It is also more problematic than in the past years due to austerity measures in many countries and a more attentive public opinion on these topics. The new economic crisis triggered by the COVID pandemic will furtherly stress the need for impactful and development-oriented solutions. Thus, it is economically relevant to investigate how to realign expectations and reality between the goals pursued through technology deployment and their actual capabilities.

Socio-political aspects. Since the economic crisis of 2008, States and the public sector become the main clients of smart city technologies providers, as subjects having budget and means to access their services or trade in benefits [see also more extended explanations in Chapter 3]. This situation determined a status quo in which **the benefits coming from the use of technology in cities are unequally redistributed between major ICT companies and governments partnering on one side, and the society at large on the other side.**

[4] These projections had been elaborated by the Research and Consulting Group Frost&Sullivan in 2018 (https://go.frost.com/VIG_SmartCities), and they are still growing year after year. To have a term of comparison, the smart city market in 2025 will surpass the financial value of the global arms trade, that is one of the biggest trade sectors, and that was estimated in 2017 at 1.74 trillions by the Stockholm International Peace Research Institute (SIPRI http://www.visual.sipri.org/). It means that, globally, States already spend in smart city technologies more than in arms.

Year after year, all around the world, protest movements against ICT companies raised to challenge their entitlement to condition city developments (such as against Sidewalk in Toronto). In parallel, numerous institutional initiatives emerged to also limit the influence of multi-national ICT companies destabilising urban dynamics and local governments even when not providing services directly linked to city activities (e.g. initiatives driven by the municipality of Barcelona). New EU policies[5] propose to address part of these problems at a higher level, setting a common framework of minimum standards to mitigate the risks of authoritarian regimes based on the coalitions between government and technology providers, but also the systemic social problems linked to the monopoly position of certain technology providers. Nonetheless, **alternative technological solutions ensuring a better distribution of the benefits coming from the access to specific technology application in cities are still missing**.

The events happened in 2020 further highlighted the deepness of social disparities and the fundamental role that information technologies could and should have in cities to cope with unprecedented collective challenges. On this ground, from a socio-political perspective, the relevance of realigning how to align expectations and technology capabilities to promote local development acquires clear evidence.

Cultural aspects. Rethinking the applicative areas of technology in cities from hard to soft domains is also a way to move in the direction of technologies supporting the "cityness" and not a technocentric "smartness". Considering cities as socio-political entities and not just as a type of anthropic landscape with a dense aggregation of buildings, that is the key standpoint of this work [see section 1.1.2], it is necessary to frame cities as spatial aggregation of capital, knowledge and infrastructures, both tangible and intangible. These resources are established, maintained and developed through people interactions defined by shared norms in peculiar local cultures. Even though it can be daunting the challenge of clarifying nature and type of these cultural norms "making the cityness", ignoring these cultural norms is certainly detrimental, not only from a cultural perspective, but more concretely at an economic, social and political level.

Misunderstanding, undermining or ignoring the potentialities of the cityness determines a dangerous **cultural flattening of different urban contexts** that lead to **missing growth opportunities, suffocating innovation processes and cultural ecosystems, underusing local social and institutional capital**. In this sense, understanding how to realign city technologies with local cultural norms becomes a relevant priority for improving the impact of technologies at the local level in ways sustainable from a business perspective.

Academic relevance. These aspects, discussed in detail in Chapter 3, constitute strong drivers for this work, forcing to connect this research with real-world issues. Undertaking research deeply anchored to these issues wants to be an attempt of translating the outputs of research on cities and technologies in inputs for technologies that in the future could help cities in working better as a whole starting to meet the high expectations in their potentialities. So far, technology development is driven by growing computational capabilities in elaborating urban data. At the same time, people-centred smart city visions elaborated in academia are progressively oriented toward topics such as people's needs, institutions, governance, sustainability, community resilience. **From an academic perspective, it is an interesting open challenge to understand if it is possible to build some connection between these two detached strands apparently going in opposite directions. Its relevance is in the process, regardless of the results.**

[5] The Digital Services Act: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/digital-services-act-ensuring-safe-and-accountable-online-environment_en;
The Digital Market Act: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en

1.1.4 POSITIONING THIS WORK RESPECT TO URBAN DEVELOPMENT RESEARCH

This thesis had been prepared as a research output of a PhD in Urban and Regional Development. The framing of the topic and, most of all, the way of approaching this topic is tough rather unusual for a thesis in this field. Moreover, the aim of deeply engaging with other fields belonging to Informatics and address them directly [see Chapter 2] is perhaps even less common. In this section, I am going to clarify my vision of this kind of research respect to urban and planning research.

A significant part of urban and planning research, especially sociological urban studies and technical planning research , is already focused on understanding how to address current urban problems and support planning practices by using existing or emerging digital technologies[6]. The implicit and obvious assumption within this segment of research is that **the definition of new technologies for cities is beyond the scope of urban research.** Thus, the efforts should be focused on making the best out of what is existing in the technology landscape, even if it does not fit with needs, expectations, constraints and practices in urban contexts, not even the ones of urban practitioners. This orientation has been consolidated for decades, since the introduction of information technologies in the practice of professionals and researchers operating on the built environment [Steenson 2017].

The work reported in this thesis goes in an alternative direction [see Steenson 2017 for other examples of this kind of attempts]. **I propose using the knowledge of cities consolidated in urban research and planning practices to inform the development of future web-based technologies designed to support local development processes. The explicit assumption of this choice is that web-based technologies aimed at infrastructuring collective actions in the city should be considered as urban infrastructures**. As such, inputs from planning theories, methods, and practices, that are usually aimed at modelling tangible and intangible urban infrastructures and processes, can also contribute in defining better *"digital places"* in which people share the same space and collectively structure their activities as they do in cities [Arango 2018]. My "counter-orientation" is based on two essential considerations.

At a practical level, planning practice and research are primarily oriented to make possible the coexistence of a plurality of social groups, instances, goals, operational frameworks in the perspective of improving the chances for positive future developments and urban growth [Gunder et al. 2018]. This general and aspirational aim tends to be true irrespectively from the specific planning traditions or urban research community. **Considering that the core problem with web-based technologies in cities is understanding how they can support collective actions, we face a class of problems with several analogies with the problem of elaborating plans for cities that are the instrument aimed at collectively structuring actions in cities.** Thus, it is worth exploring how inputs from planning (and accessory disciplines) could be incorporated in the development of web-based technologies for cities.

At a higher level, my orientation is informed by the Friedmann's vision on the scope of planning research. He wrote that *"all planning must confront the meta-theoretical problem of how to make technical knowledge in planning effective in informing public action. The major object of planning theory is to solve this meta-theorethical*

[6] In Urban Planning, Geographical Information Systems (GIS) are the key technology meant to help professionals in resources and land use management tasks, possibly combined with the use of parametric modelling tools (e.g. BIM, AR, VR), decision support systems, and recently with smart city technologies for big data processing. Differently, many city planning initiatives documented in literature turn toward web-based technologies as key resources for public participation in local projects and plans [e.g. Kingston 2007, Hanzl 2007, Evans-Cowley & Hollander 2010, Fredericks & Foth 2013, Falco & Kleinhans 2018]. In this sense, Urban Planning turns toward Urban technologies, while City Planning tends to turn toward City Technologies. Even though the differences between Urban and City Planning are fading at the level of theorethical or practical approaches, the interest in different types of technologies persist.

problem. If it is not solved, planners will end up talking only to themselves and eventually will become irrelevant." [Friedmann 1987]. **Nowadays, information technologies shape the nature and effects of public and private actions into the public domain of cities. In my view, this fact gives a new form at the same crucial meta-theoretical problem of sharing planning knowledge into actionable forms with the new actors defining the role of technologies in cities (ICT companies and decision makers) and what kind of technologies are chosen to instantiate specific visions of future cities.** These technologies and visions can be ethical or not, balanced or not, sustainable or not. This depends on our understanding of city dynamics and the impact of these technologies at the local level on real-world issues. Thus, I argue that **contributing to strengthening the role of web-based technologies to support collective actions in cities is also a problem that should be situated at the core of contemporary and future urban development research to keep planning remaining relevant in local decision processes.**

It is useful mentioning that the object of urban development research and planning can be intended in several different ways. They are grouped in planning practice under the two labels of Urban and City Planning, respectively conceived as *"design-oriented physical planning"* and *"policy-oriented socioeconomic planning"* [Gleye 2015]. **Urban planning is historically linked to the management of the material aspects of urban development, such as land use, building regulations, mobility plans, industrial installations. City planning instead looks at the improvement of community life, public participation, decision-making processes and placemaking as the result of social, cultural and economic dynamics contextualised in the urban environment.** In recent years, the distinction between Urban and City planning is increasingly fading thanks to the growing relevance of theories and practices oriented toward integrated planning [Healey 2000], bottom-up initiatives triggering urban regeneration processes [Batty 2012], tactical urbanism practices [Silva 2016] and collaborative governance models reframing even the entire City as a commons [Foster & Iaione 2015]. All of these theories and practices envisioning the fusion of Urban and City planning insist indeed on the intrinsic interdependence between the qualities of urban spaces and social, institutional and economic changes. In addition, planning approaches are now predominantly oriented toward enabling progressive or radical changes in the way of managing and using city resources among different social forces in the city. Contemporary approaches to planning are based on paradigms completely different from top-down planning approaches popular in the past century and aimed at consolidating the status quo [Steinø 2013], even though examples of conservative attitudes can be found around the world.

By referring to this short overview of the different perspectives in urban development research and planning, **I considered almost exclusively the inputs coming from experiences and theories dealing with the immaterial aspects of city dynamics**: social groups and communities, governance models, institutions structures, roles and responsibilities of different actors in local actions, constraints and factors of local development processes. In this work, I relied on these inputs for the theoretical, methodological and empirical aspects of the research, as I am going to illustrate in the next sections and chapters.

In this regard, it is also worthy to made explicit two more points. First, urban research and **planning research** (i.e. in short, how cities are and how to transform them) often and extensively overlap. Second, planning research tends to be explicitly linked to **practical and theorethical reflections on the political aspects of city dynamics.** For this reason, it constitutes a primary source of this work because, as stated at the beginning, **the problem of technologies not supporting collective actions is a problem rooted in specific political visions of the city** even if obscured and kept tacit.

Indeed, it is still common to consider technologies as *"antipolitical instruments"* [Barry 2001], meant to remove the complexity and messiness of addressing the political aspects of the activities they support. On the contrary, the space for technology, defined by Barry as *"technological zone"*, is the space for the definition, representation and implementation of collective practices that cannot escape to political considerations.

Recently, especially in various domain of Informatics and Systems Design, the political implications of the use of technologies and the politics behind specific design choices for their development gained growing attention. At the same time, the focus on local applications of technologies, especially web-based technologies, and their relationships with the city context remained stable in the last two decades. **Composing the attention to "the political" in its practical aspects with the focus on "the local" is the strong characterisation of planning research**, as explained above. Thus, in this work, I propose to use this kind of knowledge elaborated in planning and urban research to move forward also in addressing the specific problems under consideration for the development of technologies reducing the gap between expectations and reality. In this sense, I consciously position my work on the perimeter of urban development research with the aspiration of expanding its radius.

1.2 UNFOLDING THE NATURE OF THE PROBLEM FROM A CITY PLANNING PERSPECTIVE

The under-exploitation of web-based technologies in collective actions at the city level can be partially unfolded by looking at these technologies from the perspective of city planning aims, theories and practices. Indeed, as mentioned before, city planning is a domain of research and practice deeply grounded on the understanding of city dynamics to inform actions in urban contexts and orient these actions toward local development goals. On this ground, reflecting on the misalignments and convergences between the perspective of city planning and the current approaches applied in shaping web-based technologies applied in urban settings can clarify some of the existing limitations and obstacles for a more extended integration of these technologies in city life and local development processes. At the same time, reasoning on these limitations helps to outline the exact boundaries of this work.

The notes on the misalignments and convergences between the perspective of city planning and the definition of web-based technologies for cities had been organised according to the three axes of **people**, **city**[7] and **technology** that constitute the key dimensions for reflecting on the role of technology in urban contexts [see also Foth 2008]. The orthogonal axis is articulated in aim, theories and practices for organising the analysis at an ideal, abstract and concrete level.

1.2.2 CITY PLANNING AND WEB-BASED TECHNOLOGIES: MISALIGNMENTS

One of the main limitations of current urban applications of web-based technologies is linked to the profound contrast between the specificity of each urban context and the generality of the digital environments defined by existing tools. The dichotomy specific/general is indeed also reflected toward the development of **technology-driven replicable solutions** (virtually applicable everywhere) and the more **contingent use of technology** in city activities, assessed case by case and influenced by a plurality of local constraints.

The misalignments between urban applications of web-based technologies and city planning perspectives resulting from the **dichotomies specific/general and contingent/replicable** are grounded on different aims associated with the use of technology in urban contexts, different theoretical assumptions, and lead to parallel practices [see Table 1.1].

[7] The axis of City corresponds to the one of "places" in the conceptualisation of [Foth 2008].

Technology. Technology is often publicly represented as "the fixer" of urban issues and complex problems under a tech-solutionism paradigm [Morozov 2013]. But the use of web-based technologies is usually more pragmatically framed only as instrumental for amplifying the voices of the different actors operating in the public arena by offering them an additional communication channel [Scholz 2008]. While the aim of technology is ideally projected to address and overcome urban problems directly, technology users rarely consider relying on technology for finding solutions to local problems. At best, web-based technologies are used for communicating problems and solutions, but rarely to structure actions for addressing them.

The theoretical foundations of this different framing of technology by its providers and the intended users are based on two opposite visions of local engagement. On one side, the principles of the *"networked individualism"* support the idea that single users act individually, driven by their own purposes and needs, and at the same time, they can potentially achieve goals relevant at a social level because of the intrinsic capabilities of networking technologies [Wittel 2001]. On the other side, the perspective of city planning finds its basis in theories of collective actions as a collective process structured within and across institutions and social groups to increase the local capital [Rydin & Pennington 2000, Healey 2003]. Thus, it is not the sum of individual actions that can help address local problems, but their organic composition accordingly to shared norms at a collective level.

These different foundations deeply affect also the practices supported by web-based technologies or the ones associated with city initiatives. Web-based technologies are indeed intentionally designed to support individual decisions, both for personal or public purposes (such as choosing a restaurant or voting in digital assemblies). On the contrary, acting into the public domain of cities relies on social practices of cooperation, learning and participation aimed at collectively building shared meanings and actions with others, beyond the individual and personal sphere, even without converging on the same positions or goals [Hajer 2001].

People. Shifting from the axis of technology to the one of people, empowerment seems to be the aim of both urban applications of web-based technologies and city planning initiatives. Empowerment can be direct toward improving the capacity to act of individuals and groups (*power-to*) or to renegotiate the relationships between multiple actors (*power-over*) [Schneider et al. 2018]. However, the design of technologies, web tools included, privileges forms of psychological empowerment based on access to information or new experiences that can improve individuals' perceptions, knowledge and activities [Schneider et al. 2018, Zimmerman 1995]. On the contrary, direct engagement in urban actions from the perspective of city planning looks primarily at forms of social and political empowerment of specific segments of the population over other groups, institutions, norms that had set an unbalanced status quo [Friedmann 1992, Rocha 1997]. The empowerment in city actions is achieved by setting multi-lateral decision-making processes or management protocols for local resources and structuring these collective actions within established or emerging social practices.

The psychological framing of the intended outcomes associated with the use of web-based technologies and the socio-political framing of urban actions find their basis, respectively, in behavioural theories and urban governance theories. On one side, behavioural science (often associated also with cognitive sciences) are constitutive of the leading research fields engaged in studying the design and development of digital technologies. For instance, Information Systems, Human-Computer Interaction, Computer-Supported Cooperative Work explicitly refer to behavioural and cognitive sciences as foundational for their core research [Hevner & Chatterjee 2010, Rogers 2012, Schmidt & Bannon 2013]. Differently, planning theories and urban research historically rely on a plurality of philosophical and political standpoints that consider people's behaviours and cognition only very marginally because of the predominance of contextual constraints in determining collective phenomena. In this case, the interpretative frameworks of urban realities are always considered as shaped by institutions, organisations, and structured social forces [Friedmann 1987, Innes & Booher 2010]. Recent conceptualisations extend previous theories on urban governance models (more functional or static) by taking into account also the fluidity of relationships among local institutions and social segments [Andersen & Nielsen 2009, Schragger 2016].

The adoption of divergent theoretical lenses, respectively focused on the psychological aspects of individuals and on the relational dynamics of social structures, determines two utterly different representations of people acting through the Web or people operating in the city. In web platforms, technology users are usually decontextualised from their operative environment [Lamb & Kling 2003], and they have assigned roles and identities existing only in the virtual environment of a specific application. In the city, individuals have to be considered as embedded in a dense set of networks [Castells & Cardoso 2006] in which they operate as part of groups, communities, organisations constituting the *"anthro-ecology"* of individuals in cities [Friedmann 1987]. These two different representations deepen the gap between the individual practices supported by web-based technologies and the form of collective actions and decisions constituting the essence of urban actions.

City. Continuing the analysis of the current misalignments, web-based technologies usually focus on action flows directed from the city to people, while a city planning perspective focuses on the flows from people to the city. In other words, the city in web-based technologies is often framed as a set of commodities, services, resources providing users what they need or want to know. In city planning, people are considered as the drivers and agents for the transformation of urban spaces to readapt them to new needs and activities. As a consequence, the practices respectively supported by web-based technologies or envisioned by city planning initiatives configure, on one side, an active city for passive users, and on the other side active agents in a passive city.

These two sets of visions and practices are consistent with the emerging model of the *Cognitive City* as the paramount for Urban Technologies, and the *Dual Complexity* model for describing city dynamics. In the Cognitive City model, the urban environment is enabled by technology to communicate with humans, self-monitoring the functioning of its components, learning and continuously improving the management of urban resources [Portmann & Finger 2016]. People can react to the inputs from the environment, but the City is considered as a kind of autonomous organism. Differently, the Dual Complexity model insists on the vision of the City as shaped by people's actions. The intrinsic complexity of the multitude of interrelated urban systems and components (determined also by social norms, institutions, and contextual arrangements) is thus doubled by the uncertainty and unpredictability of people acting in urban environments [Portugali 2011]. Therefore, in the Dual Complexity model, a city is not flattened to its materiality or services, but it reflects the inseparability of people activities and decisions from the nature of the City in itself.

The misalignments discussed in this section can be summarised in the distance between:

- web-based technologies ideally aimed at fixing urban problems and providing access to urban resources, but practically focusing on users as individuals and individual actions (even though addressing urban problems or managing urban resources are collective endeavours)
- city planning perspectives based on a comprehensive relational vision of urban reality as the product of collective actions, but not structurally integrating technology to explore and manage the complexity of city interactions nor at a theoretical or practical level.

Table 1.1. Synoptic view of misalignments between web-based technologies and city planning

	AIMS	THEORIES	PRACTICES
technology	TECHNOLOGY as SOLUTION to urban issues TECHNOLOGY AS COMMUNICATION TOOLS	NETWORKED INDIVIDUALISM COLLECTIVE ACTIONS	use of tech for INDIVIDUAL DECISIONS SOCIAL PRACTICES AND PROCESSES
people	PSYCHOLOGICAL EMPOWERMENT SOCIAL and POLITICAL EMPOWERMENT	BEHAVIOURIST THEORIES SOCIO-POLITICAL THEORIES	DECONTEXTUALISED USERS CONTEXTUALISED ANTROPO-ECOLOGY
city	ACCESSING to city services and resources TRANSFORMING urban spaces	COGNITIVE CITY CITY as DUAL COMPLEXITY SYSTEM	ACTIVE CITY PASSIVE USER ACTIVE PEOPLE PASSIVE CITY

web-based technologies   city planning perspective

1.2.3 CITY PLANNING AND WEB-BASED TECHNOLOGIES: CONVERGENCES

Despite the misalignments indicated in the previous section, there is also an overall convergence in recent orientations for the design of web-based technologies (also well beyond common urban applications) and city planning perspectives looking at new strategies for supporting local development processes. In both cases, the value of systemic visions for intervening in urban contexts, without or through technology, is having an increasing recognition. The efforts in the development of future web-based technologies are not anymore oriented only toward the integration of tools through their modularity and interoperability [Schaffers et al. 2011]. These efforts are also directed toward the harmonisation of digital services within systemic visions taking into account the social impact of Web solutions into the real world [Hendler et al. 2008]. At the same time, urban practitioners and researchers are paying growing attention to understand and experiment the use of technology as a support for managing the complexity and ever-increasing flow of information generated in cities pushing forward and widening the scope of technology in cities [Kominos et al. 2013, Psyllidis et al. 2015, Riggs & Gordon 2017].

Reflecting on the underlying aims of these efforts according to the three dimensions of technology, people, and city, essential convergences point at:

- the common goal of fostering social, institutional, economic, cultural, environmental change by bringing to life new visions through pilots' projects and experimentations
- the purpose of generating new opportunities for people by enabling not only the exchange of information, but also the activation of new connections, services, jobs, investments, initiatives
- the ambition of improving the quality of life in cities at the individual and collective level, overcoming the vision of urban contexts as an aggregation of problems and enhancing their role of places for innovation, culture, sociality, community well-being, and so on [see Table 1.2].

The aim of fostering change through future web-based technologies and new visions of urban actions are supported by theories and operational models framing **change as the outcome of collective, distributed and cooperatives efforts**, instead than top-down processes.

Technology. As regarding the development of web-based technologies, the old paradigm of a closed, centralised, stable and sequential software development process aimed at producing finished products [Balaji & Murugaiyan 2012] had been largely marginalised by agile and lean methods. These new operational paradigms envision the definition of technological solutions through iterative and incremental development cycles involving their users in cooperating to the progressive refinements of software requirements, technology scope and expected applications [Beck et al. 2001, Dingsøyr et al. 2012]. As the same time, the influence of the Open Source movement emphasised the potential outcomes of collective efforts for developing new web-based solutions alternative to mainstream closed solutions. Open Source solutions in the last years proved that alternatives to dominant models can also be more adaptive and resilient than standard solutions, and therefore more competitive even from a market perspective [Bonaccorsi & Rossi 2003, Carillo & Okoli 2008, Söderberg 2015].
Analogously, theories associated with the top-down management of cities are rapidly losing ground. The importance of participatory processes to prioritise and achieve local development goals is supported by theories enhancing the value of collaborative practices, but also by the vision of cities as agonistic spaces where different perspective and social forces convey [Gunder et al. 2018]. At a lower scale, the management of community resources and public spaces is invested by influencing ideas and initiatives associated with the principles of "commoning" as a path for sharing responsibilities and benefits in a cooperative implementation of urban transformations [Borch & Kornberger 2015, Foster & Iaione 2015]. Thus, at different levels, the idea of collaborative processes as drivers and infrastructure for local development is already consolidated as regarding urban actions.

Operational frameworks and theories centred on the importance of coordinating collective efforts to foster changes are also informing new practices highlighting the importance of values and identities in these processes. Values-driven approaches in software development [Ferrario et al. 2016] and critical practices calling technology designer to reflect on the implications of their design choices [Dourish et al. 2004] are increasing the awareness on the clear connection between values, design choices, and outcomes of the actions mediated by information technologies. In parallel, the construction of collective memories, shared values and local identities in urban actions are increasingly becoming the strategy to achieve more practical goals, such as reinforcing urban regeneration processes to overcome community vulnerabilities and consolidate economic development [Neill 2003].

People. The purpose of generating new opportunities for people through technology or city actions is supported by the growing attention to the plurality of voices and goals to be represented and balanced for fostering the desired changes. In the domain of information technologies (not only web), attention to diversity is sustained by policies and standards to improve the accessibility of digital services [Kelly et al. 2009] and widely adopted user-centred and human-centred design frameworks [Maguire 2001]. New policies, standards and design framework significantly expanded previous reductive and universalistic conceptualisations of the user's needs. Beyond these operational measures, researchers and practitioners are also actively engaged in introducing critical theories and reflective practices as lenses for better understanding the plurality of needs, perspectives and goals of different segments of technology users to inform the design of future technologies [see e.g. Irani et al. 2010, Bardzell & Bardzell 2011, Light et al. 2017].

At the same time, new models of the relationships among city stakeholders support a pluralistic representation of local dynamics [see Calzada 2016]. These dynamics are considered as open and fluid processes in which the diverse goals and needs of governments, public agencies, business sectors, and civil society organisations are continuously negotiated and balanced to generate new opportunities.

Despite the different focus of web-based technologies and city actions at a personal and structural level, the convergence on the paramount of a pluralistic representation of different social groups and their needs is becoming a prerequisite for a radical shift toward new paradigms.

City. The plurality of needs, instances, goals of people in the city constitutes essential aspects of life in urban contexts. The ambition to improve the quality of life in cities apparently driving the design of web-based technologies applied in city activities and city planning practices finds a common path in focusing on the interactions in the city.

On the side of technologies, the importance of modelling the full range of interactions between users and technologies "into the world" is nowadays supported by the effort of taking into account the theoretical frameworks and operational protocols of User Experience and Interaction Design research [Preece et al. 2015]. However, it is important to acknowledge that the central focus in the development of web-based technologies remains the set of interactions with the system and within the system. Marginal attention (mainly ex-post) is dedicated to the interactions in the context and to the direct and indirect social interactions mediated by technology.

Planning theories looking at the city as a *multiplex entity* focus primarily on modelling the interactions of users in the context and with the context. The kinds of interactions considered in a city planning perspective include the interactions among the multitude of interdependent and distributed components of the city and the interactions among people with these urban systems. In this frame, space and time relations act as cohesive factors to connect interactions among city components and people's actions [Healey 2000].

The common focus on interactions is also translated in practices sharing the common goal of "fluidifying" urban experiences, both through the services provided by web-based technologies and under the perspective of city planning. The improvement of the quality of life in cities mediated by these practices is sought by making easier to overcome practical constraints and contingencies in urban activities in one case, and by connecting different urban realities in the other case. Again, the misalignment between supporting individual or collective actions remains, but the convergences on improving urban experiences by modelling interactions between systems and users, as well as interactions in the context and with the context, indicate potential alternatives to the current logics of web-based technologies.

The convergences between urban applications of web-based technologies and city planning orientations highlighted in this section can be summarised in a common focus on:

- collective efforts as a condition and driver for change
- a comprehensive understanding of the plurality and diversity of people' needs
- contextualised experiences and social or technology-mediated interactions in the context.

Table 1.2. Synoptic view of convergences between future web-based technologies and emerging city planning orientations

	AIMS	THEORIES	PRACTICES
technology	FOSTERING CHANGE BY BRINGING TO LIFE NEW VISIONS	COLLABORATIVE PARADIGMS (agile, lean, open source) / COLLECTIVE EFFORT / COLLABORATIVE PROCESSES (commoning and participation)	VALUES-DRIVEN approaches / VALUES & IDENTITIES / VALUES and COLLECTIVE IDENTITIES as strategic asset
people	GENERATION OF NEW OPPORTUNITIES	DIVERSITY and PLURALITY of users'needs and voices / PLURALITY & GOALS BALANCING / PLURALITY of goals of local stakeholders	USERS' NEEDS / NEEDS FIRST / LOCAL NEEDS
city	IMPROVING THE QUALITY OF LIFE IN THE CITY	USER EXPERIENCE & INTERACTIONS with technology into the world / FOCUS ON INTERACTIONS / INTERACTIONS in the MULTIPLEX CITY	overcoming constraints and OBSTACLES in urban activities / FLUIDIFY URBAN EXPERIENCE / overcoming BARRIERS to the connections among urban realities

web-based technologies — city planning perspective — convergences

1.2.4 PATHS FOR OVERCOMING CURRENT MISALIGNMENTS AND BUILDING ON CONVERGENCES

The notes presented above will be extended in the analysis reported in the following chapters. Meanwhile, they highlighted that one of the most critical misalignments between the urban applications of web-based technologies and the implementation of collective actions in the city under the perspective of city planning is the different focus on individuals, in the first case, and upper-level social structures and institutions, in the second case. On the other hand, some emerging and promising trends indicate that there are significant convergences in both spheres toward paradigms centred on more systemic visions of technologies and city actions to address problems and foster change in current practices.

Table 1.3. Schema of the misalignments to overcome and convergences to build on for city-oriented web-based technologies

	OVERCOMING MISALIGNMENTS	BUILDING ON CONVERGENCES
tech	City Technologies to support: - the activation of processes for identifying and implementing solutions to shared problems - the sharing of responsibility at individual and collective level - individual and collective decisions at the same time	**City Technologies built: - to convey and optimise collective efforts in local actions - as adaptable and incremental - to link values to needs**
people	City Technologies to support: - the personal and social empowerment of people - the framing of people's actions in their context, and beyond their observable behaviours and cognition - the understanding of people inreference to their social roles	**City Technologies built: - to facilitate the access to common resources - as pluralistic and inclusive - by linking needs to values and identities**
city	City Technologies to support: - physical, functional and social aspects of urban transformations - the navigation of the dual complexity of urban contexts - the combination between inputs coming from the city to users and viceversa	**City Technologies built: - to balance short term and long term goals of city activities - to include interactions and experiences as basis for collective actions in the city**

To overcome these current misalignments, it is reasonable to expect that future city-oriented web-based technologies should **support the activation of processes for identifying and collectively implementing solutions to shared problems**, instead than proposing direct technology-centred solutions. These technologies should balance the individual and collective dimensions of people's decisions and actions, **framing users in their social and political context**, going beyond their behavioural and cognitive aspects. At a higher level, these technologies should support **synergies between different transformations of the urban context, by connecting these transformations to people's actions** [see Table 1.3].

By building on the convergences of aims, theories and practices, future city-oriented web-based technologies should enable the **optimisations of collective efforts in local actions**, as now already it happens in the development of technology itself. Working in this direction, future city technologies should also **integrate multiple mediated experiences as the basis for supporting these collective actions, linking needs to values and local identities in a pluralistic way** [see Table 1.3].

This general preliminary overview of the existing misalignments and emerging convergences between the urban applications of web-based technologies and the dynamics of local development processes from a city planning perspective helped to outline the research space explored by this work. The boundaries of this research space are indeed traced by the need of overcoming the conceptual and operational misalignments, and building on the emerging convergences. At the same time, these reflections were aimed at clarifying the nature of the problem of getting web-based technologies supporting local development processes.

1.3 DEVELOPING CITY-ORIENTED WEB-BASED TECHNOLOGIES AS A DEEP DESIGN PROBLEM

The previous section clarified some of the reasons concurring to the under-exploitation of the potentialities of web-based technologies in urban actions due to specific aspects characterising these technologies. At the same time, the previous section envisioned some potential paths for the development of city-oriented web-based technologies, designed for supporting collective actions in cities through technology. So far, the non-existence of technologies instantiating the alternative paths sketched above and the lack of knowledge to build them qualify the problem of exploring **how to bridge web-based technologies and local development actions as a *"deep design problem"*** [Manzini 2011].

1.3.1. NATURE OF THE PROBLEM

A problem could be defined as a **design problem** if it presents one of the following three conditions:

- lack of effective existing solutions to address the problem
- lack of artefacts instantiating theories and allowing the exploration of the practical implications of a problem under their analytical, explanatory, and prescriptive aspects
- difficulty or impossibility of studying a system or an alternative condition of the current situation through observation only, because some phenomena and aspects could become evident only by attempting to change them through the use of a new artefact as the trigger of alternative processes [Gleasurea 2015].

The problem addressed in this work cover all three conditions. The lack of specific web-based technologies intended to support local development actions had been already motivated, but in Chapters 3 and 4 will be further supported by additional analysis. Then, instantiating principles and theories to connect web-based technologies to local development actions in specific artefacts is the only way to examine the practical implications of addressing that problem. But these artefacts are not yet available. Lastly, it is impossible to understand how and in what ways web-based technologies designed for local development could set situations alternatives to the current ones without actually trying to put such artefacts in urban contexts, and then observing and reflecting on how they change people's actions.

In addition to these three conditions, a design problem is defined as a **deep design problem** if it requires a comprehensive understanding of the systems and processes to elaborate appropriate design solutions [Deming 2018[8]]. This understanding can be built only by combining "*design practice with robust intellectual inquiry*", knowledge production and its translation in artefacts and viceversa, reflections on complex social and political issues with experimental attitude [Manzini 2011]. In this case, the knowledge of city dynamics is still quite undefined for the specific purpose of modelling web-based technologies accordingly. This condition implies that the study of alternative city-oriented web-based technologies must be carried out by **joining design and research, theory development and empirical explorations, with the awareness of dealing with social and political issues more than just technological ones.**

Formalising the kind of problem addressed by this work as a deep design problem also requires specifying what kind of design problem I propose to explore. Conventionally, especially outside domains normalising design into their activities, design problems are still reduced to the operations of making products, or more in general physical objects or "objects that can be seen", even when digital. Slowly, the idea that design can also cover immaterial products is gaining public visibility and it is helping to connect design also to services and even policies, that cannot simply be established or engineered. **Linking design problems to the definition and configurations of systems, that are technological and social at the same time (including their political, economic, organisational, environmental aspects), is still extremely rare.** This kind of problems are problems pertaining the **systemic design of socio-technical systems,** and practically require the exploration through research and design of solutions including products, services, organisational processes, or policies [Jones & Kijima 2018].

In this regard, going back to the problem of understating how web-based technologies could support collective actions, the design is extended to the exploration of the **design of a political space**. Indeed, collective actions in cities are based on a **plurality of irreducible identities, values and commitments** and conflicting visions [Hillier 2003]. These identities and visions are continuously negotiated in the public domain, and even if predominant collectivities tend to overwhelm other voices, they still exist and act in the same arena [Mouffe[9] 2013]. **The composition, harmonisation, orchestration of this diverse voices and collective perspective requires a political space, strictly intended as a space for the reciprocal negotiation of ideas and actions leading to the formation of collective identities and to collective actions**.

Even though the political driver of design and the political value of design outputs is widely acknowledged [Fry 2011, Ehn et al. 2014], the design of a political space as required to orchestrate collective actions in cities is something not theorised yet, especially as regarding the design of information technologies. Indeed, as recently highlighted by Keshavarz [2018], design tends to propose solutions to specific issues and

[8] Deming is considered the first theorist that formalised the inputs for what is now called "deep design", while his book "The New Economics for Industry, Government, Education" (1993 and following editions) was not specifically on design, but on management. However, Deming indicates that the "layers" for a profound knowledge of systems to be transformed are: the appreciation for a system (its understanding), knowledge about variation (system and context), a theory of knowledge (dividing knowable and unknowable, certain and uncertain, true and possible), and psychology (understanding of human nature at individual and organisational level). See also Manzini 2011.
[9] Note: Mouffe elaborated her theory of the agonistic space of political actors looking at national dynamics, Hillier contextualized this perspective at the city level.

problems, or in alternative featuring specific political positions, tacitly or explicitly taking sides. The design of a political space pertains instead the creation of a space not pre-shaped to favour one of the parties negotiating in the arena. Ideally, the creation of such space is the aim of planning instruments, and thus also under this point of view planning perspectives can be useful for approaching this kind of problem, besides unveiling its nature.

Focusing on web-based technologies and looking at them as potential City Technologies meant to address the socio-political complexity of urban settings, I have decided to explore the conditions and implications for designing a technology-mediated political space in which different segment of users operating in the city can structure and negotiate their action at a collective level fostering local development.

Summarising, the problem of the understanding how to get web-based technologies supporting collective actions in cities is a deep design problem pertaining the design of a technology-mediated political space, to be approached through design explorations and research investigations looking at the integrated design of socio-technological systems, including products (such as digital platforms) and/or services (online and offline) or policies (concerning the city context of technology).

1.3.2 RESEARCH QUESTIONS

By formalising the problem under study as a deep design problem related to the exploration of a technology-mediated political space for the composition of different social and operational instances in the city, I formulated the **overall research question** as follows:

> *how to design web-based technologies to support city stakeholders*
> *in the orchestration of local development actions?*

This overall research question is intended to drive the design exploration of alternatives to current web-based technologies aligned with the research on the interdependence between:

- people (in structured formations and at a collective level, indicated as city stakeholders)
- their actions at the local level potentially supported by technology
- and the city context where these different actions take place (and require to be orchestrated for concurring to local development processes).

The two aspects of research and design are driven by two complementary research questions:

RQ_A: How to translate the interdependence between people, their local actions and the city context into the design of web-based technologies?

RQ_B: How to structure the design process of web-based technologies for orchestrating the plurality of interests, goals, activities and settings of local development processes?

In Chapters 3 and 4, these high-level research questions will be progressively reframed and split into multiple sub-research questions covering specific aspects of the design and research problem.

1.3.3 AIM, GOALS, OBJECTIVE OF THE WORK

The aim of the work is to understand how web-based technologies could be effectively integrated into city dynamics by design and supporting local development processes. This work is not aimed at a solution to fill the gap between expectations and reality associated to the capabilities of city technologies. This work aims instead to explore alternative perspectives, strategies and artefacts to conceptually and practically overcome or bypass the stringent limitations posed by the contingencies linked to a lack of structured and operational knowledge on the link between collective formation in cities and forms of technological support to their local actions.

The **goals of the work** are:

- G1. understanding what factors in context of use and in the design of a multi-stakeholder, multi-scale and multi-purpose platform could **facilitate the coexistence of divergent or conflicting goals, practices, constraints, discourses in a shared virtual environment**
- G2. studying how **local stakeholders could interact with/in/through this digital shared environment**, overcoming part of the current limitations of standard web-based technologies to infrastructure multi-actor actions in local development processes
- G3. analysing the **implications of design choices and solutions** for web-based technologies intended to support these processes to formulate an organic set of reccomendations and operational propositions.

The specific **objective of the research** is **elaborating a design theory of the capabilities of web-based technologies intentionally designed to support local development actions**, making explicit the connection between the design choices in the development of technology and the implications on collective actions and decisions in urban contexts supported by technology.

Accordingly to the framework of the **"anatomy" of a design theory** proposed by Gregor & Jones [2007] and referred specifically to the design of technologies, a design theory is an organic corpus of conceptual devices and instantiations that will be systematically outlined step by step in the next chapters. It is composed by:

- the definition of a *"purpose and scope of the system"* to be designed, corresponding in this work to a specific design proposal as a set of abstract meta-requirements linked to the goals set for the technology to be designed [see Chapter 3]
- the *"principle of form and function"* of the artefact object of the theory, corresponding in this work to the definition of the research and design object as a specific class of web-based technology [see Chapter 4]
- the *"constructs"* and the *"justificatory knowledge"*, or rather the concepts and reflecting the entities or the reality relevant in the theory, and the underlying knowledge from external theories and practices. In this work, they correspond to the conceptual models developed for supporting research and design explorations [see Chapter 5]
- the *"principles of implementation"* intended as description of the processes for implementing the theory in specific context and the *"Expository instantiation"* intended as material implementation of the artifact for expository or testing purposes. In this work, they correspond to the real-world case studies used for elaborating and refining the theory along the design and research process [see Chapter 7, 8, 9].
- a series of ***"testable propositions"*** intended as proposition based on evidence and giving support to envisage the outcome of specific design choices. These testable propositions account also for the *"artifact mutability"*, or rather they help in anticipating the variable configurations of the kind of artefact set as object of the theory [see Chapter 10].

1.4 DEFINITIONS AND SPECIFICATIONS

The overall research question formalised above requires clarifying and disambiguating a few expressions, such as **web-based technologies, city stakeholders, local development actions, and orchestration**. The purpose of the **short-reasoned glossary** in this section is two-fold. Firstly, it provides the **definitions** of recurrent terms used throughout this thesis, by specifying the **meanings attributed to them within this work**, despite the plurality of interpretations and alternative characterisations reported in the literature of different academic and technical domains. Secondly, these definitions constitute the initial nucleus of a **common vocabulary** for a diversified audience of scholars belonging to different research communities, considered as the audience for this dissertation. Indeed, as I am going to explain in Chapter 2, this work looks both at urban and informatics disciplines that, in general, have different levels of familiarity with terms and concepts such as the ones defined below.

1.4.1 WEB-BASED TECHNOLOGIES

As mentioned in section 1.1.2, **I decided to focus on web-based technologies because of their intrinsic characteristics of being communication-focused, people-centred, accessible, flexible, pervasive**. Indeed, these characteristics make web-based technologies potentially more adaptable to support collective actions in local development processes in comparison to smart city technologies.

Web-based technologies are a class of information and communication technology (ICT) including any program (i.e. software) that can be:

- **accessed through a web browser** (e.g. Chrome, Firefox, Safari, Edge)
- **executed within a web browser** (that means the processing of inputs and information is done over the internet on an external server and not inside the user's device[10])
- **used by means of a web interface** allowing users to interact with the program functionalities. A web interface is a bidimensional surface organised through visual elements conveying inputs for the system and feedback to users[11].

Most of the programs that we use every day are web-based applications: email tools, calendars, online services platforms, rooting systems, words processors, social media sites, and so on. The expression web-based technology is also a synonym for **web-based applications** and web apps. There are different types of web-based technologies. Among them, web portals and web platforms are the most common when considering urban applications.

- A **web portal** is an interactive system aggregating a wide range of contents from different sources in a single virtual environment in a way that facilitates their access and use by users.

[10] In general, web-based applications do not need to be installed on the users' devices. A part of web-based applications (called client-based applications) can require the installation of one component on the users' devices, functioning as a proxy for the elaboration of the users' inputs to the program at the local level (e.g. moving from one page to another in the same application), while the processing of information is still done over the internet (e.g. executing an operation such as finalising a registration or a purchase).

[11] This type of interface is also the basic type of interactive interfaces, considering that the types of interactions between digital technologies and urban environments are now open to other possibilities based on vocal inputs and other sensorial experiences. Focusing this work on this basic type of interfaces is a way to narrow the space of analysis on the relation between design choices and implications on users' activities to the arrangements of textual and visual components over a bidimensional surface.

- A **web platform** is an interactive system integrating multiple services, functionalities and modalities of interactions and creation of contents allowing the user to manage its own contents and actions, as well as interacting with other users.

A growing part of web-based technologies are also **ubiquitous technologies** because of the possibility to access to web applications through mobile devices, public displays, and other peripheral devices make them usable everywhere in every time. According to Dourish's definition, ubiquitous technologies are technologies embodied in the context of users' actions[12] [Dourish 2001]. They do not include web-based technologies only, but more in general technologies relying on the Internet infrastructure and operated in the context. In this thesis, I am not going to focus on the specificities of mobile and not-mobile interactions with the platforms mentioned in analysis and case studies. I am going to focus instead on the context of users' actions, where users are not necessarily considered individuals, as it will be explained in Chapter 5.

General paradigms led to the definition of subsequent "generations" of web-based technologies, indicated as Web 1.0, 2.0, 3.0, 4.0, and 5.0. These paradigms will be briefly described in Chapter 4 [see Section 4.1.2.], but in this work I will refer to **Web 2.0 technologies**, or rather the ones are characterised by a focus on **geospatial functionalities and user-generated contents**. Indeed, despite the relative advancements in other paradigms, web-based applications for cities still remain predominantly anchored to the Web 2.0 paradigm. On the one hand, this choice had been forced by the need to refer to existing technologies in the analysis of their shortcomings, and then try to design and develop some alternatives using the available technological resources in my working setting. On the other hand, the analysis of current solutions focused on the socio-political assumptions and evidence emerging from existing platforms, aware that this kind of assumptions are not linked to the specific technological configurations, but to upper-level choices regardless of the technological paradigm. Moreover, the consolidation of these tools and their familiarity allowed to focus the research on the socio-political aspects of the integration of the existing and proposed platforms in the context, without dealing with emerging technologies.

Connected to this point, the last essential aspect for the definition of web-based technologies is their "readiness". The intrinsic property of the readiness of a technological system usually refers to the level of technical maturity achieved by certain solutions [Parasuraman 2000], conventionally structured in nine levels going from the principles for developing a proof of concept to actual solutions available and operational in the market. More recently, new concepts such as the ones of system readiness levels [Sauser et al. 2006], or social readiness levels [Bellamy 2019], and societal readiness level [Chan & Meijer 2020] had been introduced to highlight the issues linked to the restructuring of the social, organisational and political contexts in which technologies should be integrated, not necessarily aligned with the maturity of technology. In relation to these frameworks, **Web 2.0 technologies have the highest level of technological readiness, but still a low level of system and socio-political readiness**. Indeed, the gap between expectation and reality stated at the beginning can also be expressed in these terms and the investigation of how to improve their societal or system readiness is still a matter of research primarily.

[12] An example can help in distinguishing the difference between "*technologies that are where the action is*" and "*actions that are where technology is*". In the first case, we have applications such as google maps, or every other web platform, that can be accessed and used wherever we are, from whatever user device connected to the internet, and that helps us to do actions in a certain context, such as reaching a place, or making a purchase, or recording and sharing an event in the street, and so on. In the second case, we have technologies associated with a specific use, a specific device (usually desktop) and usually with a specific place. For instance, a company software installed only on our office computer (e.g. AutoCAD, ArcGIS, NViVo, MCDA tools) that can be used only when we are at work because it is accessible only from a specific device. It is similar for a touristic information totem in a square that you can use only in a specific place where we can perform certain actions because technology is there. Ubiquitous technologies do not include web-based technologies only, but every other technology that is embedded in our context of actions and connected to other devices and systems through the internet (and this also include credit cards with their microprocessor, environmental sensors, public displays, etc.).

1.4.2 CITY STAKEHOLDERS

City stakeholders are defined in this work as the segments of society formed by structured and unstructured social entities expressing a homogenous set of goals, values, operational frameworks outlining the nature of their interests in city dynamics and defining the boundaries of their collective agency over local development processes and in relation to other stakeholders acting at the local level[13].

The distinct classes of city stakeholders considered in this work are:

- **Local Governments – LG** (e.g. municipalities and public administrations at city level)
- **Public Agencies - PA** (e.g. local units of national and regional agencies and authorities, such as public health or education service providers)
- **Business Sector - BS** (e.g. industry, retail, and creative enterprises)
- **Capital Holders - CH** (e.g. financial institutions, donors and private foundations, but also citizens intended as property owners and taxpayers)
- **Knowledge Cluster – KC** (e.g. universities, research institutions, think-thanks)
- **Non-Profit Organisations - NPO** (e.g. charities, volunteering organisations, professional associations)

The plurality of models defining characteristics and roles of stakeholders in the city are discussed in detail in Chapter 5, in correspondence of the description of the social system of cities. Here it is important to highlight the rationale of studying local actions and city dynamics by referring to the concept of stakeholders, instead than to more general concepts of "actors" or "players".

As mentioned before, cities can be considered as *dual complexity systems*, because the complexity of the city as a system of systems is multiplied by the uncertainty of the evolution of such system due to the unpredictability of people's actions [Portugali 2011]. However, most of the actions of individuals are over-constrained and overdetermined by the fact that every single action happens in a social context in which individuals are forced to comply or to position themselves respect to formal and informal norms regulating the life in shared spaces. This is particularly evident in cities, where people coexist in the same space, insist on the same resources, and also share the same risks and opportunities related to the use of these resources and the relationships with others. This condition determines further constraints reducing the degrees of freedom of people's actions. Thus, the multiplicity of social segments and social structures operating in cities are not simply "actors" enacting a sort of script on a stage or "players" engaged in some sort of local activities for unknown or personal reasons. They are instead subjects acting under multiple constraints and in a shared space to define the boundaries for their actions in line with with their goals, priorities, interests, resources, capabilities.

On this basis, **the concept of "stakeholder" as a set of social entities expressing a homogenous set of goals, values, operational frameworks also allows to pragmatically deal with the unknowability of the actions of individuals in urban environments**. Indeed, setting observations and analysis at the level of social, cultural, and normative constraints for people's actions (by framing individual actions in their context) makes possible to study factors and dynamics based on elements that are knowable (norms, organisational structures, history, cultural profiles, and so on) and that are predominant in structuring collective actions.

[13] See [Friedman & Miles 2006] for an exhaustive list of all the definitions of stakeholders and the historical overview of the evolution of this concept.

The adjective "city" associated with stakeholders is intended to include the subjects operating in the city at different scales, but not necessarily defined as "local" stakeholders. For instance, retails chains can operate in the city, without being local (e.g. Tesco, Wall-Mart, Carrefour). In these cases, stakeholders operating locally without belonging to the city are less affected by the tight interdependence among city stakeholders.

Understanding stakeholders' definition in this work is central to follow the design processes reported in the following chapters. Indeed, **the design methods applied across the design and research explorations are primarily stakeholder-centred design process**es.

In the literature documenting or theorising on design processes, it is more common finding expressions such as "**user-centred design**" or "**human-centred design**". These two design frameworks, both targeted on users as individuals, respectively indicate:

- processes centred on the analysis of functional and cognitive needs of users interacting with a product or services (even not necessarily a technological one) [Gulliksen et al. 2003] to increase their efficiency from a technological perspective
- processes taking into account more holistically the human perspective (including values and emotions) within the definition of product and services compliant with the users' preferences [Giacomini 2014].

In some cases, expressions such as "**community-centred design**" are starting to appear for describing design processes of technologies or services targeted on collectivities, but usually, these processes are oriented to generate the community in itself [Preece et al. 2004, Zavratnik et al. 2020].

In this work, I am going to report instead design processes centred on the relationships among different city stakeholders, or rather their relationships in the city and not their positions respect to the platforms that will be analysed. So far to my knowledge, there is not yet a theorisation of the nature of stakeholders centred-design processes to refer to, and producing one is out of the scope of my work. As will be explained in Chapter 2, I relied on the practical knowledge of planning practice that extensively relies on what we can call "stakeholders-centred design methods" as a common way to produce negotiated interventions in cities and norms for the city transformation.

In this sense, the stakeholder-centred design processes developed in this work differ from the forms of generic stakeholders' involvement outlined domains such as business development or risk analysis. In these domains, the concept of stakeholder is used to position different segment of direct and indirect subjects involved or affected by a product or service in relation to their capacity and interest in supporting or hindering the process. In the case of cities, and interventions on cities, the priority is accorded to the dynamics among city stakeholders and not to the position of city stakeholders in relation to the proposed action, product or service. In practical terms, the main question in these cases is not "are they going to adopt this solution?", but "is this solution going to change local equilibria and in what ways?". Indeed, the answer to the first question comes from the one to the second question.

1.4.3 LOCAL DEVELOPMENT ACTIONS

Local development actions are the **actions implemented by city stakeholders that concur to generate, implement, or support local development processes**. To furtherly detail this general definition, I proceed by focusing on the terms a) action, b) local, c) development as defined in this work.

a) An **action is a set of activities intentionally performed by an agent to achieve a specific goal that is set by the agent, or of which the agent is aware**. The agent is the subject implementing the activities.

In theories of action, across different domains going from philosophy to social science, there is no consensus on the definition of what an action is or how should be conceptualised [e.g. Parsons et al. 1965, Danto 1973, Coleman et al. 1986, Moja 1991, Bourdieu 1998]. However, three central aspects recur to identify the key properties of an action:

- there is an agent, not necessarily an individual, but also higher-level social structures such as groups or organisations, or even non-human agents
- this agent has a goal or is aware of the established goal
- the agent acts intentionally to pursue this goal by carrying out a series of activities, planned or not.

In this dissertation, **I focus on the agency of city stakeholders**, organised or defined accordingly to the socially recognised missions, roles and norms that regulate urban interactions. Thus, I focus on the collective agency of social structures. The pursued goals are influenced or determined by the type of interest that city stakeholders support or express as collectivities distinct from others. The type of supported interests is assumed to be known to the agent at the individual, organisational or inter-organisational level, but not necessarily consciously understood and defined at each level for each individual. The goals pursued by an agent are not necessarily known to other agents in the same context or publicly stated[14].

The unit of analysis of actions can vary exactly as the nature of the agent. An action could be a single activity linked to sub-level goals of the agent (e.g. attending a meeting or giving a talk as part of an initiative) or could be a structured series of activities united by higher-level goals (e.g. achieving the project goals).

In this dissertation, **I refer to actions mainly as structured sequences of activities** instead than single activities. Thus, I refer to actions like the provision of a service, the implementation of a project, the organisation of a public event, the preparation of a plan for a project, initiative or strategy. It is possible to refer to these actions as **urban actions** because they happen in the city, but also as **city actions** because they are the result of people's interactions with the physical, functional and social structures configuring the urban environment.

b) **Local** is an adjective frequently used in geography, urban studies and social sciences to refer to regional or macro-regional entities or territories and their sub-units [Dematteis & Governa 2005]. This dissertation is focused on the urban scale and its sub-units (such as district, neighbourhood, building blocks). Thus, the adjective **local is referred primarily to the scale of an urban area, or to its sub-units where specified**.

c) **Development** is the outcome of a process improving the status quo of a situation before intervention. Expressions such as "Urban development" are used both as restrictive terms by referring to the physical expansion or transformation of the urban fabric, or in a broader sense to indicate the improvement of the quality of life in the city, under the perspectives of sustainability, social justice, democracy, services effectiveness, and environmental aspects. In this dissertation, I consider the broader meaning of urban development and I refer to the definition of local development formulated by De Matteis & Governa:

[14] In the city context, the same action can be implemented by different agents (for instance, PA or non-profit) or by a plurality of agents jointly acting (for instance, PA and non-profit) toward a share contingent objective (implementing a project), but for different goals or purposes (e.g. consolidating the electorate in a specific area or helping local communities). While the objective is shared, the goal is not necessarily shared or reciprocally known among all parties involved in the action or by the external parties or target groups directly or indirectly affected by the action. Even though all these goals are legitimate, the praxis of urban activities not necessarily implies to make them public and explicit, more commonly keeping separate the two different representations of actions in reference to practices or to the public discourse.

"**process aimed at combining cultural, social, economic and political improvement of a territory**" [Dematteis & Governa 2005]. As stated before, I focus on the urban scale instead than vast territorial areas.

Clarified the specific meanings of actions, local and development as used in this dissertation, it is possible to reframe the definition of **local development actions as the urban activities of which the result is generating an improvement of social, cultural, economic capital at the local level**. These activities can include, for instance, urban regenerations projects, the provision of community services, public engagement initiatives, local projects enabling a better use of tangible and intangible local resources and so on.

While triggering or contributing to local development is not necessarily the explicit pursued goal of a specific city stakeholder implementing some local actions, it can be considered as one of the expected outcomes in several cases. Indeed, the distinction between **local development actions** and actions oriented only to economic development relies on their outcomes. Local development is aimed at **expanding individual and collective opportunities to access to improved conditions for education, work, housing, political participation, and human flourishing more in general** [Sen 2001].

This definition of local development keeps its distance from other framings of local development based on the abstract concepts of the "Common Good" or equivalent ideas, mostly linked to strong moral assumptions about the general goals to be pursued at the individual and collective level, and the conditions and rules to be applied in this direction. As it should be predictable by now for the reader, **I prefer instead assuming a plurality of visions and frameworks in which individuals and collectivities establish what opportunities they intend to pursue within a shared sphere**. Consistently with the statements exposed in previous sections, this assumption is linked to the vision of the **city as a political space for the negotiation of discourses, structures and practices of city stakeholders, in literature defined as an agonistic space** [Hillier 2003, Mouffe 2005].

The definition of local development actions formulated above also refines and clarifies the two combined choices of:

- focusing on web-based technologies as technologies meant to connect people, instead than connecting things to people as smart city technologies [Section 1.1.2]
- privileging the exploration of the forms of socio-political empowerment in the city context potentially enabled by web-based technologies (as central in city planning perspective oriented toward local development), instead than other forms of psychological empowerment that these technologies usually enabled already [see Section 1.2.2.].

In fact, stating that there is no univocal definition of the concept of smart city had become a popular rhetorical construct in academic and non-academic literature that opened the association of this expression to a wide range of possible interpretations and framing of the goals of related technologies. However, it is useful to keep some objectivity in the distinction between the label "smart city" and other expressions linking cities and technologies to motivate the choice of clarifying the definition of local development instead than creating a further definition of smartness tailored on the goals of this work.

To this regard, I agree with the semiotician Violi and her distinction between the labels "smart city" and other labels such as "intelligent city". She points out that the label "smart cities" can be associated with the capability of cities (enabled by smart technologies) to implement rapid changes and adjustments to respond to a situation or problematic events. She refers to the Greek concepts of *"mètis"* that *"implies flexibility and adaptive capability in relation to a changing environment, the capacity of exploiting the wider potential of some given context, which can also be found in the natural world, as is the case with the camouflage characteristics* *possessed by certain animals"*. **The concept of "mètis" outlines a form of reactive and responsive behaviour of a city envisaged in the common visions of smartness**. This reactive behaviour can be positive in the sense of helping to overcome difficulties and unfavourable contingencies, but its plasticity can also be ambiguous and potentially negative. On the contrary, **other labels such as the ones referring to the intelligence of cities are linked to the *"quality of being"* of cities, that allude to more permanent configurations and dynamics in the urban environment** [Violi 2014].

The rapid mobilisation of material resources in a city and the adjustments in their management envisioned by smart city paradigms are certainly important. These operations require monitoring the status of things for promptly reacting as smart city technologies allow to do. However, **local development processes are strictly linked to the "way of being of cities", and ultimately to more permanent (while evolutive) features of cities that define their "cityness"[15].** These features, according to the vision of the city as a socio-political entity, relate to the dynamic configuration of the power relationships among different social segments and to the way in which these configurations shape the nature and impact of their actions on the basis of local norms and institutions. Thus, **focusing on local development implied also focusing on technologies meant to connect people such as web-based technologies, primarily respect to the activation of material resources**.

Over the last years, several labels tried to depict various links between cities and technologies, the associated meanings and the different roles attributed to technologies. They include "virtual city", "ubiquitous city", "intelligent city", "information city", "digital city", "knowledge city", "learning city" [Cocchia 2014]. However, a few recent surveys highlighted that the label "smart city" gained traction against every other label under multiple pressures (market, policy, donors) [see e.g. Coccia 2014, Albino et al. 2015, Camero & Alba 2019]. Despite extensive interpretations of the label "smart city" recently promoted [see e.g. Yigitcanlar et al. 2018], the corpus of work and research on smart cities is still quite distant from a focus on the social and political aspects of local development processes [see Mora et al. 2017] or from critical reflections on the limitations and shortcoming of smart city technologies in local development processes [Lim et al. 2019]. Thus, **I decided to avoid formulating additional definitions of smartness, or referring to labels nowadays fading and not perfectly matching with the framing of technologies in cities proposed by this work.**

1.4.4 ORCHESTRATION

Orchestration is the term used in this work to indicate the **process aimed at composing, combining and harmonising a set of distinct independent or interdependent actions by supporting coordinative, cooperative and collaborative dynamics among the agents implementing the actions at the local level.**

The exact meaning of the term orchestration can be clarified with an example. In an orchestra execution, there are pieces played by a *solo* player, pieces played by different groups of players on different tracks, and pieces played by a plurality of players on the same track with different instruments. The orchestration is aimed at:

[15] Turin is certainly different from Milan, as Chicago from Minneapolis, Jalandhar from Delhi, Teheran from Isfahan, Lyon from Marseille, Glasgow from Manchester. Their differences are not simply in their morphology or economic profile, but in the geometries of local relationships among city stakeholders shaping the city socio-political profile of the city that is influenced by the available resources (or local modes of resource production) and it influences all the other aspects of city life.

- indicating to each player the beginning of his/her solo performance to compose solo pieces with collective performances (coordination support)
- orienting different groups of players performing different tracks at the same time to combine their effort in a unit (cooperation support)
- continuously modulating the performances of different players executing the same track to harmonise the sounds of different instruments (collaboration support).

In a city, the orchestration of urban actions is a fragmented discontinuous process, always partial. It does not admit the centralised control of an orchestra director[16], but it requires instead the synergic effort of a plurality of actors, representing the different groups of city stakeholders at every level. Indeed, as mentioned in several occasions in the previous sections, the essence of a city is the negotiation of a plurality of instances. This thesis investigates specifically how this synergic effort in urban actions could be supported through web-based technologies by reinforcing and sustaining the three key mechanisms of collective actions: coordination, cooperation, and collaboration[17].

- **Coordination is the mechanism aimed at spatially and/or temporally combining independent activities carried out by different agents for distinct goals and objectives. The agents do not share resources or risks, but they can gain benefits from the coordination.**

- **Cooperation is the mechanism aimed at composing a set of activities independently carry out by different agents to achieve a shared objective (but not necessarily the same goal). The agents do not share resources, but they share risks and benefits because the common achievement relies on the commitment of each agent involved.**

- **Collaboration is the mechanism aimed at harmonising a set of interdependent activities carried out by agents having shared objectives and aligned/compatible goals. The agents share resources, risks, and benefits.**

These three mechanisms are not considered as a gradient, establishing for instance collaboration as preferable to coordination. On the contrary, they are all three essentials to describe, understand and support different forms of practical negotiations of the local development actions.

The orchestration in reference to city-oriented web-based technologies is the process and result of appropriate, timely, decentralised and not-authoritative forms of support provided to users for the implementation of coordinative, cooperative, collaborative actions at the local level[18].

In Chapter 3, I formulate the design proposal corresponding to this type of web-based technologies, and I refer to them with the label of "City Mirror". Here, I anticipate the definition of City Mirror.

[16] In Chapter 3, I am going to examine how and why the vision of a Public Administration or Local Government in charge of the "orchestration of the city", supported by the predominant models of smart city initiatives, is not consistent with the reality of city dynamics, nor desirable.
[17] The definitions of coordination, cooperation and collaborations substantially vary in the literature. In general, in urban disciplines, these terms are often used interchangeably, with some exceptions in research dealing with Public Administration Sciences and Local Government studies. In specific domains of Informatics, such as Computer-Supported Cooperative Work these terms have instead specific characterisations, but they are not necessarily completely distinguished. Extended discussion in Chapter 5.
[18] As regarding web-based technologies and interactive systems in general, the term "orchestration" is often used in the literature in informatics to indicate the process with which software can reconfigure computing tasks in an automated way by optimizing the management of the software components and the system governed by the software. In this dissertation, the term orchestration refers instead to city activities and not to the orchestrations of computing processes internal to the interactive systems.

A City Mirror is a web-based technology reflecting city dynamics, in terms of interactions among city stakeholders, local activities and urban environment, designed to support coordinative, cooperative and collaborative actions concurring to local development processes.

1.5 NOVELTY AND ORIGINALITY OF THE RESEARCH

In this section, I am going to summarise the decisions made to set up this research and stated in the previous sections, by highlighting the novelty and originality of the work resulting from these decisions.

The novelty of the research is two-fold.

- Firstly, this work exposes the primary reason for the gap between high expectations related to the use of technologies in cities and their actual marginality or limited impact in substantial changes in the way local actions are performed. From a conceptual and practical perspective, this gap is linked to the fact that every local action relies on the interactions of structured collectivities in cities and current technologies ignore the issues of providing appropriate forms of support to these collectivities in their actions. On this basis, **the research directly explores how to deal with the constraints associated with shaping these forms of technology support to collective action in cities, moving beyond the focus on the forms of technology support to individuals central in current commercial and governmental technologies**.

- Secondly, this work addresses the fact that **political considerations lie at the core of the possibility of orienting future technologies to support collective actions in cities**. They need to be **incorporated openly and constructively** in the process of realigning expectations associated with technologies and their capabilities. Looking at "the political" broadly as a dimension to which we refer for identifying collective formations and their actions in society, this work proposes to examine the **assumptions and implications linked to the configuration and use of specific technologies in cities**. At the same time, this work gives absolute prominence at the **city as a socio-political entity. In contrast, the common way to approach cities in relation to the deployment of technologies is still mostly limited to the materiality of the urban environment.** Thus, I focused specifically on web-based technologies, meant to connect people, instead of smart city technologies aimed primarily at monitoring the urban fabric.

In the research process, since the beginning, **I declared myself apart from the crowdy and popular discussions about smart cities because of the parallel tracks of these discussions in industry and academia, apparently keeping fast proceeding in opposite directions. Instead, I preferred to focus my efforts on studying the relationship between technologies and the "cityness" of cities**, defined as their "way of being" for collectively configuring and restructuring social and operational dynamics in urban environments. In this sense, I look at **local development actions** as the urban activities, resulting in improvements in the social, cultural, and economic capital at the local level, benefiting the various collective formations linked to these actions. The hope is that going in this direction, eventually, it will be possible establishing a bridge between the academic and societal demands for more people-centred technological solutions in cities, and the industry instances fairly prioritising the economic sustainability of their provided solutions.

The originality of the research is linked to the following three aspects.

1. I have identified the substantial analogy between the core problem of understanding how web-based technologies can support collective actions in cities and the problem of elaborating plans for cities that are the instrument aimed at collectively structuring actions in cities. Based on this consideration, **the work presents the process and the results of a structured and goal-oriented knowledge transfer from the domains of planning and urban research to the domain of system design**, also leveraging on the convergence of interests of these two macro-clusters on "the political" and "the local" dimensions of technologies in cities and the development of technologies in itself. As it will be presented in the following chapters, **this knowledge transfer process implied a critical reinterpretation of several theories and methods coming from city planning research and practice, and their radical repurposing to orient the experimental design of "city technologies".**

2. I have elaborated the **framing of the problem of getting web-based technologies supporting collective actions in cities as a deep design problem**. This framing allows to consider the starting problem of the gap between expectations and technology capabilities that is a wicked problem in itself, and it **outlines a concrete path to approach the study of the problem by combining design and research, theory development and empirical explorations, with the awareness of dealing with social and political issues more than just technological ones.** In this perspective, indeed, the approach of the problem must be based on systemic design visions and oriented to the design of a political space, more than to the design of a specific technological product or service.

3. I have **configured and applied a stakeholder-centred design**, all along the empirical and applied part of the research process, as reported in the following chapters. This approach concretely let emerging and clarifying tensions, issues, and opportunities for designing web-based technologies meant to support city stakeholders' local actions. While indispensable in planning practice, this kind of approach is not yet formalised or theorised nor as stakeholder-centred design or in other consolidated frameworks directly applicable and transferable to other kinds of practices (including technology design). In this work, I have not attempted to develop this formalisation. However, the application of stakeholders-centred approaches in the design of prototypes of city technologies, and their radical difference of in comparison with user-centred or human-centred design approaches (focused on individual users), allowed me keeping my analysis and exploration of technology solutions anchored to the collective nature and norms of local actions.

I am aware that the PhD thesis usually states the contribution of the work at this point of Chapter 1. However, I considered the necessity of adequately introducing the research framework in Chapter 2 without anticipating aspects of the research that would result unclear without referencing such a framework. Therefore, nature and articulation of the contributions will be outlined in Chapter 2 and the specific contributions linked to the various steps and strand of the research will be specified at the end of the subsequent chapters.

1.6 OUTLINE OF THE VOLUME

The thesis is organised in 11 chapters clustered in 4 parts, as shown in Fig. 1.2.

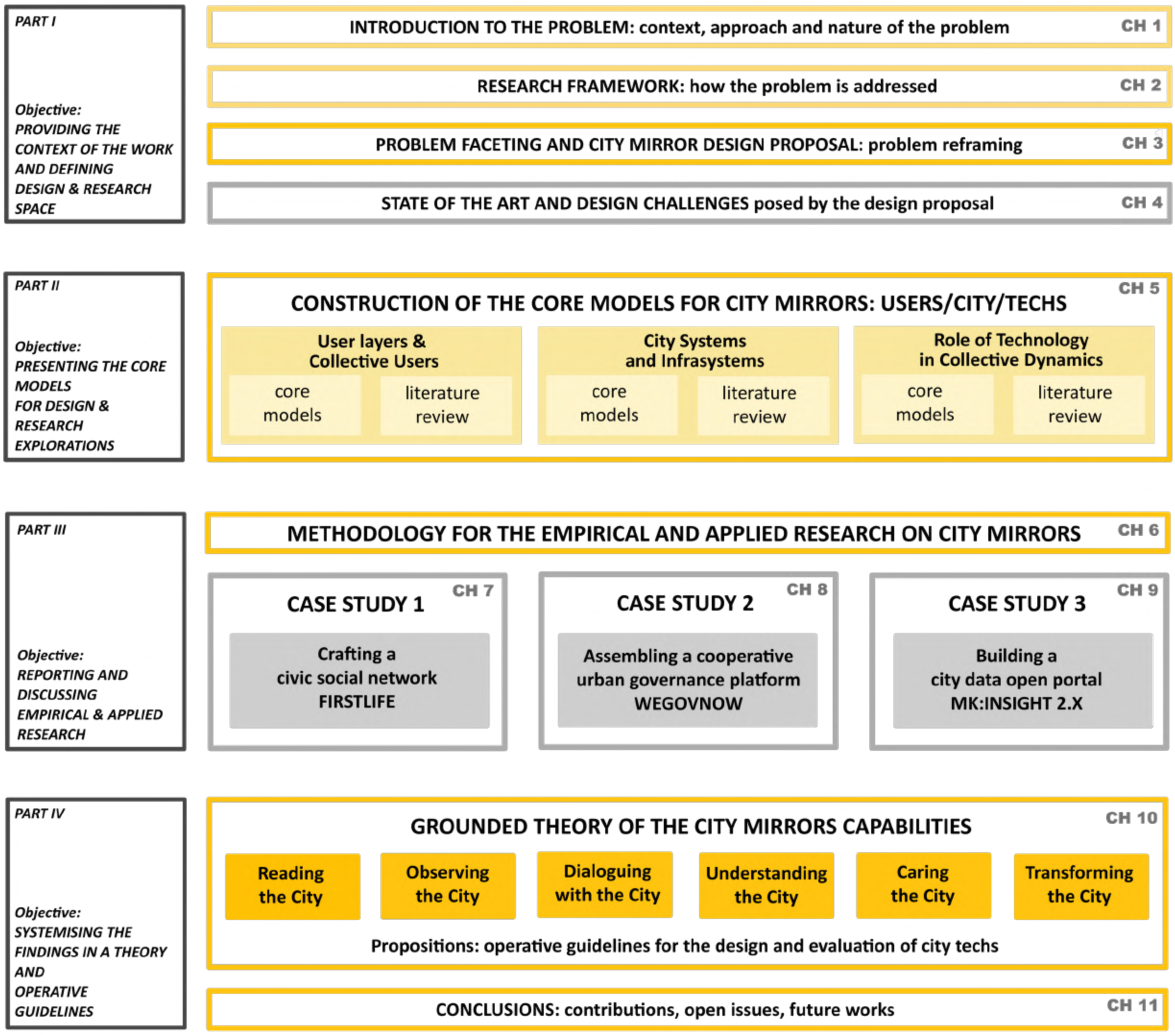


Fig. 1.2 Schema of the chapters structure

Part I includes chapters 1,2, 3 and 4 aimed at framing the problem as a design and research problem, by also providing background elements for the definition of the research questions.

- **Chapter 2** illustrates the transdisciplinary framework that guided and structured the research process across urban and informatics disciplines to address the problem of rethinking scope and functionalities of web-based technologies to support local development actions in the city.

- **Chapter 3** reports on the analysis of the constraints and boundaries for addressing the real-world problem considering the perspectives of city stakeholders and technology providers. The output of the analysis is the **breakdown of the problem into three facets** that could be addressed as a knowledge problem through research and design activities. This reframing of the problem led to the **formulation of the design proposal of the City Mirror** and the research questions concerning: the modelling of

Users as subjects potentially acting through city technologies; the modelling the City ecosystem as the object of these actions; and the modelling of the role of Technology as the means to enable these actions (i.e. information technology, and specifically web-based technologies).

- **Chapter 4** reviews the main types of existing web-based technologies having urban applications under the light of the relationships among users (subjects), the representation of city actions (objects), and the scope of the platforms (means) to identify the specific design challenges of web-technologies potentially oriented toward supporting local development actions. This critical examination of current web-based technologies led to define the **characteristics of the research object** referred as City Mirror and to formulate the **research questions** related to the design process of such technology and the interdependence between users, city and technology.

Part II corresponds to chapter 5 that present the core models respectively covering the representations of users, the structure of city systems structure and the role of technology. The three core models had been built on the integration of literature belonging both to urban or informatics disciplines. This part is also aimed at providing a shared knowledge base on the key-facets of the problem under study to readers with different backgrounds, not necessarily covering both informatics and urban disciplines.

- **Chapter 5** provides a review of the literature focused on the three different aspects to take into account for designing new technologies reflecting city dynamics:
  - the social structures defining the reality of the subjects operating in the city
  - the representation of the city as a multidimensional information object
  - the role of technology crystallising the implicit or explicit goals of the subjects operating in the city by defining the technology features and configurations to support collective actions.

  The outputs of this literature review are **three conceptual models of the users, of the city systems, and of the technology roles aimed to define the foundations for the design of City Mirrors**.

Part III is developed in a methodological chapter and three chapters discussing the case studies constructed to pursue empirical and applied research activities for exploring the City Mirror proposal. Each case study is indeed a specific instantiation of the City Mirror proposal. The combination of the three case studies allowed to gather solid insights on the interconnection among users, city and technology in different settings, as well as to answer to the research questions on the design process in different settings.

- **Chapter 6** explains the **methodological choices** that oriented the empirical and applied research activities. This chapter also describes the **construction and analysis of case studies**, specifying the relations between design research and research through design methods, as well as the ones between action design research and grounded theory methods.

- **Chapter 7** describes and examines the participatory design process of a **civic social network, FirstLife**, crafted and refined by integrating the prototype into a series of local initiatives. This case study enlightened the **forms of technological support to social innovation dynamics in local development processes**, by critically analysis the link between design choices made along with the development of the prototype and their impact on the applicative scenarios outlined with the city stakeholders involved in the research and design activities.

- **Chapter 8** reports and analyse the process of requirement analysis and validation for a **cooperative urban governance platform, WeGovNow**, assembled by refactoring the scope of a set of consolidated e-government tools. This case study informed the reflections on the need of **rethinking governance**

models and forms of technology support at the same time for activating transparent, open, and substantial processes of responsibility-sharing among all the stakeholders involved in local development processes.

- **Chapter 9** explains the redesign process of **MK:Insight**, the **Open Data portal** of Milton Keynes. This case study led to the formulation of a few **design concepts for a city data portal opened to the collaboration among local stakeholders to transform available data into actionable sources for local development processes by changing the modalities of production, use and interaction with city data**.

Part IV delivers an organic theoretical framework and operative guidelines to shape the capabilities of a City Mirror, or rather the functionalities and applications of information technologies intended to support the orchestration of city stakeholders' local development actions.

- **Chapter 10** discusses, systematises and generalise the findings coming from the case studies by applying a constructive and interpretative process inspired by the Grounded Theory methodology to define **principles and requirements for the design of City Mirrors** in the form of testable propositions. This chapter also highlights the **practical implications of introducing a City Mirror in the orchestration of local development actions** considering the perspective of decision-makers (city stakeholders and technology providers), system designers and urban practitioners.

- **Chapter 11** summarises the **main contributions of the work**, and it formulates complete and extended answers to the research questions about the interconnection among users, city and technology models compared to the partial perspectives offered by each case study. This chapter concludes the work by indicating a set of open issues and future directions for further development of the research.

As regarding the overall objective of the work to elaborate a design theory for web-based technologies intended to support local development processes, each chapter provide a component of the theory.

- Chapter 3 defines the purpose and scope of these technologies in the forms of the proposal of the City Mirror.
- Chapter 4 outlines principles and functions of these technologies.
- Chapter 5 presents the conceptual models to inform the design process of City Mirrors.
- Chapters 7, 8, and 9 discusses three implementation processes and instantiations of the City Mirror proposal, informing the set of propositions reported in Chapter 10.

PUBLICATIONS

Part of the contents or concepts presented in this chapter are also included in the following publications and/or presentations.

- Lupi L., (2020). ***Moving from Urban to City technologies: envisioning future trajectories for urban research,*** URBANISTICA, Special issue "The dark sides of smart cities" [*Journal Paper - Forthcoming]*

- Lupi L., (2019). ***Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development,*** IASDR 2019, Manchester, United Kingdom. *[Conference Paper]*

- Lupi L., (2019). ***Post-smartness: recomposing the disconnected representation of the city ecosystem mediated by smart city technologies***. AESOP Conference 2019, Venice (IT) *[Extended abstract and conference presentation]*

- Lupi L., Antonini A., (2019). ***City planning and Web-Based technologies: misalignments, convergences and possible future directions***. 16th International Conference on Computers in Urban Planning and Urban Management CUPUM 2019, Wuhan, China. *[Conference Paper]*

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CHAPTER 2.

FRAMING THE RESEARCH

CHAPTER 2. OVERVIEW

Chapter 2 explains the research framework and the philosophical assumptions for investigating the problem of designing web-based technologies to support local development processes from a theoretical and operational perspective. Chapter 2 is organised into nine sections, as follows.

- Section 2.1 provides the arguments in support of the choice of adopting a **transdisciplinary research framework** to study the problem stated in Chapter 1 and it explains the key characteristics of this kind of research.
- Section 2.2 unfolds the connections among the different **disciplines and research domains considered as roots for the study** belonging to the fields of informatics and urban disciplines
- Section 2.3 explains the **strategies used in this work for integrating urban and informatics disciplines** at a theoretical, methodological and practical level.
- Section 2.4 describes the **research protocol** structuring the research process from the analysis of the problem to the elaboration of the theory for designing web-based technologies oriented to support local development actions.
- Section 2.5 enlightens the **research ontology**, or rather the assumptions on the reality to be investigated, in reference to the axioms of the transdisciplinarity that provide the foundations to deal with complex problems in a complex reality such as the city environment.
- Section 2.6 makes explicit the **epistemology of the research**, or rather the characteristics of the knowledge generated in the research process. The section specifies how multiple epistemologies can be combined by associating them to distinct intertwined paths of investigation in research and design.
- Section 2.7 states the **axiology of the research**, or in other words the perspective of the researcher in approaching the research, and the assumptions on the value of the research motivating and driving the investigation process in itself.
- Section 2.8 illustrates the nature of the **research outcomes** associated with transdisciplinary research. It also includes the specific criteria for evaluating transdisciplinary research, differently from monodisciplinary or interdisciplinary works.
- Section 2.9 summarises the **chapter contributions**, accordingly to the outcome spaces of transdisciplinary research.

This chapter provides a common infrastructure for the following chapters. Chapters 3 and 4 continue the analysis of the problem introduced in Chapter 1, focusing on reframing the design and research problem within a transdisciplinary framework, that implies converting a real-world problem in a knowledge problem. Chapter 5 hybridises concepts from the urban and informatics disciplines considered as research roots for producing the core models about a) the representation of users in the urban context, b) the interactional model of the city, and c) the role of technology as a connector between the user and the city model. Chapter 6 presents the methodology constructed for the empirical and applied part of the research process by hybridising methods and techniques associated with the design and research on cities and information technologies. Chapters 7, 8 and 9 will present the instantiation of the hybridised concepts and methods in three case studies. Chapters 10 summarise the outcomes of the research process in a theory and operational guidelines for the development and evaluation of future city web-based technology, according to the imperative of transdisciplinarity of contributing to academic and practical knowledge.

CHAPTER 2. DETAILED TABLE OF CONTENTS

2.1 RESEARCH FRAMEWORK: TRANSDISCIPLINARITY

The problem of overcoming the detachment of current urban applications of web-based technologies from local development goals is a complex multi-facet problem requiring the knowledge from multiple disciplinary sectors to improve its understanding. As highlighted in Chapter 1, the core of the problem is that web-based technologies still are not oriented to support collective actions, despite their impact on individuals' everyday activities in cities. The challenge of understanding how to get web-based technologies supporting collective actions have several analogies with the one of developing plans to orchestrate collective actions in cities. In particualr, the need of purposively handling political considerations in the definition of choices and interventions without taking sides and proactively negotiating different instances and visions of a plurality of subjects. Thus, the complexity of the problem and the evidence that its understanding could benefit from the knowledge transfer from the domains of urban planning and research to technology design pushed for an effort beyond the conventional disciplinary boundaries to hybridise theories, methods, and practices.

An example of that approach was introduced in Chapter 1, which outlines misalignments and convergences between city planning perspectives on local development processes and web-based technologies. In this case, this kind of approach helped clarify the nature of the problem to be addressed as a deep design problem, requiring combining research and design explorations. Indeed, on the one hand, we need to build the knowledge still missing on the interdependence between the representation of collective actions, their agents and the required forms of technological support appropriate case by case. On the other hand, it is necessary to experiment in real-world setting how to actually design platforms meant to support collective actions in the city.

Framing the problem in these terms called for more systematic organisation and solid infrastructuring of this knowledge transfer to make it operational in research and design explorations in complex settings. For this reason, **I have set up a transdisciplinary research framework providing practical guidance for the exploration of the complex problem of linking the design of web-based technologies to local development actions, but also methodological and theoretical foundations for hybridising different disciplines.** In this section, I specify the architecture of this research framework; the motivations for adopting a transdisciplinary research framework; and how the essential characteristics of Transdisciplinarity are instantiated in this work.

2.1.1. ARCHITECTURE OF THE RESEARCH FRAMEWORK

Despite the growing popularity of transdisciplinarity, examples and methods to practically undertake exploration paths in between and beyond urban disciplines and informatics are "scarcely" documented. When mentioned, transdisciplinary research frameworks can be often linked to the exceptionalism of individual scholars able to navigate across disciplines through their intuition, and not to explicit research infrastructures.

Reacting to this obstacle, I decided to rely instead on theories and strategies developed in the meta-research on transdisciplinarity, and I structured my research framework into five layers [see fig. 2.1].

The layers of the transdisciplinary research framework [Fig. 2.1] correspond to:

- the specific types of **inputs defining the research environment** (multi-dimensional problems, knowledge coming from multiple stakeholders, and evolving contexts)
- the kind of **philosophical assumptions** compatible with
  - the acknowledgement of the complex nature of reality (dual ontology),
  - the scope of generating actionable and socially robust knowledge (social constructivist and pragmatist epistemology),
  - the aim of transforming the role of technologies in city activities (change-oriented axiology)
- the **disciplines considered as sources** for conceptualising, investigating and developing potential solutions to the addressed problem combining the consolidated knowledge on urban phenomena (Urban Planning, Urban Design, Urban Studies) with the one on the design and impact of interactive systems in social environments (Information Systems, Computer-Supported Cooperative Work, Human-Computer Interaction)
- the **strategies for integrating these disciplines** leveraging on their commonalities and complementarities (integration through concepts, methods and artefacts hybridisation)
- the **forms of knowledge expected as outcomes of the research process**, intended as knowledge suitable for research communities (system knowledge) and for more practical and operational goals (target and transformational knowledge).

In the next sections, I am going to focus on the inputs defining the research environment [section 2.1.3], and then on the disciplines considered as sources for the study and their integration [sections 2.2, 2.3, 2.4]. In the end, I am going to discuss the philosophical assumptions of this work [sections 2.5, 2.6, 2.7] and the nature of its expected outcomes [section 2.8].

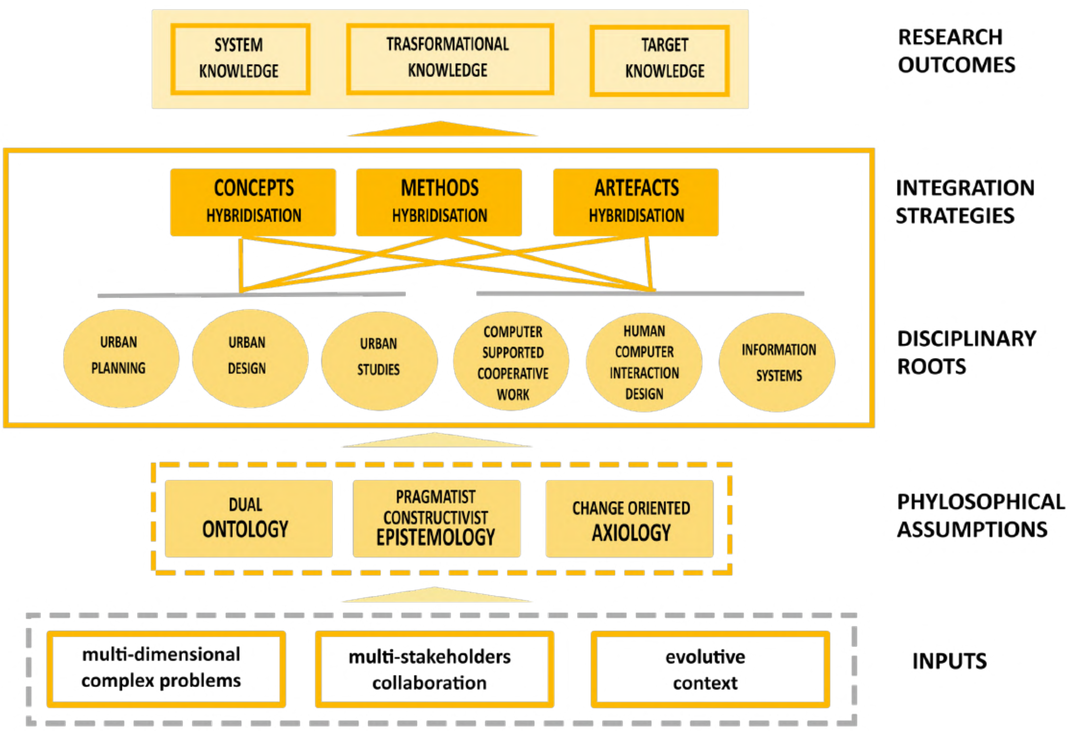

Fig. 2.1 Levels and connections among the layers of the research framework structured for this work

2.1.2. TRANSDISCIPLINARITY VS MULTIDISCIPLINARITY AND INTERDISCIPLINARITY

Two considerations motivated the adoption of a transdisciplinary research framework.

1. It is recognised that **developing information technologies for urban contexts requires a transdisciplinary approach** [Foth et al. 2011, Bilandzic et al. 2011, Kukka et al. 2014, Kukka et al. 2015]. Keeping an ecosystemic and ecological vision of issues and specific dynamics of a city environment can help in designing the appropriate technological solutions.
2. Research **domains that traditionally adopted a transdisciplinary approach opened their sphere of interest also to information technologies[1].** Indeed, urban ecology models and urban sustainability issues cannot ignore that technologies are nowadays an avoidable component of city life [Black et al. 2005, Buizer et al. 2011, Du Plessis 2011, McPhearson et al. 2016].

Therefore, adopting a transdisciplinary framework seemed to be appropriate to understand how to design new web-based technologies for supporting city stakeholders in local development actions. In particular, for investigating the complex interdependences between users, city and technology.

Transdisciplinarity (TD) is considered in the literature as complementary to multidisciplinary and interdisciplinary research frameworks. The key aspect of **multidisciplinarity is the study of a topic from the perspective of several disciplines at the same time.** In multidisciplinary frameworks, each discipline focuses on one separate independent sub-aspect of the problem that could be addressed with the standard methodologies and pre-existing theories in that discipline. Differently, **interdisciplinarity is the study of a topic supported by the transfer of the domain-specific knowledge from one or more disciplines to another discipline.** The goal is to enrich the theoretical and methodological background of the dominant discipline [Nicolescu 2002 and 2006, Ramadier 2004, Max-Neef 2005, Darbellay 2015].

Two examples of multidisciplinary and interdisciplinary studies can help in clarifying the differences.

- Example 1. Research on Open Data is a multidisciplinary field, in which several disciplines (ranging from informatics, political and administration science, urban economy, etc.) are engaged in studying the structure, governance and social impact of Open Data and related technologies. In doing so, they usually keep self-contained disciplinary perspectives on the problem, leaving out the interconnections with the different aspects of Open Data studied in other disciplines.

- Example 2. A significant example of interdisciplinarity is offered by the transfer of ethnographic methods in the analysis, design and evaluation of information technologies. While ethnography in cultural studies and social sciences is aimed at studying a particular population or social group, the application of its revised methods to support the design of information technologies is limited to the acquisition of the relevant information for understanding the prospective users of a system. In this case, the research agenda and expected outcomes coming from the application of ethnographic methods are set by the "recipient discipline".

These two examples point out how the **goals of multidisciplinarity and interdisciplinary research are always explicitly internal to the disciplines** involved in a multidisciplinary study or, in interdisciplinary studies, **conditioned by the goal of the "recipient discipline"** [Nicolescu 2002 and 2006, Ramadier 2004, Max-Neef 2005, Darbellay 2015].

[1] The theme of transdisciplinarity and information technology for instance was the main theme of the TD conference 2018. http://www.transdisciplinarity.ch/en/td-net/Veranstaltungen/ITD-CH-2018.html

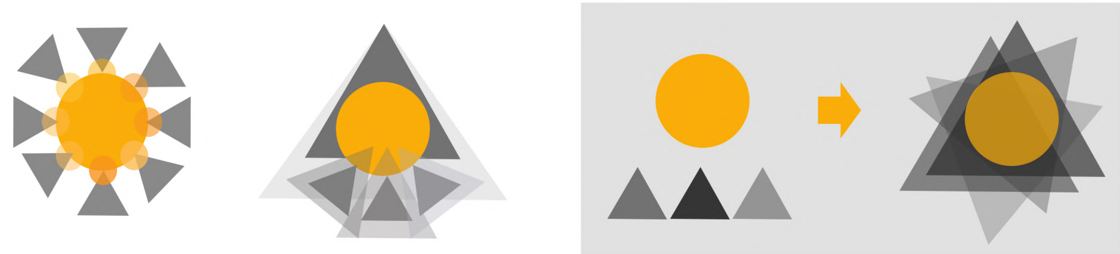

Fig. 2.2 Diagram representing the position of the research problem (represented by a yellow circle) in a multi, inter and transdisciplinary research (in which each triangle represents a discipline)

On the contrary, **transdisciplinarity is oriented to reach goals beyond the disciplinary boundaries**, starting from a definition of problems grounded on real-world issues instead of disciplinary knowledge gaps [Klein 2002]. Transdisciplinarity is not focused on building a specific knowledge product (e.g. a theory, a method, or a technological solution) that fit into a specific discipline, but in **developing the capacity of creating new integrated knowledge functional to broader goals across multiple disciplines** [Klein 2004, Russell et al. 2008]. This integrated knowledge could be expressed through a theory or a method or a technological solution or all of them as research outputs. However, the **goal remains to improve the understanding of a problem and advance the possibility of collaboratively reasoning on the problem** and addressing it at the society level.

Consistently with this vision, the application of a transdisciplinary framework oriented and structured the research presented in this thesis. Starting from the definition of a real-world problem[2] (as stated in Chapter 1, section 1.1), I explored how to convey the relevant knowledge stratified in multiple disciplines (such as urban planning, urban design, informatics, see section 2.2 of this chapter) to improve the understanding of the role and potentialities of web-based technologies in the city.

2.1.3. CHARACTERISTICS OF TRANSDISCIPLINARITY RESEARCH

Explained the motivations for adopting a TD research framework and its goals, in this section, I am going to explain the key characteristics of Transdisciplinarity and how they are instantiated in this work.

Transdisciplinarity is:

- **problem-focused**
- **socially oriented**
- **collaborative** in its nature
- and informed by an **evolving methodology** throughout the research process [Scholz 2000, Klein 2002, Nicolescu 2006, Wickson et al. 2006].

2.1.3.a. TD as problem-focused

The **problems to be addressed through transdisciplinary research are always complex and multidimensional, covering several systemic and interdependent issues** [Nicolescu 2002, Wickson et al.

[2] As mentioned before, the problem addressed in this study is not a specific problem stated in the literature of urban planning, urban design or urban studies, but is relevant for these domains because it offers the opportunity to highlight how the knowledge coming from these disciplines can be effectively integrated into the design of information technologies for the city.

2006, Klein et al. 2012, Lang et al. 2012]. Therefore, their exploration is "process-oriented" and "practice-oriented" with an intrinsic openness which prevents from defining the endpoint of research [Klein et al. 2012]. Relying on these characteristics, TD research topics are usually framed as wicket problems that could be partially approachable by adopting a holistic view oriented toward the "unity of knowledge" [Nicolescu 2006, Klein 2015], merging scientific and social, rational and relational knowledge [Max-Neef 2005]. Urban problems[3] are the most emblematic examples of wicket problems [Rittel and Webber 1973], and they are one of the privileged domains of investigation and experimentation for TD research [Klein 2002, Ramadier 2004].

As introduced in Chapter 1, the under-exploitation of web-based technologies in contributing to support collective actions and local development goals is a complex problem with enormous economic, socio-political and cultural consequences. This real-world problem is indeed multi-dimensional and irresolvable because of the impossibility to approach simultaneously systemic issues. However, the conversion of this real-world problem into a research and design problem makes it partially approachable. Its exploration is driven by the adoption of a strategy aimed at conveying, reusing and bridging part of the knowledge developed in city-oriented and technology-oriented disciplines.

As we are going to see in the next chapters, this exploratory strategy is based on structuring, conducting and analysing long processes to acquire knowledge and expertise on different aspects of the problem and on the practices related to the use of technology in urban contexts. The temporal constraints of the PhD programme set the end of this exploration and the need to produce this thesis as the output concluding a cycle of research activities, even though research activities on the topic could continue indefinitely.

2.1.3.b. TD as socially oriented

Transdisciplinarity is socially oriented [Klein 2002] and *"aspire to make the change from research for society to research with society"* with the goal of contributing to address the challenges of our times [Scholz 2000]. Mutual learning between science and society can be triggered through participatory processes [Scholz 2000]. Overcoming the dichotomy between scientific practices and social practices can speed up the implementation of new solutions in complex contexts and the production of "socially robust knowledge" [Klein et al. 2012]. Undeniably, scientific practices are often conditioned by disciplinary specialisations. Therefore, the goal of communicating the results of scientific practices to the related academic community could determine the priority accorded to methodological and theoretical innovation more than to practical solutions. On the other hand, social practices tend to address problems by focusing on actors' dynamics and looking mainly for results that practically addresses common issues through strategies, action plans, protocols, prototypes. [Lang et al. 2012]. A joint effort could break reductionist approaches and build communicable and transferable results to incrementally and iteratively address socially relevant problems in an actionable way.

The strategy adopted in this work to build "socially robust knowledge" is based on combining research explorations with participatory processes associated with the design of three web-based technologies. The research outputs are grounded on findings coming from extensive fieldwork, conducted across a wide range of social practices and highly contextualised issues in the design of experimental city technologies. At the

[3] Interestingly, education problems and urban problems are the two main areas in TD research. Education and urban problems can be seen as related problems calling for highly complementary solutions. These solutions are respectively aimed at forging individuals and society, to create the kind of sustainable environment where individuals and society can flourish [Hadorn et al. 2008].

same time, the approach and tactics used to elaborate these findings look at consolidated academic practices in forms of research methods and techniques. However, in this work, the goal of elaborating a theory is tied to the purpose of contributing to design better web-based technologies able to enhance the vitality, strengths and resources of cities, their cityness.

2.1.3.c. TD as collaborative

The collaborative nature of TD research finds its application in pursuing a multi-stakeholder involvement to understand the different aspects of a problem, design alternatives and validate possible solutions [Wickson et al. 2006]. Moreover, the effective participation of multiple stakeholders allows researchers to clarify the roles, perspectives, preferences, and utility functions of different players and their reciprocal perceptions toward the knowledge production and application [Sholz 2000]. In this sense, **TD participatory practices are reflective practices** aimed at understanding, expressing and communicating grounded social knowledge. They differ from participatory approaches focused on empowerment discourses and liberation from external forms of oppression, such as the one inspired by the Scandinavian workplace democracy movement [Muller 1991, Schuler 1993].

One of the key aspects of the empirical work presented in this thesis is the involvement of different classes of stakeholders in reasoning and developing future applicative scenarios for web-based city technologies. A variety of participatory techniques and forms of engagement had been implemented to gain a clear understanding of the contextual constraints impacting on the integration of information technologies in the stakeholders' activities. At the same time, these participatory processes promoted a critical reflection of the involved groups about their practices within and across different social structures, as well as on their relationship with the city and their vision of technology.

Stakeholders participation in the research process is identified by Klein as the key concept to join the themes of transdisciplinarity and sustainability research, and to dialogue over urban development issues, democratic values and socio-technical challenges. Beyond the similarities and partial overlapping of problems and topics in the two macro-domains of TD and sustainability research, they share the **interest in concrete actions and motivations informed by the research on normative judgment defining the common good for society** [Klein 2016]. In literature, sustainability goals and the societal demand of engagement in decision-making are also considered important contextual drivers for TD [Byrne et al. 2016]. For instance, problems related to the implementation of smart city strategies as well as the role of information technologies in potentially refactoring urban governance models are often linked to the engagement of local stakeholders in achieving common goals.

In this work, a comprehensive vision of society resulting from the interaction and coordination of city stakeholders is considered a strong driver to inform the design of appropriate information technologies enabling concrete actions towards local development goals.

2.1.3.d. TD as responsive

TD is also characterised by evolving methodologies. It means methodologies oriented toward experimental pluralistic disciplinary fusions, but at the same time responsive to context changes and fluctuations of the perspectives of actors involved during research activities [Wickson et al. 2006, Klein et al. 2012]. In this kind of situations, “scientific rigour” is defined as taking into account all existing information to build the arguments and the proposals [Nicolescu 2002].

According to this principle, this work's research design focused on choosing specific techniques reactive and easily adaptable to the constraints set by the different contexts of the case studies, people involved, projects goals, limits of technology. For instance, workshops, group discussions, living lab experiments, interviews, and contextual inquiries were all used as data collection techniques during the study to take the most from the specific settings of research activities [see Chapters 6, 7, 8, 9].

Summarising, the key characteristics of Transdisciplinarity had been instantiated:

- in the framing of the problem
- in designing and implementing fieldwork and research activities
- in involving multiple stakeholders to reflect both on the problem and their practices
- and in the choice of producing a design theory as main goal of this work [see fig. 2.3].

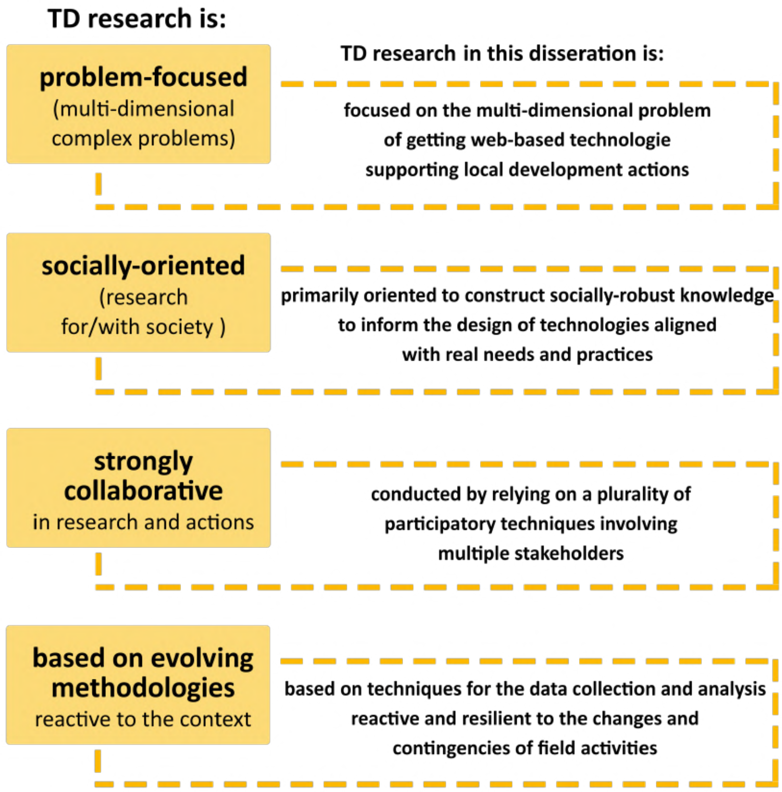

Fig. 2.3 Schema representing the key-characteristics of transdisciplinary research

2.2 RESEARCH ROOTS

In this section, I am going to introduce the disciplines considered as roots for this study[4], by specifying the perspective or contribution of each field to guide, integrate and enrich the research process.

[4] As I mentioned at the beginning, this thesis is written for a diversified audience, not necessarily familiar with the specificity of distant research fields that here I propose to bridge. Thus, a very synthetic overview can help establishing a basic common ground.

2.2.1. SELECTING THE DISCIPLINARY ROOTS FOR THE STUDY

Transdisciplinarity is intended to be a *"conceptual tool to produce interlanguages"* since its earlier theorisations [Klein 2002]. Indeed, TD is defined as a "*space for synthesis across, between and beyond disciplines*" [Nicolescu 2002]. In reference to that, the key decision at the beginning of this study concerned the choice of **bridging urban disciplines and informatics as two complementary macro-domains** for addressing the problem of understanding how to design city technologies for orchestrating local stakeholders in their actions.

On the one hand, I considered **Urban Planning (UP), Urban Design (UD) and Urban Studies (US)** because of the stratified, consolidated and applied knowledge about city dynamics and urban transformations in this sub-set of urban disciplines[5]. On the other hand, I considered **Information Systems (IS), Computer-Supported Cooperative Work (CSCW) and Human-Computer Interaction Design (HCI/d)** as a sub-set of disciplines in Informatics[6] characterised by a focus on developing technological solutions taking into account the operational context of their application[7] [Fig.2.4].

[5] There are also other disciplines potentially relevant for investigating urban contexts such as, for instance, **geography**. However, geography is a social science focused on the study of past and present phenomena, and oriented toward the production of research outputs having a prevalent descriptive nature, or rarely an explanatory purpose. Differently, the domains of urban planning and design are clearly oriented toward the future transformation of urban environments. Their research outputs, especially theoretical ones, tend to have a normative value, instead than being descriptive or explanatory. Thus, operational problems centred on understanding how to design something in the context, change the context through interventions, understand, anticipate, and reflect on the effects of specific interventions on the urban environment are primary concerns in urban planning and design not in geography. Moreover, the theoretical modelling of urban environments in geography is based on the horizontal dichotomy urban/rural (then multiplied in peripheral, peri-urban, rururbanised, and so on). Even the adjective "urban" is used in geography to refer to the city as an administrative entity (e.g. Lefebvre, Harvey) [Ultramari & Firmino 2010]. Differently, the underlying modelling of urban environments in urban planning and design is usually a vertical composition of overlapping layers, based mostly on dichotomy tangible/intangible, physical/social, transformable/permanent, and so on. However, some models and concepts coming from geography (especially urban and political geography) are also integrated into the field of Urban Studies with generative potentialities (in terms of inputs for development processes and governance changes).
These specifications are needed because the preliminary attempts of integrating inputs from disciplines specialised in studying urban environments in other disciplines such as their HCI or CSCW considered geography as main source (see Chapter 5 for specific examples and practical implications). In this work, I decided to primarily consider the inputs from the literature, theoretical perspectives, approaches, scope and methods of the selected sub-domains.
[6] In common language **"Computer Science"** and **"Informatics"** are often confused, used as synonyms, or one of the terms preferred to indicate both according to different traditions in Europe and US. Nevertheless, they cover different domains related to the study, design and development of information technologies. Computer Science addresses the mathematical modelling of information and operative flows, concerning the internal features, structures, and behaviours of computer systems. Informatics addresses the technology and its context simultaneously, focusing on technology design, information systems development, human-computer interaction, and management of technology in different operative environments (an extensive introduction on the different use of the terms Computer Science and Informatics can be found in Smutny 2016).
Building on my direct experience in the last ten years, this specification is necessary because Computer Science and Informatics' perception as a monolithic illegible strictly technical and mathematical domains prevents a proactive engagement of researchers working in other disciplines. Highlighting instead that the kind of approaches to technology in Informatics value first of all analytic reasoning on multi-dimensional problems can help to open fruitful contaminations.
[7] There are also other disciplines potentially relevant for the kind of study presented here or that seems to be relevant. For instance, there is a research community in Computer Science specialised on **Web technologies** only (WWW). While the object of this work, web-based technologies, could suggest a proximity with that research community, there are no touchpoints as regarding assumptions, methods, type of research and goals between the two. The core of WWW studies is focused on the definition and optimisation of algorithms for web services. Design research on web-based technologies and the study of web-based technologies in complex social settings are not developed in this community (see the Proceedings of the WWW Conference of the last 5 years).
Beyond Computer Science and Informatics, there is a third segment of disciplines dealing with information technologies that is "Engineering". It covers the study and development of software, hardware and infrastructural components of information systems. The analysis of systems requirements and their conversion in technological solutions is a central concern in the field of **software engineering**, and there is growing attention in that field to understand how to codify the social requirement for technology. But in this thesis, I decided to do not cover also the aspects related to the engineering of the digital artefacts that will be examined as case studies, focusing instead on the study of the context and design of information technologies for the city, according to my research questions and my expertise.

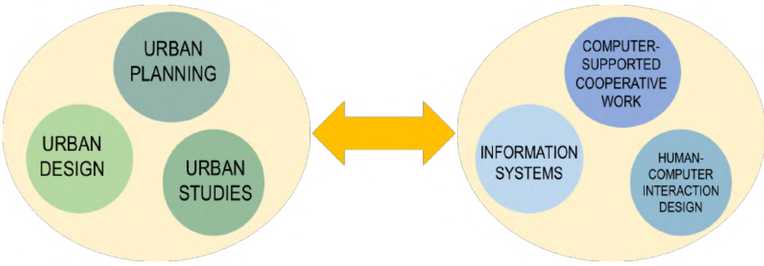

Fig. 2.4 Diagram of the disciplines to bridge in the research

The **main obstacles to building a** ***"space for synthesis"*** **across these disciplines** are:

- breaking the **common misconceptions** that experts of one side frequently have about the nature, methods and scope of their counterparts
- overcoming the **linguistic differences** among distinct domains to describe the same phenomena or objects with different expressions, or various topics with the same word.

Common misconceptions of technology in urban environments are related to utopian or dystopian visions of the effects of technology on the spatial and social arrangements determining city life, but also to the unclear perception of the actual capabilities of technology in itself confronted with the political, economics, organisational constraints in real applicative contexts. These misconceptions on technology are often extended to unfamiliar research domains dealing with the development of technologies, supposing a lack of effort or critical reflection in these domains to create more appropriate and sustainable solutions.

On the other hand, **common misconceptions of urban environments as the applicative context of technologies are due to a static or fragmented vision of city dynamics. That mosaiced vision** can favour the elaboration of an easy fix for complex unknown problems. These misconceptions of urban environments are often grounded on the personal experience and mental models of cities, supposing the lack of more holistic visions of city dynamics that could better serve the definition of technology solutions integrated into the complex reality of urban environments.

The **battle against these misconceptions cannot be a win**. They are pervasive from the macro-scale to the level of individuals. Over the last years, I observed several times that researchers in informatics are frequently assimilated to IT technicians and engineers, as well as planning theorists to unscrupulous real-estate developers. Incorrect roles, spheres of action, and responsibilities are attributed to both groups, especially in problems common across disciplines. As Harper et al. [2017] synthesised: *"cross-disciplinary exchanges are dialogues of the non-listening-very-carefully"*. These authors generalised the notes of Leijonhufvud [1973] about the **numerous "taboos", "distrust", and "contempt" inhibiting the connection across different discipline**, even in the case in which they have a common ground.

Overcoming the linguistic differences is potentially easier and technically feasible. It requires to build a metalanguage to communicate about the same phenomenon or problem under different perspectives. However, the actual use of this **metalanguage compels a generalised agreement or consensus on the meanings attributed to terms and concepts, and this is a long uncertain process**. The most significant

Lastly, fields such as **Socio-Technological Studies** (STS) are focused on studying technologies in their context, but centred on the social components of these interactions instead than on the design aspects. I preferred to rely on the inputs coming from STS studies already incorporated in IS and CSCW.

example of linguistic misalignments is, perhaps, in the expression *"urban informatics"* that assumes completely distinct meanings in urban disciplines and technology design (detailed in section 2.2.2.b). More complex scenarios concerns words having already multiple different definitions and common-sense interpretations, such as "engagement", "civic", "support", "collaboration". In this thesis, I decided to address this issue by making explicit the definitions of key terms that can be perceived as ambiguous across domains, without attempting to overcome the obstacle of linguistic differences at a more general level.

Instead than moving against their differences, **my approach to building a "space for synthesis" across the selected disciplines** is based on:

- **leveraging on their commonalities**
- **enhancing** the **complementarity** of their visions of technology and cities
- focusing on the substantial **homology of methods and research strategies.**

An **interdisciplinary profile** characterises the domains I have chosen as disciplinary roots for this research. These disciplines are intrinsically permeable to incorporate and transform external inputs also in a transdisciplinary setting because generated from the specialisation and combination of pre-existing domains. Urban Planning, Urban Design and Urban Studies are all interconnected interdisciplinary domains informed by a variety of other disciplines such as geography, sociology, economics, political science, etc. Similarly, a large part of Informatics relies on social sciences such as psychology and sociology, as well as on management disciplines and philosophy, and not only on the mathematics of physics.

Beyond their intrinsic permeability, what unites a part of urban disciplines and informatics is the orientation to convert theories and findings into **normative knowledge** for the transformation of the context in which they operate through design or planning interventions. Bardzell&Bardzell expresses the difference between the descriptive and normative nature of disciplines as the need to "*make value commitments about how things should be, rather than attempting to objectively describe facts as they are, which is a paradigmatic goal of traditional science*" [Bardzell&Bardzell 2015]. These authors, advocating for humanistic approaches to HCI, call for reflecting and expressing these value commitments as generative in technology design. On the side of Urban disciplines, especially planning, values commitments are naturally embedded in design choices, planning directions, policies priorities and often made explicit as a condition for the understanding of the criteria used in the development process. Endless references could be mentioned to make this point, that Davoudi expresses as the planners' process to organise facts as evidence for value objectives, for a persuasive and purpositive use of information, instead than reporting and organising facts [Davoudi 2015]. To this regard, central in planning theory is also the Aristotle concept of "Phronesis" intended as the practical wisdom to make value judgments about alternative decisions concerning what needs to be done for setting a specific balance of interests, a desirable direction for the future, an outcome considered good, useful, or equivalents [Flyvbjerg 2004, Gunder 2010].

The third point in common among Urban and Informatics disciplines is in their **orientation toward the future.** This orientation is instantiated by the effort in understanding how the conditions of the present could progress or be innovated. The design of new policies, plans, projects, tools, systems is considered as a potential driver of change. Research strategies and methods are built around the conditions for creating this change, the object to implement it and the observation of its effect in the context. This future-oriented approach to the understanding of current problems is profoundly different from the present-centred or past-oriented approach of natural and social sciences [Zimmerman & Forlizzi 2014]. Also, Secchi, a scholar central for Italian Planning Theory and advocating for the essential need of deep analysis of cities before designing any intervention, stressed in most of his work that the observation of the reality made by a geographer or planner are fundamentally different: the first look at what characterise the context of analysis and the planner look at what can be used in the context to implement an alternative arrangement of the reality in itself [Becchi et al. 2015]. This difference is made evident in using the construction of design processes and design outputs as a way for understanding the reality [Cross 1982], stressing the constraints that determine the current status quo, and identify the directions for change. However, it is also essential to acknowledge that the presence of social scientists in Urban Studies, CSCW and HCI is particularly high and this contributes to defining concurrent framing for research in terms of approaches, visions, goals.

Identifying these three commonalities helped me navigate the selected disciplines by limiting the scope of the exploration of the essential elements for answering the research questions.[8]. The purpose is clarifying the logic of their combination and anticipate specific theories, methods, approaches extracted and readapted from them in my investigation process.

2.2.2. THE ROLE OF THE DISCIPLINARY ROOTS IN THE STUDY

2.2.2.a. Urban Disciplines

Urban Planning, Urban Design and Urban Studies are considered as sources to investigate how to design web-based technologies for local development actions. More specifically, I considered the:

a) **Approach of Urban Planning** in building shared rules and framework of action across competing goals and different stakeholders
b) **Design Principles of Urban Design** for shaping public spaces for multiple types of users, activities, and meanings associated with specific "urban interfaces"
c) **Scope of Urban Studies** to identify the factors impacting on local development processes and building conceptual tools to interpret multi-dimensional phenomena [Fig. 2.5].

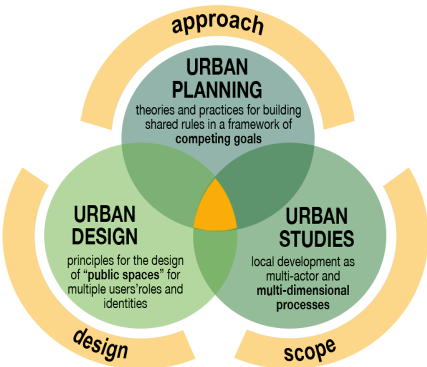

Fig. 2.5 Schema of the elements extracted from urban disciplines applied in the present research.

a) Urban Planning

Urban Planning as an academic discipline includes both urban planning and city planning, respectively defined in Chapter 1 as *"design-oriented physical planning"* and *"policy-oriented socioeconomic planning"* [Gleye

[8] The short introduction about the nature and focus of each discipline selected as a source for the study is due to the purpose of making this work accessible to a multidisciplinary audience.

2015]. Under both perspectives, there is a convergence of urban planning theories and research[9] on **defining and constructing shared negotiated rules in the public interest**, even when the concept of public interest in itself is contested and opened to contradictory interpretations [Gunder et al. 2017]. **These negotiated rules are usually instantiated in plans or policies or programmes to infrastructure future public and private actions to transform cities and territories,** always considered complex built environments, economic areas, and socio-political entities.

Even though Urban Planning is focused on the physical and functional transformation of territories and cities, the **modalities to approach the problem of defining shared rules among different stakeholders** (public and private players operating at the local level) could offer a **fundamental contribution into the design of web-based technologies integrated in city activities**. Indeed, these technologies cannot keep being centred on individuals as customers, as usual in commercial applications. On the contrary, future city technologies need to be integrated in more complex logics and dynamics shaping the city context, as mentioned in Chapter 1. This vision requires moving the unit of attention from the individual to upper-level social structures embedded in a dense net of formal and informal norms regulating their reciprocal interactions and their action in the city.

The need for a shift from the paradigm of the "user-centred design" to the **"stakeholder-centred design"** is already acknowledged as one of the **future challenges for digital technologies** [Forlizzi 2018, Forlizzi et al. 2013]. To this regard, a solid base to build stakeholder-centred design practices looking at the same time at the big picture and the practical matters of contextual constraints can be provided by:

- the experimentation of **collaborative planning practices** as well as the insights coming from the **critiques to their limits** [Innes et al. 1999, Booher et al. 2002, Healey 2003, Brand et al.2007, Innes et al. 2010, Gunder et al. 2018]
- the lessons learned from **communicative, pragmatist and phenomenological approaches** to planning issues [Friedmann 1987, Forester 1988, Whittemore 2014, Gunder 2010, Gunder et al. 2017].
- the logic of **radical planning practices** developed outside classical institutional frameworks and in contested settings [De Leo & Forester 2019], as well the approaches theorised for strategic planning practices in uncertain settings [Albrecths et al. 2016].

For instance, the very simple principle of structuring urban collaborative processes by building a "local chain of interests" as suggested by Innes et al. [2010] can have direct application in technology design processes.

The second important aspect concerning the peculiar way Urban Planning approaches the construction of shared rules in multi-stakeholder frameworks is the conceptualisation and practical handling of power-related issues in an open political space. Power and unbalanced forms of power between different social formations in the urban area are an inescapable condition of any city dynamic [Forester 1988]. Most of XIX-XX centuries top-down approaches of Urban Planning tended to favour established forms of power sustained by central and local governments in charge of urban transformations (defined by Steinø 2013 as "planning for the status quo). However, for decades and in particular in the XXI century, the effort of urban thinkers and practitioners focused on the way to **re-centre and distribute power in civil society acting within and around the net of norms regulating action in the public domains and urban life more broadly** [Friedmann 1987, Gunder et al. 2018]. In this sense, Urban Planning theories and practices advocating for a radical or progressive change [Friedmann 2011, Steinø 2013] bring a unique perspective

[9] The overview of planning traditions and their theoretical foundations is out of the scope of this thesis, but their synthetic representation is available in Friedmann, *"Planning in the Public Domain"*, pp.74-75.

on power relationships: they exist and are not necessarily balanced, but they can be actively shaped and reshaped through intervention. Therefore, the **knowledge of power relationships is seen not as an end but as a means for action**, differently from social sciences that are more detached from the contingencies of making plans, projects and policies that can potentially work in real settings.

The analytic, pragmatic and strategic approach to power dynamics cultivated in urban planning practices and theories can also be translated in the analysis and design of Information Technologies. In this new domain, this approach can help designers, researchers, and technology providers in developing a lucid understanding of the consequences of complying, pushing or attempting to disrupt current power dynamics through specific design choices. In particular, framing the **design of city technologies as the design of an intangible urban infrastructure** [see Chapter 1, Section 1.1] highlights how the approach of urban planning is valuable, not only for building spatial information systems. Moreover, there is already a fundamental awareness in this discipline that "*Urban planning is all about information*" and that "*Information is power*" [Forester 1988], making easier the transfer of logics and methods in the domain of Informatics that is literally built around the management of information in digital systems.

The third cluster of inputs from Urban Planning to this work concern the **framing of city complexity**. I already mentioned in Chapter 1, that cities are the most prominent example of human ecosystems characterised by a double complexity: the one related to the unpredictable actions of individuals in the urban environment, and the one due to the interdependence of city systems [Portugali 2011]. A significant part of research associating cities and complexity build prevalently on biological and physical metaphors to study urban morphology and elaborate predictive models of simple urban phenomena [e.g. Allen 1998, Batty 2013]. On the opposite side, in Urban Planning there are other **visions of complexity in cities based on the understanding of institutions** (always meant as established rules regulating social life), their structure and the generative patterns for their evolution. This perspective is deeply rooted in theories such as the inter-organisational coordination theory of Alexander [Alexander E. 2014], or in a relational and evolutionary framing of city dynamics [De Roo & Hillier 2016], and more in general to the institutional approach in planning [Healey 2006].

What is extremely interesting in approaching the complexity of cities looking at their institutions is that this view makes them potentially readable. As explained by Moroni [2015], *"a complex system is a structure of phenomena, not a mass of phenomena, […] that spontaneously seeks out some form of orders"*. On this assumption and looking at the work of the philosopher Hayek, Moroni distinguishes between the *"explanation of detail"* and the *"explanation of the principle"*, respectively leading to reliable predictions or to the understanding of the internal logic of phenomena. In cities, especially in relation to social dynamics, the explanation of the principle is essential to understand how a sub-system actually works and enables any kind of intervention and support. The relevance of this framing of city complexity to inform the design of city technologies relies on orienting the attention toward more general principles to comply with, keeping great flexibility in the specific solutions for specific settings.

In this work, I used the inputs of Urban Planning approaches in two ways:

- **for developing the two core models of Users and the City** in web-based city technologies oriented to support local development actions, respectively build on a multi-layer vision of individuals operating in the city and a multi-actor representation of urban activities [Chapter 5].
- **for structuring the participatory processes in the case studies** by taking into account the different interests and priorities of a variety of city stakeholders and pushing for them to emerge by adopting Action Research methods as data collection means [see Chapters 6, 7, 8, 9].

b) Urban Design

Urban Design is the academic and applied discipline concerned with the design of public spaces and the interfaces of the city represented by its built and natural environment. Historically there are three main approaches in urban design reflecting normative theories about how the city should be organised, formal theories about the aesthetic of cities, and environmental theories aimed at creating liveable environments for individuals and communities [Steinø 2013]. Considering this last type of approaches, **Urban Design** principles are aimed at shaping places by reflecting the ***"dynamic multiplicity"*** of city actors and their needs, perspectives, expectations [Madanipour 2006], as well as at creating **spaces intrinsically opened** and able to communicate specific values and identities while leaving the "users" free to use that spaces in multiple ways [see e.g. Carmona 2014, Moughtin 2007, Burton et al. 2006, Sternberg 2000].

Urban Design tactics had been considered in this work for attempting to transfer the two principles of "dynamic multiplicity" and "values openness" from the design of public spaces in the city to the design of a virtual public space on the web. The importance of transferring urban design principles to inform the design of digital technologies intended to create public interfaces for people acting in cities is already acknowledged and examined by recent works [De Wall 2014, Arango 2018]. But what is worth mentioning is that emerging but influential schools of thought in the design of digital technologies push for re-orienting the Research and Design agenda toward principles very much closer to the theory and practice in Urban Design. For instance, by supporting the value of **pluralism** in the different views and uses of digital artefacts by users not flattened to ideal user models and embodied in social and cultural systems, the role of designers as **advocacy** leaders for groups marginalised in the current practices of technology development, the usefulness of **participatory practices** involving the public in setting goals and solutions of technology to be stratified within an ecology of other artefacts already in place [Bardzell 2010].

On this background, I used the inputs of Urban Design principles in two ways:

- **For developing the core models of Users and Technology** in between Users and City, by focusing on the fluidity of roles and identities for users and the support to their agency according to these roles and identities as goal for city technologies [see Chapter 5]
- **For informing and orienting the Design Research within and across the three case studies** [see Chapters 6, 7, 8, 9].

c) Urban Studies

Urban Studies is a field studying **problems, solutions and processes of the development of cities** through the analysis of the context in its socio-cultural aspects, focusing on the interactions between people and urban environments, and looking at the organisation of urban systems. The label "Urban Studies" corresponds to the definition of a common interest area across multiple disciplines. It is not a domain with defined boundaries, and incorporates strands from social sciences, political science, urban economics and humanities [Hutchinson 2009] **framing local processes as multi-dimensional processes**, in which the cultural, economic, social, political components of the context are strictly interdependent and require to be analysed and assessed in an integrated way. The **orientation of Urban Studies is mainly theoretical and empirical**, instead than applicative as Urban Planning and Urban Design.

As regarding theories from Urban Studies, the key inputs considered in this work concern mainly the use of interpretative frameworks of city dynamics, such as the ASID model (Agency, Structure, Institutions, Discourse model) developed by Moulaert et al. [2016]. The value of these models for the design of city technologies is that they provide a general schema to understand urban phenomena (to be supported by or through technology) going beyond their observable aspects. Other models cover, for instance, legitimacy issues on actions in the public domain, functional perspectives on communities, analysis of institutions and institutional interactions, management of common resources.

As I will explain below, the study of people and organisational practices in their context is the backbone of disciplines such as Computer-Supported Cooperative Work, but it is also relevant in Information Systems research and in Human-Computer Interaction Design. However, **models and analytic frameworks developed in Urban Studies can extend and deepen the analysis of practices in the city context by considering the structural and representational components of social interactions** and consequently their potential transpositions in a virtual shared space. This is particularly important for the development of future digital technologies as *"common artefacts"* [Bødker 2015], shared by a multiplicity of actors interacting in a dynamically changing context shaped by a variety of factors and dimensions difficult to analyse and transpose in design solutions [Bødker 2006].

As regarding the empirical research in Urban Studies, I considered to build on the critical factors studied in urban transformation projects, city management, and social initiatives for orienting the definition of the scope of technology as support to the everyday practices of local stakeholders, as highlighted by the field activities conducted during the research process.

Shortly, I used the inputs of Urban Studies to:

- Analysing the landscape of **existing technologies** and building the related macro-level classification of web-based technologies applied in urban scenarios [see Chapter 4]
- Informing the development of the **core model of Technology** [see Chapter 5]
- Supporting the **analysis of information** produced during the research process by connecting the contingent observations to higher-level schema and dynamics [see Chapter 7 to 10].

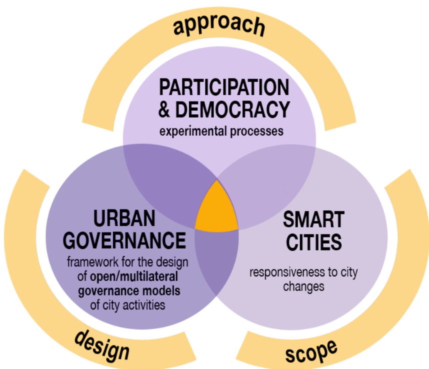

Fig. 2.6 Schema of the elements extracted from the thematic clusters

Within and across the disciplines of Urban Planning, Urban Design and Urban Studies (beyond the theoretical and methodological inputs mentioned before), I sometimes refer to the thematic clusters of **Smart Cities, Urban Governance, and Participation & Democracy**. The research on these topics had been used for deepening the problem analysis [see Chapters 3 and 4], integrating the core models [see Chapter 5] and to inform the theory on the capabilities of web-based city technologies [see Chapter 10].

2.2.2.b. Informatics

The interest in urban applications of ICTs in the research in Informatics can be related to one of the major trends investing digital technologies. As prefigured decades ago, technologies moved progressively from work settings to social settings, or according to the Grudin's expression *"the computers reaches out"* [Grudin 1990]. This revolution changed radically the scope of technologies from supporting people to accomplish specific tasks through the use of ad-hoc hardware and software solutions, to react and provide the digital environment for social interactions.

More recently, two specific sub-domains are emerging to study urban contexts through/with/for technology: Urban Computing [Zheng et al. 2014] and Urban Informatics [Foth & Choi 2011] and. Even though the terms Urban Computing and Urban Informatics are often used interchangeably or as synonyms[10], there are fundamental differences in their goals and orientations, as well as on the technological solutions developed relying on them.

Urban Computing, like other sub-domains of computing disciplines, aims to extract, organise, and elaborate data related to the urban fabric or produced within systems acting as a proxy for urban social dynamics such as online social networks [Zheng et al. 2014]. The means to achieve these goals rely on computational methods based on the definition of appropriate algorithms to operationalise and make more efficient or effective the data elaboration for specific purposes and applications.

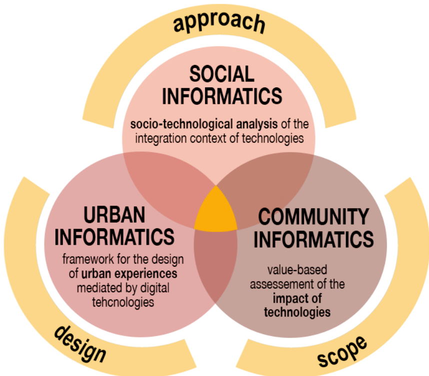

Fig. 2.7 Schema of the elements extracted from the informatics thematic clusters applied in the present research.

Urban informatics, differently from Urban Computing, has the broader scope of **rethinking the urban experience through the support or mediation of technology** [Foth & Choi 2011], and to study the context, define new potential solutions and intervene to sustain technology-driven social and community changes. In Urban Informatics, the approach to the development of technological solutions for cities is based on framing the problem to be addressed as a socio-technical problem based on the three pillars of places, people, and technology [Foth 2008] and deeply relies on participatory practices and critical explorations of technology in urban contexts [Foth et al. 2015]. This research is closer to the vision of Urban informatics as an entry point to investigate the relationship between technology and urban environments.

[10] Most of the confusion between Urban Computing and Urban Informatics is originated by the fact that Michael Batty, one of the main champions of "Urban Science" as a new discipline combining data science and urban modelling and actively involved in the research on "computational planning" uses the expression "Urban Informatics" to actually indicate "Urban Computing". As a consequence, the same use of the expression "Urban Informatics" is perpetuated by the scholars in urban disciplines working on Planning Support Systems and Geographical Information Systems.

Besides Urban Informatics, I considered as essential in this work also the perspectives of **Community Informatics** and **Social Informatics**[11], because of their respective focus on linking the use of technologies to **local development opportunities** [Gurnstein 1999, 2007] and exploring the issues deriving from the design, implementation and use of technologies (in particular web-based technologies) **within specific organisational and social contexts** [Kling 2000, 2007, Kling et al. 2005, Sawyer 2005, Sawyer & Eschenfelder 2002].

Urban, Community and Social Informatics provide complementary inputs to this research [Fig. 2.7]. Urban informatics offers methodological inputs for the design of urban experiences mediated by digital technologies, in particular as regarding action research methods associated with the design of technologies [Bilanzic & Venable 2011]. Social Informatics provides the foundation for the analysis of the context in which technologies are integrated, rooted in a systemic vision of roles and relationships within social systems [Kling et al. 2005]. Community Informatics set the background for the definition of the scope of city technologies in reference to people empowerment, social change and the impact of technology on everyday life [Gurnstein 2007]. The inputs from the literature in these thematic clusters had been used to a) build the core models, b) to integrate the analysis of case studies, c) systematising and generalising the findings (see Chapters 7 to 10).

As mentioned in Section 2.2.1, **Computer-Supported Cooperative Work, Information Systems**, and **Human-Computer Interaction Design** are the three disciplines on the "Informatics side" considered as sources to investigate how to design web-based technologies for local development actions. They had been considered in reference to the:

a) **Scope of CSCW** research as understanding of the nature of cooperative practices to inform the design of digital technologies aimed at supporting that practices
b) **Design-orientation of IS,** connecting human processes and information through the development of systems mediating online and offline actions
c) **Approach of HCID** for clearly connecting people's needs to specific choices in the conscious design the interactions between users and technologies in their context of use [Fig. 2.8].

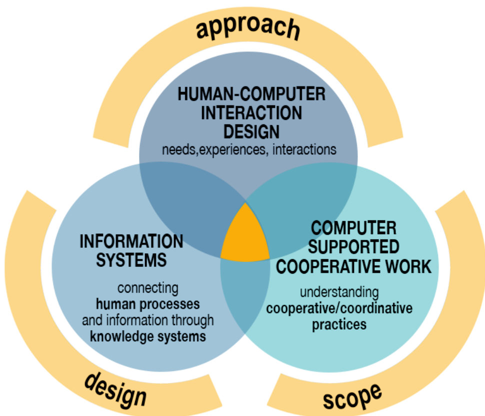

Fig. 2.8 Schema of the elements extracted from informatics disciplines applied in the present research.

[11] Urban, Community, and Social Informatics are thematic clusters (not disciplines) for researchers working on similar topics, but using different theories and methods, similarly to urban governance studies. For instance, see Sawyer & Eschenfelder 2002 about the nature of Social Informatics.

d) Computer-Supported Cooperative Work

CSCW is the discipline studying **how information technologies can support collaborative activities** [Castersen & Schmidt 1999]. The specific expression *"cooperative work"* is chosen to indicate that the object of interest are not only the activities of groups (sharing the same goals), organisations (sharing protocols) or a collectivity (sharing responsibilities), but more in general the practices performed by *"multiple persons working together to produce a product or a service"* [Bannon & Schmidt 1989]. These practices can be in the same space or distributed, performed in synchronous or asynchronous ways [Penichet et al. 2007], and driven by a plurality of norms, conventions, contingencies.

Since its foundation in the '80s, CSCW research focused on working environments and not urban settings. In recent years, growing attention to topics and studies outside working contexts led the CSCW community also to investigate location-based systems and how their uses, impact and solutions are associated with the spatial dimension of people's interactions and the characteristics of places in which they happen. [see e.g. Ciolfi & Bannon 2005, Dourish 2006]. The dominant approach in CSCW for the study of working practices relies on ethnographic methods [Blomberg & Karasti 2013], and specifically focus on understanding the nature and the principles of use for artefacts (digital or not) enabling the cooperation [Schmidt & Wagner 2018]. Over the years, part of the lessons learned from the analysis of a wide range of practices had been systematised in applicative theories explaining nature and attributes of these artefacts to inform the design of future technologies [e.g. Schmidt & Simone 1996, Schmidt & Wagner 2004, Lee & Paine 2015]. The major concern in the CSCW communities remains the transferability of the insights from a domain to another, and basically the meta-conceptualisation of the principles to get technologies effectively supporting coordinative and cooperative practices.

Coming back to the domain of city activities contextualised in the ecology of urban environments, the **limits of ethnographic methods become unsurmountable.** On the one hand, the variety of possible settings and applications of city activities are endless, making impossible to follow a significant selection of them at the same time for abstracting the common principles across different operational milieu. On the other hand, the logic of actions in multi-stakeholder settings is very rarely connected to "observable" elements and factors, and not necessarily incorporated in some artefacts mediating these actions (e.g. think for instance to a Public Administration coordinating a set of third sector subcontractors that provide social services at the neighbourhood level on behalf of the Public Administration, but competing with private alternatives). For these reasons, ethnographic approaches can marginally contribute to informing the design of city technologies, possibly as a complement of other approaches and in a light-weighted form.

On the contrary, **theories and conceptualisations elaborated in CSCW to explain and describe coordination, cooperation and collaboration mechanisms can be fundamental for reflecting and prototyping city technologies aimed at supporting these mechanisms across different operational milieu**. Indeed, even though urban disciplines have the potential to unfold the correlations of city activities relying on an institutional vision of the City, the clear formalisation of different kind of relationships and interdependences among activities is still underexplored. It is very common in urban disciplines to generically refer to "participation" or "collaboration" for indicating these mechanisms, keeping aside every consideration on the artefacts or protocols enabling them. For that reason, it is interesting to explore to what extent principles, constructs, theories from CSCW could be extended to the sphere of urban actions involving some forms of structured social interactions.

Scholars working on the use of technologies for planning purposes [Silva 2010] or on the construction of geographical information systems [Laurini 2014] had been already acknowledged that **urban technologies**

aimed at supporting collaborative practices should be CSCW systems. However, a dialogue with the foundations of this discipline and their transfer to the urban domain is yet to be undertaken, even though in CSCW there is an interest in extending the object of study to public spaces and extra-work settings, and on the planning side, CSCW systems could improve the applicative scenarios and impact of urban technologies. It is important to underline that a bridging element could be exactly the **vision of the city as place where people actually work together to run all everyday activities** going from the provision of services to the physical transformation of places. This common vision is radically different from the idealised user of technologies for cities, assumed as the perfect flaneur [Williams et al. 2009].

Building upon that, I am going to use key concepts and constructs developed in CSCW for:

- developing the **core model of the role of web-based technologies** as a "common information space" [Bannon & Bødker 1997] shared by a plurality of actors implementing their activities in the shared space constituted by the city
- the analysis of the **applicative scenarios and coordinative, cooperative and collaborative practices** associated with the three case studies
- the elaboration of a part of the final theory presented in Chapter 10, as regarding the translation of the **insights on these practices in operational recommendations for the design** of web-based technologies intended to support local development actions.

e) Information Systems

Information Systems is the discipline examining technological systems and social systems and the phenomena emerging from the reciprocal influences between these two systems [Lee 2001]. Its scope is for *"the effective design, delivery, use and impact of information and communication technologies in organisations and society"* [Avison & Fitzgerald 2003]. One of the most prominent concerns of Information Systems research is how to design better information systems to help organisations and society working better from a strategic, economic, management, and social point of view [Avison & Elliot 2006, Baden 2010]. Therefore, Information Systems is a design-oriented discipline having the purpose of improving the status quo by structuring the knowledge incorporated in the operational context of technology and in the processes to be supported by technology[12].

Under this perspective, it is easy to understand why the earlier conceptualisations and models about smart cities and smart city technologies had been elaborated primarily in the field of IS, and not in urban disciplines [e.g. Nam & Pardo 2011, Chourabi et al. 2012]. Indeed, the relationship between technology and the city framed in relation to national and local governmental structures or businesses is an important strand of research in IS.

However, the hybridisation with urban disciplines could help move beyond the conceptualisation of the city as corporate/government entity, and contribute to building better information systems. Indeed, recent conceptualisations emphasised also how Information Systems artefacts can be seen as composed by three components, corresponding to the technical subsystem (tools, platforms), the informational subsystem (contents, meaning, rules of communication within or outside technology) and the social system in which technology is integrated [Chatterjee et al. 2017]. This kind of vision not focused only on the technical aspects of the design of Information Systems can facilitate the hybridisation with other domains, potentially

[12] Similarly to the use of the context analysis in urban planning or urban design for making plans, projects, and policies, the context analysis is used in Information Systems for designing the knowledge structure and the architecture of digital technologies.

providing instruments and lenses to interpret and rationalise the complexity of social systems for design interventions in new settings.

Regarding the design orientation of Information Systems, it is important to specify that design research in this domain is still aimed at rationalising design process and design choices. The space for culturally driven design approaches such as the ones in urban planning and design (or in many other design areas) is limited. However, the depth of meta-theorisations on design processes and outputs in the IS literature provide a solid orientation in the practical challenges of exploring solutions for city technologies (see Chapters 7 to 10). In addition, the IS domain is the most receptive to the new directions in design studies and practice, in particular as regarding service design [Wigand et al. 2009] and systemic design [Djamasbi & Leroy 2019] as alternatives and complement to the design of products (digital products in this case). Differently, in domains such as HCID, these options remain underexplored. This aspect is quite important to approach the integration of technologies from an ecological and ecosystemic perspective.

In this work, I used the inputs of Information Systems research to:

- Study **examples** of spatial information systems and decision support systems during the design research activities associated with the three case studies
- Rely on the extensive corpus of frameworks, theories, conceptual tools developed in IS for dealing with **design and research problems concerning technologies from a context-sensitive perspective** (across the three case studies and for the elaboration of the theory on the capabilities of city-oriented web-based technologies)
- Build upon the existing frameworks for the **assessment of technologies** to examine the specificities of the processes, activities, organisational and inter-organisational interactions in the urban context and then to develop a specific assessment tool for city technologies.

f) Human-Computer Interaction Design

Human-Computer Interaction Design can be seen as the field at the intersection between Human-Computer Interaction and Interaction Design. HCI is the discipline studying the interactions between human and technological systems relying on cognitive science, human factor engineering (a field including psychology, sociology, etc.) and computer science (intended as both computing and informatics) [Dix 2009]. Interaction Design is the wide field of the *"design of interactive products to support people communicate and interact in their everyday and working lives"* [Preece et al. 2015]. HCID[13] originates from the convergence of the two fields grounded on scientific and humanistic knowledge on the one hand, and design methods and practices on the other hand, combined around the shaping of experiences mediated or supported by technologies [Fallman 2003].

The primary focus of HCI (and HCID) research are **users of technologies considered as individuals** (not as part of groups, organisations or collective formations as in CSCW or IS). These individuals are assumed as voluntarily interacting with technologies[14]. One central concern is designing technologies meeting users' needs, but more specifically understanding users' preferences toward certain kind of interactions. Indeed, succeeding in actively engaging users is crucial in technologies intended for individual use, voluntary interaction, and potentially substituted by a plethora of competitors. Web-based technologies are the most exposed to these issues because the competition among equivalent platforms is high and the user's overload is a concrete threat for the adoption of technology [Dix 2009].

[13] See the schema of the convergence between Hci and Design at: https://hcid.sice.indiana.edu/

[14] Stolterman E., "A Blind Spot of HCI Research", http://transground.blogspot.com/2018/11/a-blind-spot-of-hci-research.html

The focus on individuals is clearly a strong limitation to address the study and design of technologies to support city stakeholders in their actions. Besides, it is also necessary to consider that interactions in the city (technology-mediated or not) are always overdetermined, and not voluntary, if not marginally. Running a public or private service, implementing plans and projects, organising initiatives in coordination with others requires a vast set of intentional interactions, mostly defined by a wide range of contingencies and structures. Technology and individual users can partially determine the quality of these interactions, but not their nature. Lastly, web platforms aggregating and supporting city services and activities are less exposed to the competition with mono-purpose or global applications, but their sustainability relies on providing useful, meaningful, operational support to local users.

Nevertheless, some **approaches and frameworks coming from HCI and Interaction Design** can complement the organisational or practice-oriented vision of technology coming from IS and CSCW, and contribute in **making more flexible and elastic the design of city technologies** by hybridising concepts and tactics from Urban Design. Unfortunately, a recurrent myth pursued in the design of technologies for cities is the possibility to create a meaningful or useful ontology of urban entities[15]. So far, this kind of approaches had limited outcomes. On the contrary, an interactional model could help to overcome the impossibility of creating consensus on the description and interpretation of reality. An **interaction model** can be based on the **conceptualisation of interactions defining at a meta-level the various types of experiences in cities, moving the focus from objects to actions.**

In HCID, several frameworks outlining the experience of users with interactive systems focuses on the emotional and cognitive aspects associated with the use of a specific tool, as well as on the quality of the response of the system to the user [Forlizzi & Ford 2000, Forlizzi & Battarbee 2004, Lim et al. 2008, Benyon 2014]. As highlighted by Batterbee & Koskinen [2005], these frameworks tend to ignore the social dimension of interactions with interactive systems that are usually medium for communicating with other people. At a higher level, these frameworks do not cover either the collective dimension of interactions mediated or unmediated by technologies. This collective dimension is linked to identities, values systems, and structural characteristics of the context in which users act in a social world. These elements started to be explored specifically for the design of technologies for cities [Brynskov et al. 2014], but still not in the perspective of infrastructuring collaborative practices in cities.

Against this background, the hybridisation of interactional models and experiential frameworks coming from HCID with the inputs coming from Urban Design can enrich interactional models of city experiences with a specific way of thinking (physical and virtual) spaces as places for multiplicity of users and actions. Then, a focus on identities, institutions, and collectivity coming from Urban planning and Urban Studies can facilitate the integration of the political dimension of actions and interactions with systems meant to support technology-mediated collective experiences. On the other hand, this kind of exploration is coherent with the emerging attention[16] in HCID to the design of interactive systems aimed at addressing needs

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[15] The most emblematic example of this approach is the project Townontology [see Berdier & Roussey 2007]. In this case, researchers worked for years to create an ontology that could result expressive and possibly applied to understand urban settings. They started from mobility infrastructures, that definitely are less challenging to be describe than services and other urban activities. However, the work resulted in a classification schema of over 1200 categories (in 2012), that is hardly usable, even with technology support. But most interestingly, that fine-grained classification not necessarily is robust enough to be applied to every urban setting because of linguistic, functional, normative differences. There are several other examples of attempt to create an ontology of urban components focusing on the description of reality from a geographical point of view.

[16] The evolution of HCI as academic disciplines is conventionally articulated in macro-phases (called "waves") characterised by a dominant way of approaching the study of the interaction between humans and technologies. The first wave was focused on understanding the human factors impacting on the efficiency in the use of technological artefacts. The second wave help to articulate a comprehensive understanding of users as human actors interacting with technologies, but primarily in work settings. The third wave extended the domain of interests of HCI to everyday life and extra-work settings, also considering the cultural aspects

beyond the individual. New research perspectives are embracing concepts such as ethics, agency, and responsibility in technology mediated-actions in social contexts [Frauenberger 2019].

The inputs coming from research in HCID had been used to:

- Integrating the **core model of the City**, taking into account an experiential perspective for the description of urban systems and activities
- Combining the design and research explorations across the case studies, by differentiating what is specific of **interactions in urban settings,** mediated or unmediated by web-based technologies[17]
- **Connecting Users, City as context and Technology roles in an organic interactional model** in the final theory presented in this work.

2.3 INTEGRATION STRATEGIES

In the previous two sections, I stated the adoption of a Transdisciplinary Research Framework as infrastructure for this work, and I made explicit which disciplines and fields had been considered as disciplinary roots. In this section, I am going to specify the strategies implemented for hybridising distinct domains-specific forms of knowledge in urban disciplines and informatics to explore potential alternatives and solutions for designing future city technologies oriented to support local development actions.

Among the strategies for the integration of different domains within the framework of transdisciplinarity [Bergmann et al. 2012], I selected the following three:

a) *"Integration through conceptual clarification and theoretical framing"*
b) *"Integration through screening of existing (inter)disciplinary methods and identifying methodical needs*
c) *"Integration through artefacts considered as boundary objects*

2.3.1. INTEGRATION THROUGH CONCEPTS HYBRIDISATION

This strategy had been implemented mostly in Chapter 5, where theories, frameworks, concepts and ideas coming from the disciplines and thematic clusters indicated in Section 2.2 inputs are combined to generate the three core models of:

- Users (people operating in the city) as embodied in urban multi-layer social structures,
- City context as common space of urban experiences across the different city systems
- Role of Technology to mediate or support coordinative, cooperative and collaborative practices in the city.

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of interactions with technologies [Bødker 2006]. A fourth wave is not yet univocally defined [Bødker 2015], but it seems that value-driven design and the role of technologies for addressing complex societal and political challenges are starting to be perceived as potentially characterising future research agendas [see Ashby et al. 2019].

[17] As regarding the study of interactions with technologies in the city, it is important to acknowledge that the range of interactions and types of technologies that could be considered is continuously growing and offer endless possibilities of experimentation that are currently explored also in HCID research. However, in this work, I intentionally limited the focus to web-based technologies and basic interactions with bidimensional interfaces and visual-textual contents geo-referenced and temporalised. Indeed, this work wants to be a starting point for analysing in-depth the implications of creating shared virtual spaces for competing goals where, so far, users can read, create, manipulate contents.

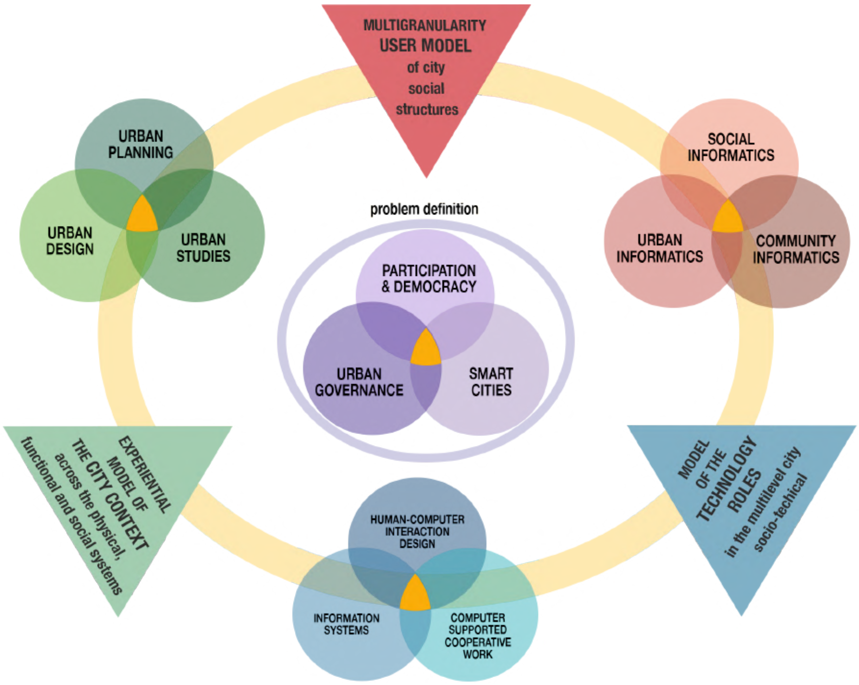

Fig. 2.9 Schema of the transdisciplinary strategy 'Integration through concepts" in relation to the disciplinary roots

Inputs coming from the thematic clusters of smart cities, urban governance, participation and democracy supported instead the analysis of the problem reported in Chapter 3. The concepts coming from the disciplines and thematic clusters used as main sources for the study have also been used as "ingredients" and "infrastructure" for the theory on the capabilities of web-based technologies intentionally designed to support local devolvement actions presented in chapter 10.

2.3.2. INTEGRATION THROUGH METHODS HYBRIDISATION

As mentioned in section 2.2.1, I decided to attempt bridging urban and informatics disciplines by focusing on their similarities. In line with this purpose, I implemented the integration through methods hybridisation by considering classes of research methods[18] established and/or applied on both sides. To explore the double nature of the problem as a design and research problem [see Chapter 1], **I combined Action Research, Grounded Theory, Research for Design, and Research Through Design.**

These methods had been hybridised at the level of techniques for data collection and data analysis, and often adapted to generate and elaborate meaningful and substantial insights from the engagement of local stakeholders in the design and research process on city technologies. The rationale, foundations and the application of these hybrids methods and techniques are explained in detail in Chapter 6. It is important instead to highlight here that these methods have a different "penetration" in the two macro-domains of urban and informatics research, in particular as regarding design research methods and research through design methods.

[18] These methods are often defined as "research approaches" or "research strategies" or "research procedures" and sometimes as classes of research methods including a plurality of techniques for data collection and data analysis. In this thesis, the label "research methods" correspond to the following definition: *"A Research Method is an organic set of procedures required to generate a specific type of knowledge for answering to the research questions".* See Chapter 6, section 6.1.3 to contextualise this definition in relation to the ones of research approach and research strategy.

Designing plans, projects, development strategies, policies, tools, conceptual constructs and physical artefacts is quite normal in the practice of Urban Design and Urban Planning, especially in those contexts where these disciplines are still strictly connected to Architecture (instead than geography and public administration[19]). The in-depth meta-reflection on the design of these kinds of special products, the reasons and the intents associated with specific design choices in specific contexts is a consolidated part of the practice, both as a cultural and pedagogic activity. However, no research handbook for urban research [e.g. Wang & Hofe 2008, Silva C. 2012, Silva E. et al. 2014] mentions design methods as legitimate research methods in urban disciplines, or as alternative or integration for qualitative and quantitative studies. Consistently, academic outputs stating the use of design research methods are difficult to be identified in the major conferences and journals. Farthing [2016] indicates that also the research in urban planning and urban design is grounded on a problem-focused and designerly[20] approach to the analysis of urban settings, but he also clarifies that in his opinion the core of research is the analysis of what is in place before the elaboration of a solution or the ex-post analysis when the solution is implemented, not considering the knowledge generated in the process or the knowledge embodied in the solution in itself[21]. Briefly, design methods are pervasive in the problem framing and in the approach to the analysis of urban topics because of the nature of urban planning and urban design practice. Nevertheless, design research does not seem to be documented as academic practice in urban disciplines[22].

On the other hand, Information Systems is a discipline explicitly founded on the two pillars of behavioural sciences and design research [Von Alan et al. 2004] and highly engaged in the theorisation and meta-reasoning on design methods for research [Gregor & Jones 2007]. The CSCW community revendicate the design-orientation of its research [Wulf et al. 2015]. In the last years, there is also a strong effort in the HCI domain to frame and integrate research exploiting design methods as an essential strand of research for advancing our understanding of the relationships between people and technologies [Forlizzi et al. 2008]. However, the use of design methods as instrumental for research activities and meta-reflections on research activities associated with actual design are not still mainstream[23].

A slightly different situation can be observed in reference to the other two methods applied in this study, **action research and grounded theory.** Participatory Action Research is consolidated in urban research on a variety of different topics, providing a number of examples [e.g. Horelli 1997, School et al. 2018, Israel et al. 2019], but still not so commonly documented in Urban Planning research. Systematic stratified analysis and conceptualisations such as the ones produced by following procedures informed by the principles of grounded theory are also common approaches in the production of urban theories, while not necessarily formalised as grounded theory [Sutrisna & Setiawan 2016]. On the other hand, action research and grounded theory have been strictly codified and widely practiced **across the different disciplines and domains of informatics considered in this study** [De Villiers 2005, Urquhart 2007, Muller & Kogan 2010, Wulf et al. 2011, Olson & Kellog 2014], but privileging some specific interpretation of these methods closer to other scientific practices.

This state of affairs had three practical implications for the hybridisation of methods.

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[19] In some countries (e.g. UK), planning studies originate from geography. In others (e.g. Italy, Spain, Portugal), Urban Planning and Urban Design are branches of Architecture, lately formalised as independent but connected field.

[20] That means looking at what can be changed instead that describing what is on place.

[21] There are several practical, historical and geopolitical reasons explaining this apparently strange situation. Their discussion is beyond the scope of this thesis, but it is useful to refer to Biraghi [2019] that clarify the difference between intellectual production and academic work for knowledge producers engaged in the material production of the space and the change of society through it. This kind of "knowledge producers" is called to communicate to society and decision makers, more than to academic communities.

[22] In 2020, for the first time, one of the major conferences for Urban Planning (EURA 2020) reserved a track to creative methods, including design research methods. Interestingly, the promoter come from the field of informatics, and it is not an endogenous event.

- I followed the key principles and orientations of the selected methods, but adapted their application to the contingencies of the data collection activities and the variety of settings in which the research had been carried out [see Chapter 6].
- I relied on the formalisations and glossary of the disciplines proposing a solid framing of the selected methods (in general, on the Informatics side).
- I build on the examples of techniques and applications of the selected methods for the study of urban settings and phenomena from my previous professional experience and training [see Chapter 6, section 6.8]. I have also incorporated the inputs from other examples in planning practice, not formally documented in the academic literature (e.g. local projects and national initiatives reports, manifestos, and other grey sources).

As a consequence, the integration of the selected disciplines through methods hybridisation required a careful preparation and experimentation, both for field activities and the analysis of the collected materials (see Chapter 6 for details).

2.3.3. INTEGRATION THROUGH ARTEFACTS AS BOUNDARY OBJECTS

The third strategy is the integration of distinct domain-knowledge through Artefacts. Its implementation relied on the applied research for the design of three city-oriented web-based technologies, that are the reported case studies [see Chapters 7, 8, 9]. These three platforms were three different examples instantiating a paradigm of web-based technologies explicitly oriented to support local development actions in the city. The proposal of this type of technology is described in detail in Chapter 3 and 4. What is important to underline here is that the working prototypes and the proof of concepts of these platforms worked as "**boundaries objects**" to explore the implications of that proposal.

The expression "boundary object" is used in this work to indicate a **digital artefact helping to create a shared understanding about what we talk about when we imagine a web technology based on logics alternative to the ones regulating existing platforms. Its scope is allowing experts and not-experts (researchers and stakeholders) to reflect on the practical implications of such technology in their everyday activities, project, relationships, values, problems.** Indeed, the primary function of a boundary object is making the collaboration possible *"across various worlds"* that do not necessarily share a common language or needs or awareness [Nicolini et al. 2012] about the link between the use of information technologies and offline actions.

As defined by Star, *"boundary objects are a sort of arrangement that allows different groups to work together without consensus"* [Star 2010]. In other words, they are objects that could have different interpretations in different contexts, and nevertheless be used in everyday practices despite the lack of a common language to define actions and perceptions around it. The three Web-based technologies used in this research can be considered as boundary objects according to all the main aspects defining this theoretical concept [Star 1989, Star 2010] because:

- **the platform's boundaries were clear** (i.e. they were clearly distinguishable from other tools)
- **the platforms were opened to interpretative flexibility** reflecting position, understanding, and use of different users, but still rooted in the materiality of the platform in itself defined by its functionalities, interfaces, components
- **the approach to the platforms was influenced by the structure** of organisations, processes, and work practices, both explicitly or ill-defined through formal and informal arrangements
- **the framing of the platforms** was tailored on a specific local use in a specific time within a specific social world constituted by an organisation or a community

In other words, each specific platform used with the stakeholders involved in the design process of the case studies was not a generic idea, but a concrete object defined by its design, applications and goals. At the same time, each case study covered a variety of uses and applications of the single platform under development. The processes associated with each case study were also influenced by the research and operational contexts in which the activities had been performed.

Implementing the strategy of the integration through artefacts considered as boundary objects prevented the risks and obstacles of searching a mutual understanding at an abstract level only, on critical topics such as collaboration among different stakeholders, governance issues, or the value of city data, and with a variety of stakeholders and across multiple research communities. Indeed, the design of three specific technologies showing what I consider as city-oriented web-based technologies made possible during the research process to focus on the connection among

a) the **assumptions** on users, city, and technologies
b) the **design choices**
c) the direct **consequences** of these design choices concerning the potential uses of these technologies in urban activities.

In this thesis, the three artefacts are described in their peculiar aspects in Chapters 7, 8, and 9. The applicative scenarios are also discussed to clarify the nature of these artefacts, their capabilities, challenges, and limitations.

2.4 RESEARCH PROTOCOL

I have structured a research protocol for managing fieldwork, design and research activities in a coherent way. This choice had been motivated by:

- the complexity of the problem under study
- the need of hybridising concepts, approaches and artefacts from different disciplines in unconventional forms
- the uncertainty related to the evolution of the three case studies due to the unpredictable and extensive involvement of several stakeholders.

To structure this protocol, I have reinterpreted and transformed the main research protocol developed in transdisciplinary research to the specificity of a design problem.

2.4.1. TRANSDISCIPLINARY INTEGRATED PLANNING AND SYNTHESIS FRAMEWORK (TIPS)

The **Transdisciplinary Integrated Planning and Synthesis framework (TIPS)** is a research protocol developed at the Transdisciplinarity Lab of the ETH Zurich, and intended to provide an operational guide for TD research step by step [Wiek et al. 2009]. The TIPS framework has been proved useful to deal with a wide range of societal and environmental problems involving a high level of uncertainty, divergent interests and marked by a relevant "non-knowledge" of many aspects of a problem. The ordinary applications of the framework concern **cross-sectoral integrated planning issues and decision-making at strategic level** [Walter et al. 2008], but the literature indicates that it could be adapted to *"any transdisciplinary problem"* [Bergmann 2012, p.86].

The protocol proposed by the TIPS framework in its different descriptions [Walter et al. 2008, Wiek et al. 2009, Bergmann 2012] always considered types of investigations calling for the involvement of natural and social scientists, without considering the specificities of transdisciplinarily addressing design problems, and deep design problems in a systemic way.

Thus, **I have decided to build on the TIPS framework, proved particularly effective, for developing a derived research protocol specific to be applied for a design problem. I refer to this new protocol as TIDS protocol (Transdisciplinary Integrated Design and Synthesis protocol).**

Fig. 2.10 and Fig. 2.11 illustrate synthetically similarities and differences between the standard TIPS framework and the version applied in this work, to which I refer as

The research protocol established by the TIPS framework is organised into seven steps:

1) Problem definition
2) Problem faceting
3) Modelling of the problem facets
4) Construction of multiple variants or alternative solutions to the problem based on the models
5) Evaluation of variants with stakeholders
6) Merging of the results and facets integration
7) Formulation of guidelines and strategies for addressing the problem.

Following, I am going to explain how each step is interpreted in the TIPS framework and readapted in the TIDS protocol.

2.4.2. READAPTING THE TIPS IN THE TRANSDISCIPLINARY INTEGRATED DESIGN AND SYNTHESIS PROTOCOL (TIDS)

In the TIPS framework, the first step of the research corresponds to the problem identification. It starts with the description of the real-world problem, its context and the thematic areas involved (the "*problem landscape*"). The result of this phase is the definition of the problem *"in a clear and generally understandable way"* for all the stakeholders potentially involved in the research, leading to the formulation of a normative question orienting the development of the study [Walter et al. 2008].

Similarly, **the first step in the TIDS protocol is the problem statement and the formulation of a normative question.** At the beginning of Chapter 1, I stated in generally understandable terms the problem of the gap between the expectations associated with digital technologies and their limited impact on the implementation of city activities. The description of the problem took into account the two main thematic areas of technology and city planning. It resulted in the definition of a high-level normative question: *how should we design a web platform to support the orchestration of local development actions implemented by city stakeholders?* [see Chapter 1, Section 1.4].

The second phase of the TIPS framework continues with the problem structuring. The problem is broken down in multiple facets, reducing its complexity. Each facet of the problem can be analysed independently and in relation to the others, by considering the perspectives of different stakeholders. The faceting process transforms the initial problem in a problem that can be addressed at a conceptual level through research activities. The reintegration and synthesis of the different facets are made in the following phases [Walter et al. 2008, Bergmann et al. 2012].

The specificity of addressing a design problem requires to define the boundaries of the design space to be explored, instead than analysing the problem with descriptive or explanatory intents. As a consequence, **the second step of the TIDS protocol reframes the problem in multiple facets aggregating at a conceptual level the contextual constraints that define the boundaries of the design space.** The result of the context analysis led to transform the real-world problem into a knowledge problem that can be addressed through design and research explorations. In this work, the context analysis had been organised according to the perspectives of city stakeholders and technology providers. It resulted in the formulation of a "non-knowledge" problem related to the lack of understanding of social, urban and technological aspects impacting on the under-exploitation of web technologies in local development actions [see Chapter 3].

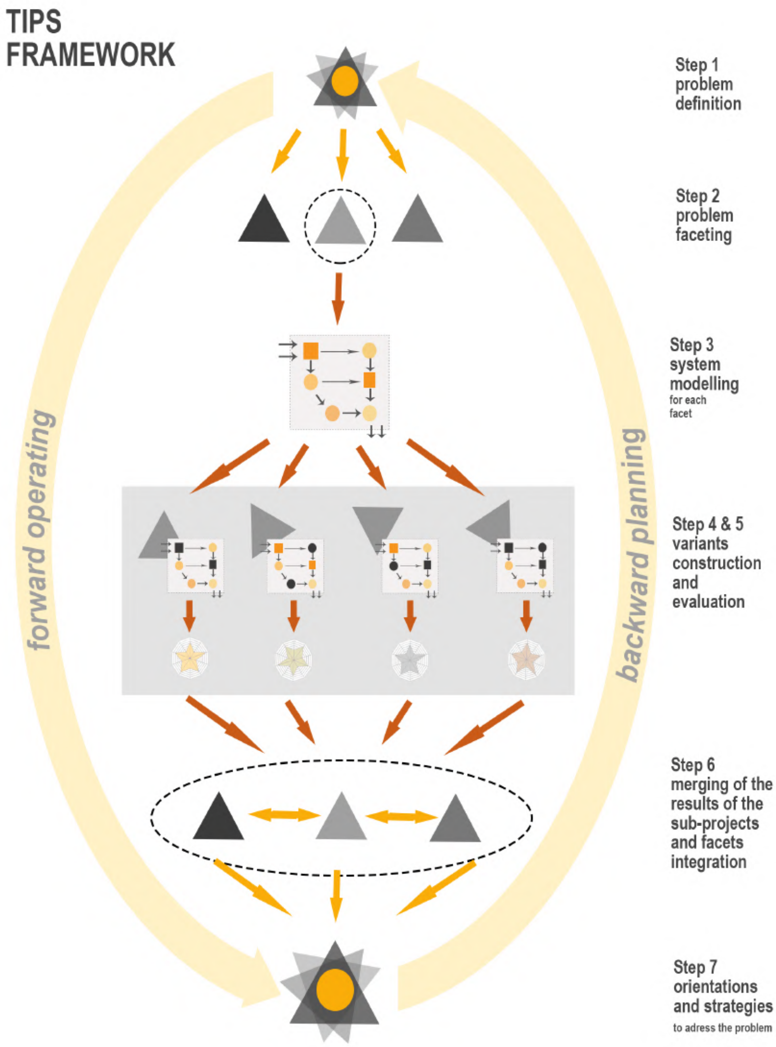

Fig. 2.10 Schema of the TIPS framework – visual elaboration from [Walter et al. 2008, Wiek et al. 2009, Bergmann 2012]

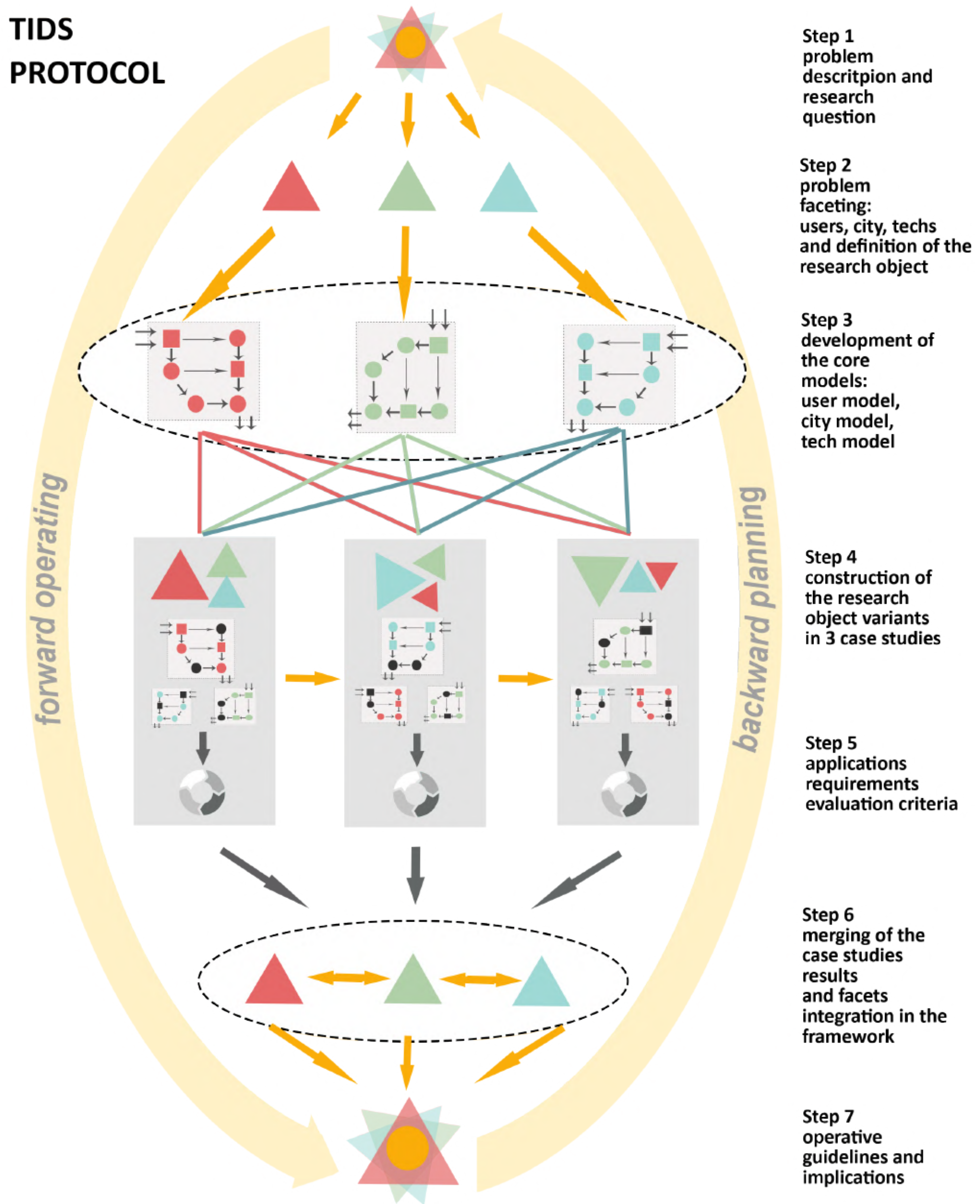

Fig. 2.11 Schema of the TIDS protocol readapting the TIPS framework to a design problem

In between the second and the third step of the TIPS framework, the TIDS protocol requires an additional step. It corresponds to the **definition of the research object in reference to the three facets of the knowledge problem**. This object is the artefact to explore the design space. It can be defined as a specific type or class of objects, but also at a conceptual level as a construct. In this case, the definition of the knowledge problem led to the **formulation of the City Mirror proposal** as a multipurpose, multi-stakeholder and multi-scale web platform, as anticipated in Chapter 1, section 1.4 (see also Chapters 3 and 4). Then, the analysis of the state of the art of existing city-oriented web platforms led to the **identification of the specific design challenges for this research object**, according to the three facets of the problem.

The third step of the TIPS framework is the analysis of the problem facets against the consolidated knowledge. It ends with the development of a system model for each facet of the problem, indicating relationships and interdependencies among the various models.

In the TIDS protocol, **the third step corresponds to modelling the three facets of the knowledge problem in reference to the research object**, and not to modelling the system in which the problem is observed. In this work, this step produced the three core models for the research object represented by the City Mirror proposal. Each model cover one facet of the knowledge problem to be explored through design and research: the representation of users in the City Mirror, the modelling of city activities, and the role of City Mirror as web-based technology for supporting the orchestration of local development actions. These three models had been developed by combining the consolidate knowledge coming from the disciplines considered as sources for the study. The core models are meant to provide an infrastructure to the research and design activities by outlining the full range of elements and aspects to be explored in the empirical and applied research [see Chapters 5 and 6].

The fourth step of the TIPS framework corresponds to the construction of multiple variants of the model developed for each facet of the problem, or to the definition of multiple scenarios for testing the model and identifying alternative solutions to the problem. Then, the fifth step consists in the evaluation of the model variants (or scenarios or alternative solutions) with the concerned stakeholders to select the preferred options. The main differences between the TIPS framework and the TIDS protocol are in the interpretations and implementation of these two steps.

Dealing with a strategic problem (as in the TIPS protocol) allows to address one problem facet at the time. In that case, separate evaluations can be carried out for each facet and each variant of the models and the results related to each aspect of the problem compared at the end. Differently, researching a design problem (as in the TIDS protocol) necessarily requires **considering multiple facets of the problem at the same time**. Indeed, these facets are related to:

- **the subjects interacting with the object to be designed**
- **the object to be designed in itself**
- **and the context and intended uses of the object to be designed**.

In this work, subject, object and scope are, respectively, the intended users of city technologies, web-based city technologies, and their applications to support coordinative, cooperative and collaborative practices in urban contexts. Moreover, the **evaluation in a design process** is rarely oriented to select the preferred option among different variants. The goal is rather to assess the **correspondence between the proposed solutions and the constraints posed by the instantiation of the models into real contexts**.

This clarification facilitates the understanding of the fourth and fifth step of the TIDS protocol. **Step 4 corresponds to the construction of multiple variants of the City Mirror** proposal. Each variant is built by considering different configurations of the three models of users, city and technology previously elaborated in step 3. In other words, each variant is constructed as a selection and combination of segments of the three models of each problem facet. Of course, the possible permutations of different segments of the models can results in dozens of variants, challenging to explore under the time/resource constraints of a research project. Therefore, I carried out my research only on a significant **subset of variants allowing me to explore in-depth, at least once, all the components of the three models for the three facets (subject, object, context)**. These variants are instantiated in the three design and research processes reported in the case studies [Chapters 7, 8, 9]. In Chapter 6, I explain in detail how the case studies had been constructed to have the full coverage of all the segments of the three core models, and also consolidate the insights on the other segments[24].

Step 5 corresponds to the assessment of variants in reference to:
a) the proposed solution,
b) the different aspects of the model segments instantiated in this solution
c) the constraints of the settings in which the proposed solutions are framed.

In the TIDS protocol, each variant of the design proposal is evaluated independently, with different methods in different contexts with different stakeholders, and in iterative cycles accompanying the design and research process. Indeed, each design product (in this case distinct web-based platforms) has its own specificities in terms of goals, applications, context, project aims, and intended users, and the concurrent evaluation of them is meaningless. On the contrary, the independent evaluation of each variant of the design proposal in reference to specific segments of the models provided significant insights on the constraints and obstacles highlighted by each different combination of them, as well as on the individual components of the three base models. As mentioned before, **the goal of the evaluation** is not selecting the preferred options of City Mirror, but understanding how to proceed in the design of web-based city technologies to get them potentially adopted in local development actions. In particular, the goal of the evaluation is understanding the **implications of specific design choices from the perspective of city stakeholders and their activities**.

The last two phases of the TIPS framework correspond to:
a) reintegrating the different models and variants corresponding to distinct facets of the problem
b) formulating strategies, recommendations, and orientation to deal with it based on the knowledge acquired during the process.

As the initial one, also the last two steps of the TIDS protocol have the greatest similarities with the TIPS framework.

Step 6 in the TIDS protocol consists of the systematisation of the findings coming from the three case studies corresponding to a set of variants of the design proposal. This systematisation is perfomed by:
1. merging at a higher level the results associated with the case studies
2. extracting the elements that enlighten generalisable and transferable insights from the specific case studies to the high-level model of the City Mirror
3. detailing each component of the three base models related to users' representation, actions in the city and role of technology in between users and city.

Thus, step 6 provides the reintegration of the three facets of the problem in a unified framework enriched by the knowledge grounded on field activities, artefacts and stakeholder's engagement.

Step 7 in the TIDS protocol finds its translation in a set of operational guidelines to design and evaluate city technologies from the perspective of technology providers and technology users (city stakeholders). These guidelines provide a practical orientation to address the initial problem of moving forward the current disconnection between information technologies and city activities, contributing to design and choose technologies to achieve local development goals.

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[24] For instance, the fact that case study 1 allowed me to study in depth topics related to the interactions with the physical system of the city mediated by technology, did not exclude to gather also useful inputs about dynamics concerning the other city systems because of the structural interdependence among city systems. Or in case study 2, I focused primarily on organisations, but this did not exclude the analysis of factors related to individual or community dynamics.

2.4.3 MAPPING THE STEPS OF THE TIDS PROTOCOL IN THE THESIS

The adoption of the TIDS research protocol in this work enabled to rationalise research and design explorations (and their analysis) in a coherent and systematic way, despite the variety of activities, projects, people involved and contingencies. Moreover, the protocol worked as a self-assessment tool to map each activity in the flow of research and its consistency with the goal of the process [see Fig. 2.12]. Lastly, the value of the TIDS protocol is making evident the logic of addressing a design problem also for readers that not necessarily have a direct experience of this type of research. Beyond that, the adaptation of the TIPS protocol from strategic decisions to design problems kept the approach and the vision of the original protocol, but extended its potential application to new domains and sectors, even if in new forms.

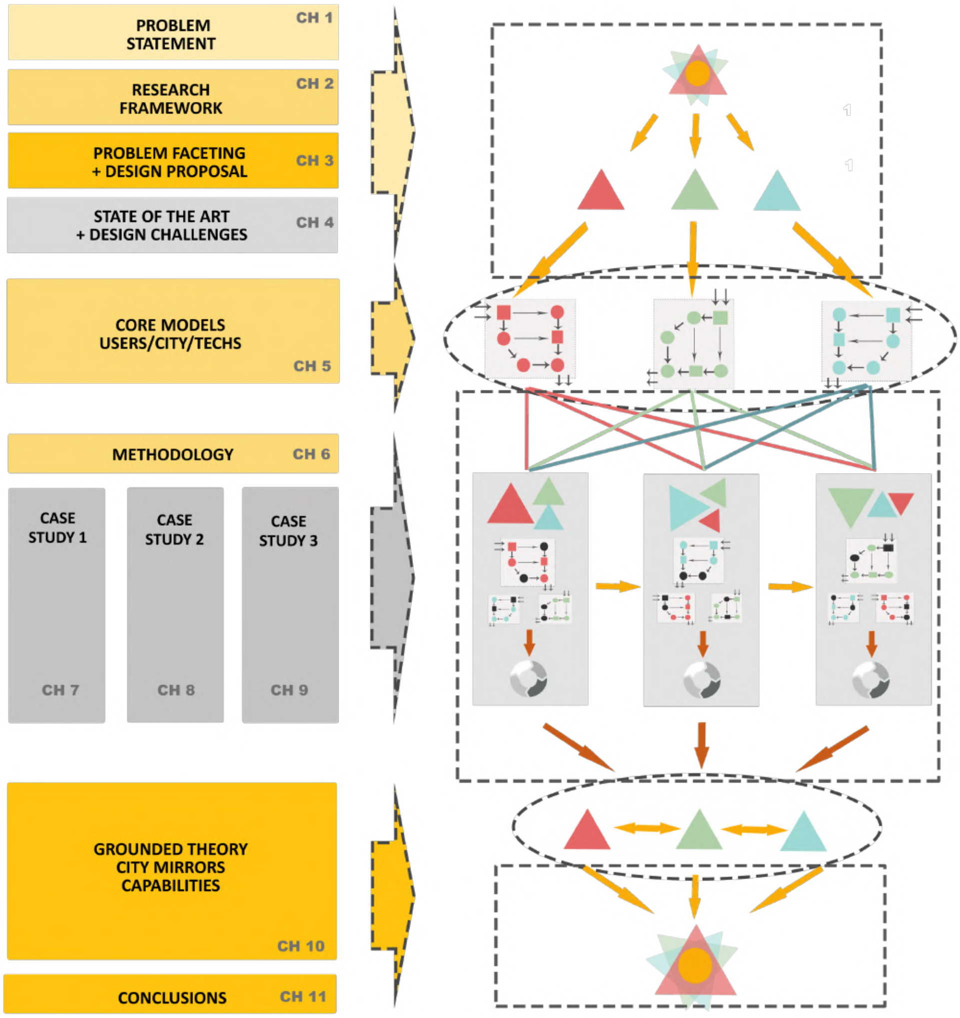

Fig. 2.12 Mapping of the thesis outline presented in Chapter 1 and the steps of the TIDS protocol

2.5 RESEARCH ONTOLOGY

Positioning my work in a transdisciplinary research framework requires not only to indicate the disciplinary roots of the research and the protocol for its implementation, but also to explicitly stating the philosophical assumptions of the research[25]. Indeed, the study of a complex multi-dimensional problem and the integration of different disciplines (with their preferential research paradigms) compels to have a clear understanding of the assumptions about the world (ontology), about what we can know of it (epistemology), and why it matters to try to know more of it through a research investigation (axiology). Thus, I am going to made explicit ontology, epistemology and axiology of this work, respectively here and in sections 2.6 and 2.7 [26].

At a highest level, the **theoretical framework of Transdisciplinarity**, as developed by Nicolescu, provides guidance for the formulation and theoretical exploration of complex problems, as well as for the interpretation of results coming from experimental facts connected to these complex problems [Nicolescu 2002, 2006 and 2014]. Nicolescu's theoretical framework is based on the three following axioms:

> *"I. The ontological axiom: There are, in Nature and in our knowledge of Nature, different levels of Reality and, correspondingly, different levels of Perception.*
> *II. The logical axiom: The passage from one level of Reality to another is insured by the logic of the included middle.*
> *III. The complexity axiom: The structure of the totality of levels of Reality or perception is a complex structure: every level is what it is because all the levels exist at the same time."*
> [Nicolescu 2006]

2.5.1. ONTOLOGICAL AXIOM

As regarding the ***ontological axiom***, Nicolescu distinguishes between *Real* and *Reality*. While the *Real* is referred to the unknowable essence of Objects and Subjects, the *Reality* is intended as the "ensemble" of experiences, descriptions, and representations connected to real Objects and Subjects.

The **Reality is the result of the coexistence of multiple levels of Reality**. Each level of Reality is characterised by its space-time dimensions and it is governed by *"laws"* that must be seen as related to:

a) the laws governing the other levels
b) the laws governing all levels at the same time
c) the laws related to the interactions between Subjects and Objects.

---

[25] The awareness and alignment of the philosophical assumptions is one of the parameters to evaluate the quality of a Transdisciplinary research, see section 2.8

[26] The literature on transdisciplinary research follows three macro-strands.

1) The **operational strand** led by Swiss/German institutions is the one that provided me support for structuring the TIDS protocol, described in section 2.4.
2) The **educational strand** led by Australian institutions, but developed across many other universities and labs in the world, provided me the tools to critically reflect on my research activities, but also the parameters to assess the quality of TD research, as I am going to report in section 2.8
3) Then, the **theoretical strand** is the one led by the formalisation of TD theory developed by Nicoleuscu and other scholars in Europe and USA. Ontological, epistemological and axiological concerns are prevalently discussed in the literature belonging to this third strand.

There is no hierarchy among distinct Levels of Reality, but an interdependence based on the fact that each level of Reality provides an incomplete representation of the world. The Levels of Reality are distinct where there is a discontinuity in the laws regulating them. Otherwise, we have one single Level of Reality organised into multiple Levels of Organisation corresponding to different structures under the same fundamental laws.

The various levels of Reality are accessible to our knowledge thanks to the Levels of Perception. The perception allows humans to understand and having a vision of the Reality as a Unit constituted by the multiple Levels of Reality and the intermediate spaces in between them, defined as "zone of non-resistance". The Levels of Perception are levels of Reality of the Subject, while the Levels of Reality are levels of Reality of the Object. **The Unity of Levels of Reality and their complementary zones of non-resistance constitutes what is called the Transdisciplinary Object. The Unity of Levels of Perception and their complementary zone of non-resistance constitutes what is called the Transdisciplinary Subject** [Nicolescu 2006 and 2014]. Fig. 2.13 illustrates these concepts.

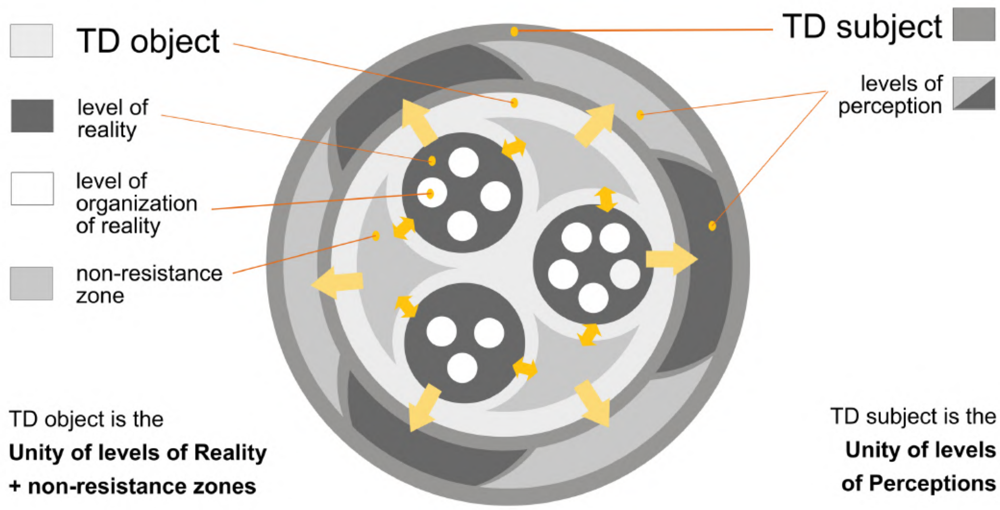

Fig. 2.13 Schema of the Ontological axiom in TD

The importance of the ontological axiom for investigating city dynamics and their transposition on web-based technologies is due to the essential guide provided by the conceptualisation of the world in levels of Reality, level of organisations and non-resistance zones. This conceptualisation allows to model the complexity and the apparent chaos of the city context in a treatable and generalisable way, avoiding at the same time reductionist simplifications. Indeed, the City is conventionally considered a "system of systems", but also as a living organism. By referring to the ontological axiom, it is possible to investigate city dynamics considering at the same time city systems as distinct components and the ecological functioning of the City as results of the interactions between city systems and non-resistance zones.

According to the ontological axiom, the conceptual models developed in this thesis are based on the interpretation of the **City as a Transdisciplinary Object** and the **Unity of technology-mediated human interactions in the City as Transdisciplinary Subject.** The conceptualisation of the City as Transdisciplinary Object provides support for reasoning about the multisystemic ecological nature of the City and how this nature can inform the design of city technologies [see Chapter 5]. The conceptualisation of the City as Transdisciplinary Subject will be instead the infrastructure of the grounded theory about the capabilities of a City Mirror [see Chapter 10].

The modelling of the City as Transdisciplinary Object will be explained in detail in Chapter 5, but I anticipate here a few details making clear the assumptions about the nature of Reality. In this thesis, the **City is considered as the result of three overlapping and interconnected systems: physical, functional, and social systems**. They are distinct because of the discontinuity of logics, non-hierarchical relations, space-time properties, and laws governing the different systems[27]. The **non-resistance zones** in between these systems correspond to the **balance between needs and resources** determining the functions in the space, the **practices and relationships** determining purposive social interactions, and the **values and identities** connecting social entities to their space of action. Each Level of Reality and non-resistance zone correspond to a Level of Perception that is the representation of the experiences of the City as Object. In this work, the representation of these experiences is more specifically referred to the ways they are conveyed and supported by web-based city technologies [see Fig. 2.14].

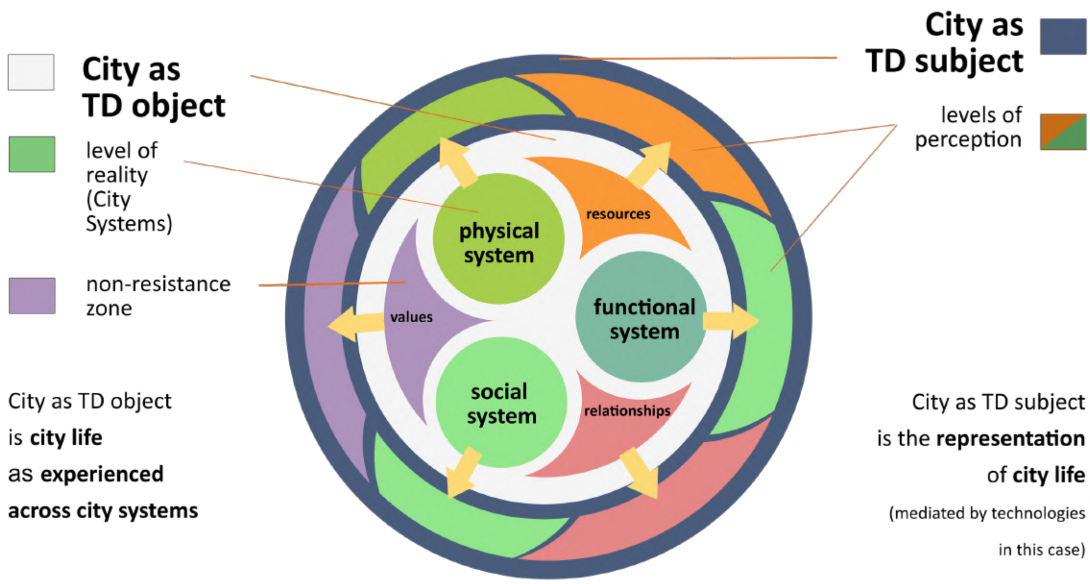

Fig. 2.14 Schema of the application of the Ontological axiom of the TD framework for modelling the City as TD object and subject

2.5.2. LOGICAL AXIOM

The second axiom of the Nicolescu's Transdisciplinary theoretical framework is the logical axiom. It covers the limits of the self-consistency of Reality. The incompleteness of the laws governing distinct Levels of Reality leads to negating the Aristotelic principle of the excluded middle in the exploration of multiple levels as a whole. Indeed, even in every single Level of Reality, some elements seem to contradict the rules governing that level. Still, these elements can be understood by considering the interdependences and influence of other Levels of Reality impacting on the first one and more general laws governing the Reality as a whole. *"The logic of the included middle on the different levels of Reality induces an open structure of the unity of Levels of Reality. This structure has considerable consequences for the theory of knowledge because it implies the impossibility of a self-enclosed complete theory. Knowledge is forever open"* [Nicolescu 2006].

[27] As example, the activities carried out in a public building, the profiles of people visiting that place, and the physical characteristics of the building hosting the activities are regulated by independent laws, respectively under the organisation of functions in the space, social norms, and the affordances of a space due to its physical properties.

The logical axiom is crucial to investigate complex urban processes in which decisions and actions are hardly regulated by linear rules or self-evident rationalities. For instance, choices that seem to be irrational in the management of local services because they contradict the principles of utility, effectiveness, economy or other internal "laws" of the functional system of a city could be understood by exploring the interdependence of the rules governing the social system or the rules framing the objects in the physical system. Analogously, the adoption of a new technology in the city apparently oriented to fix a recognised urban problem could be critical not because of the technology in itself or the perception of its usefulness, but because of other factors related to the physical system (e.g. inadequate instrument) or to the social system (e.g. control issues). Therefore, the logic of the included middle logic helps in investigating in-depth the inconsistency and scale up to more general and integrative rules governing the systems under study, even though it is acknowledged that the Reality is knowable only in part.

2.5.3. COMPLEXITY AXIOM

The third axiom that is the ***complexity axiom*** states that the Reality is the result of a universal interdependence among different Levels of Reality and non-resistances zones in between them. **Horizontal complexity** refers to several levels of Reality and their interactions. **Vertical complexity** refers to a single Level of Reality that is organised in multiple Level of organisations. **Transversal complexity** refers to crossing different Levels of organisation at a single level of Reality. Nicolescu affirms that the interdependences among the different components of Reality cannot be expressed entirely through an analytic or mathematical language, but they could be communicated through symbolic language addressing the totality of the human being, with its thoughts, feelings and body.

The investigation of how to reflect city dynamics through web-based technologies leads to explore multiple Levels of Reality at the same time for gathering insights about hidden processes and interactions among them (horizontal complexity). On-field activities related to the case studies and the analysis of the future applicative scenarios of city technologies provide instead the opportunity to deepen the study of each Level of Reality and its internal organisation (vertical and transversal complexity). The interdependences among these components are elaborated in the grounded theory of the city mirror capabilities through metaphors communicating them in a visually rich way, opened to multiple interpretations [see chapter 10].

From an operational perspective, the set of the three Nicolescu's axioms provide:

- the infrastructure to conceptualise the City as a TD Object and technology reflecting city dynamics as expression of the unit of the TD Subject
- the approach to identify the reasons and causalities among facts and phenomena navigating across distinct Levels of Reality and Levels of Perception of Reality
- the support for classifying the empirical observations by referring to the vertical, horizontal, and transversal complexity and elaborating their synthetic representation at the level of TD Subject.

To conclude, the axioms of the Transdisciplinarity theoretical framework are considered in this work as the foundations for the philosophical assumptions about the nature of reality and its representation. The **research ontology is a dual ontology, based on distinguishing between the "tangible aspects of reality" characterising the TD object and "intangible aspects of reality" related to the perception of reality by the TD subject.** The first ones can be observed, and the second ones can be investigated through intervention. In both cases, even though the "Real" is unknowable, we can search for the laws and rules governing the organisation of Reality in an open process of knowledge construction. In particular, as regarding the intangible aspects of reality, my attention is on the collective perceptions.

2.6 RESEARCH EPISTEMOLOGY

TD research is oriented to **improve the understanding of complex problems**, and at the same time, to produce results that can be applied to handle a problem, such as models, guidelines, strategies, plans (see section 2.1 and 2.4). Indeed, even recognising that the knowledge gained from the research is possibly partial, limited, contextualised, not always true (in the sense of not falsifiable in scientific terms), TD research assumes that it is still possible **to develop new solutions appropriate to the problem** by building upon that knowledge. The scope of the TD models is not to describe a phenomenon in "naturalistic" terms, because they are normative and not descriptive. Their scope is providing the means for analysing and handling multi-dimensional phenomena in their different instantiations by relying on a theoretical understanding of relations and patterns correlated to the various aspects of the problem. Therefore, the **knowledge produced through a TD research can be often associated with constructivist and pragmatist epistemologies**.

In this thesis, the assumptions of constructivist and pragmatist epistemological perspectives are associated with the two main tracks of the work, respectively research and design. The two epistemological perspectives, constructivist and pragmatist, are combined in the elaboration of the theory on the capabilities of web-based technologies supporting local development actions because the theory is basically a design theory with a normative orientation [Friedman 2003, Gregor & Jones 2007]. In this theory, the recommendations about the definition of solutions for different technological components (design knowledge) are grounded on the elaboration of social and contextual factors defining the domain of the technology intervention (research knowledge).

2.6.1 SOCIAL CONSTRUCTIVIST EPISTEMOLOGY

The knowledge built upon reflections and analysis of the dynamics concerning city activities and the use of web-based technologies in urban contexts is framed under a constructivist epistemology, social constructivism more specifically [see the in-depth analysis and description of this paradigm in Kim 2001, or Kukla 2013]. I have observed and studied these dynamics through the collaboration with the wide range of city stakeholders involved in the three case studies reported in this work. Then, I interpreted the various applicative scenarios of city technologies explored in the research process to extract their **underlying meanings and representational elements, structural components and key aspects of the involved practices** [Krauss 2005]. The interpretation of these scenarios assumed the existence of **different perspectives of a plurality of social actors determined by social, cultural, political, historical, institutional, economic, and geographical factors**. The interpretation process focuses on the elements defining the actions of high-level social structures such as groups, organisations, and communities, searching for the so-called *"intersubjective meanings"* [Kim 2001]. At that level of abstraction, it is possible to investigate how part of these factors and socially shared meanings are actually linked to the observed actions, even though personal factors at the level of individuals are still considered as unknowable or not generalisable.

The introduction of city-mirror-like technologies in local processes during participatory activities facilitated the emergence of meanings, structures and practices through dialogue and joint actions with local actors, allowing me to ground my interpretation on continuous dialogue, collective reflection, and co-generation of interpretations. At the same time, the interpretation of the observed dynamics also relied on my direct knowledge of explicit norms and regulations in the contexts of the study. Lastly, the interpretation of the reality proceeded by triangulating of the emerging concepts with the existing literature, other "grey sources" (press, social media, informal sources, parallel studies), and across different applicative scenarios presenting similar characteristics [see also Chapter 6, sections 6.4 and 6.6.]. The result is not a knowledge that is always true or that necessarily has universal value. Instead, it is a **knowledge helping in tracing how actions observable in urban contexts (and that can be possibly supported by city technologies) are linked to specific social and contextual factors that should be considered in the design of such technologies**[28].

>>>>>>>

2.6.2 PRAGMATIST EPISTEMOLOGY

The knowledge constructed during the design process of the three web-based technologies included in the case studies is framed mainly under a pragmatist epistemology. This type of knowledge concerns the limits and potentialities of specific design choices and technological solutions in relation to the multiple constraints posed by city activities, but also which solutions can address specific types of problems and under which conditions they could potentially work or not. This type of knowledge is built on experiences associated with specific settings given by the various combinations of "platform + stakeholders' geometry + city activity". However, it is transferable to other settings because formulated in terms of problem boundaries and dimensions for the analysis and development of solutions.

As noted by many authors interested in the epistemology of the design knowledge, designers (including architects, planners, engineers, system designers, etc.) think to be possible to improve the existing conditions in an objective way through the solution they are elaborating and usually base this belief on the understanding of problems coming from current technologies and solutions [Fransenn 2015, Vermaas 2011, Vermaas 2014]. On this ground, part of research concerning design problems often deviates toward post-positivist epistemology and try to convert design processes into scientific processes [as critically discussed in Cross 2001]. However, a pragmatist epistemology remains very common and the one better describing my approach in the generation of design knowledge in this work. Knowledge that is useful for understanding the stakeholders' needs and assessing in advance potential solutions to address their needs through city technologies.

>>>>>>>

[28] An example can clarify the point. In chapter 5, I will introduce the concept of spontaneous and artificially created spatial communities. In my investigation, I explored the introduction of city-mirror like technologies in both types of settings. Regarding to that, my focus was not on the perception of technology by specific individuals belonging to these communities, highly contingent anyway. My focus remained on the way technology impacted on the relations of dependence/influence of that community against others and on the operational patterns of different social forces in that context. These patterns are not always present in every possible type of communities in every part of the world. Nevertheless, they recur in presence of similar geometries of social determinants.

2.6.3 EXCLUDED OPTIONS

It is important to specify two additional details to prevent potential misunderstandings with the reader about subsidiary or conflicting epistemological assumptions not considered in this work.

The ontological assumptions on the double nature of the Reality as object and Reality as perceived by the subjects interacting with it [see section 2.5] apparently can lead to embrace one of the two opposite epistemologies of positivism and subjectivism. Building a TD research on one of these two epistemological assumptions (positivism or subjectivism) would contradict the conceptualisation of the reality as a multi-level entity composed by interdependent objective and subjective components. Moreover, similar choices would also be against the central driver of Transdisciplinary research of exploring complex problems by building a synthesis between multiple domain-specific and social knowledge. Therefore, **this work is not positioned under a positivist nor subjectivist epistemology.** As mentioned above, I focused my analysis at the level of structured social entities (not individuals) in order to benefit also of an infrastructure of objective constraints, shared meanings and norms, established processes in their context of action to cover the most intangible aspects of the social interactions with technology in the city.

The analysis of power relationships is fundamental for understand city dynamics, especially in the framework of multi-stakeholder processes [see section 2.3]. Thus, the discussion of power issues and implications of power as a topic and as an intangible object will recur throughout the thesis. However, **I have not adopted the perspective of critical theories or ideologically informed lenses for the analysis, or the assumptions on reality and knowledge associated with a critical epistemology**. I focused instead on the factual aspects of power (limitation of agency, control, legitimacy, etc.) recurring in intra and inter-organisational and community relationships and how they influence or are influenced in technology-mediated interactions. As I mentioned before in relation to urban planning and urban design, in design activities linked to city settings, power relationships are one of the “materials” of the design process (material that can be malleable to a certain extent), exactly as programming languages could be considered as a material for making interactive systems. The analysis of power relationships is then framed under a pragmatist epistemology, serving the identification of useful inputs for making city technologies socially acceptable.

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2.7 RESEARCH AXIOLOGY

The research axiology is related to the role of the researcher's values in the generation of new knowledge [McGregor 2011]. The researcher's values are important to select the topic of the research, the way to conduct the investigation process, the definition of findings, and at a higher level the aim of the research [Tracy 2012]. Indeed, working on a topic because of its social, political or economic importance is related to the researcher's view of the world and his/her position about what is right or good to pursue. Moreover, choosing methods and techniques centred on interactions with people or interaction with instruments depends on the value accorded to understanding the world through other people experiences or by measuring it. Lastly, envisioning theoretical or practical outcomes of the research relies on the specific view of the researcher's role and work in its context.

Consistently with the ontological and epistemological assumptions stated in section 2.4 and 2.5, I do not suppose that the value of the research is neutral or free from biases (as it could be in research following positivist paradigms). On the contrary, I am aware that personal values and the socio-cultural context of the researcher influence the research process in the following ways [elaborated on the basis of Hofkirchner 2003, Cicovacki 2004, Horlick-Jones &Sime 2004, Funtowicz and Ravetz 2008, Mc Gregor 2011].

- As regarding the ontological assumptions, the **researcher's interpretation (and values) filter how and what level of reality and level of perceptions are represented in investigating complex problems**.

- As regarding the epistemological assumptions, adopting a constructivist epistemology based on the assumption that reality is socially constructed places the interpretation in reference to multi-perspective social dynamics and not on the subjectivity of the researcher. Nevertheless, in this case, the **researcher's values are fundamental in deciding what is relevant in the process of knowledge generation**.

- The nature of the problem as a deep design problem and the consequent pragmatic epistemology led to assess the findings in relation to their utility for addressing the problem and not to the personal perspective of the researcher. But again, the **researcher's values are fundamental in the communication of results**.

- Lastly, in transdisciplinary research is widely recognised the essential role of the **researcher's values for interconnecting the different aspects of complex problems with the different systems of values of the stakeholders affected by the problem**

The practical implication of acknowledging that the researcher's values influence the research process and outputs is openly stating what values informed the research process as regarding a) the **selection of the topic**, b) the **aim of the research and the role of the researcher**, c) the **approach to the research activities**. Following I discuss these three points, while in Chapter 6 I will specify the relationship between my personal standpoints and the definition of the methodology for the empirical and applied research.

2.7.1 VALUE DRIVERS IN THE SELECTION OF THE TOPIC

My interest in the design and use of web-based technologies for local development began in 2008, years before starting my PhD. This interest was motivated by the fact that I had the opportunity to experience how this class of technology had the potential of really addressing most of the problems related to the communication and self-organisation of people both in ordinary and extraordinary situations happening and shaping city life. The same experiences that highlighted these potentialities also pointed out the difficulties of overcoming personal, social and institutional barriers to get people collaborating through technology. These reflections drove me to initiate a research on these barriers for identifying what could make web-based technologies appropriate and socially acceptable in urban contexts. This kind of research is explicitly meant to bring practical outputs for improving the outcomes associated with the use of web-based technologies in local development processes.

My personal **first-hand long experience** with web-based technologies in city settings determined the selection of the topic. Then, my **identities (**e.g. European, Italian, Expat, Millennial, Designer, Transitioning researcher), **gender** (woman and mother), **socio-economic status** (over-educated not-privileged working class), **political and religious believes** (liberal and catholic), **direct experience and contacts with different geographical contexts and operational domains**, oriented me to:

- focus on the **collective dimension of the experience of the city**
- critically reflect on the tension between **personal responsibilities and influence of social structures**
- pay more **attention to everyday activities** instead than episodic top-down or bottom-up initiatives
- embrace the natural **coexistence of dynamics** that cannot be labelled binarily as positive or negative
- attribute a **relative value to academic knowledge**, acknowledging the value of people's knowledge.

Notes and references >

2.7.2 ASSUMED ROLE OF THE RESEARCHER

When I started my PhD, I was aware that web-based technologies were still considered marginal in the discourse and applications of technology in the smart city framework. Consequently, also the research on the relation between web-based technologies and city dynamics is not a consolidated strand of research. Meanwhile this situation changed. The major provider of web services in the world[29] entered in the arena of smart city solutions with the ambition of revolutionizing the relationship between smartness and technology by focusing on people in the city, their activities, their needs, instead than on the urban fabric as other competitors. While I am writing this thesis, the pilot project [30] is still on-going and we do not yet the results. But what we do know is that the company in charge of the project engaged an "army" of planners, experts in urban design, facilitators and urban practitioners to define this new approach to smart city solutions. We do know also that the pilot project in Toronto is intended to be just the beginning, pushing also other ICT companies leading the smart city market to innovate their strategies.

[29] Alphabet is the holding aggregating Google and the other controlled companies of the same group, including "Sidewalk", that is the company engaged in urban planning and smart city solutions.
[30] https://sidewalktoronto.ca/

In this new context and in the near future outlined by the radical change in the focus and type of smart city solutions, I believe that the responsibilities of planners and researchers addressing the relationship between city and technology will be enormous.

- **Responsibility of contributing to orient the realignment between technology scope and local development goals, industry imperatives and society aspirations**, specificities of each urban context and transferability of good practices and solutions by working with who design and implement these solutions.

- **Responsibility of generating and structuring the knowledge that could inform this realignment process** by producing *actionable knowledge* for the benefit of cities.

I would like to argue that these responsibilities are perfectly consistent with the primary goal of planning that is translating "knowledge to action" [Friedmann 1987], but applied to new domains, possibly out of the conform zone of planning practices and urban research.

2.7.3 APPROACH TO THE RESEARCH ACTIVITIES

The adoption of a transdisciplinary framework during a PhD programme is still an unconventional choice, as pointed out in several occasions in which I had the opportunity of presenting this work. Indeed, transdisciplinary research is not the mainstream way of conducting research in academia. However, as it happened for web-based technologies and smart city solutions, during my PhD a big change invested also status and perspectives of transdisciplinary research. The European Commission, that is the major research founding body in the world, established that the next Research & Innovation programme "Horizon Europe 2021-2027" will primarily support *mission-oriented research*. **Mission-oriented research is the one driven by real-problems and society challenges**. It is explicitly aimed at elaborating actionable solutions for addressing these problems and challenges through synergic effort beyond the canonical disciplinary boundaries, actively involving the stakeholders supposed to benefit from research innovations[31]. This fact constitutes literally an enormous source of legitimation for research adopting transdisciplinary approaches. Most important, it emphasises the **value for researchers in being actively engaged in addressing social challenge by using their knowledge for this purpose**.

This emerging trend reflects the considerations of one of the last works of Popper stating that real-world problems are problems worth of research investigation as well as theoretical problems framed within one specific domain, because problem for research can legitimately emerge both from knowledge gaps or from the society, even though the frameworks of investigation or the criteria of success and relevance can be different [Popper 2013]. Thus, even though TD research is not yet mainstream, the perspective that it could become a more common research framework motivated me to pursue my research training and my work in this direction by learning how to **do research with people and for people, in mixed settings (public/private, academia/society), addressing and negotiating among competing goals**.

[31] https://ec.europa.eu/info/designing-next-research-and-innovation-framework-programme/what-shapes-next-framework-programme_en

2.8 RESEARCH OUTCOMES

In this section, I am going to anticipate the **nature of the research outcomes** and making explicit the evaluation criteria proposed in the literature for **assessing the quality of transdisciplinary research outputs**.

2.8.1 RESEARCH CONTRIBUTIONS, OUTCOMES SPACES AND FORMS OF TD KNOWLEDGE

The intrinsic characteristics of Transdisciplinary research (discussed in section 2.1) extend the range of conventional research outputs. In TD research, they are framed in reference to “outcome spaces”, intended as spheres for integrating the knowledge generated in the research process into the real-world [Mitchell et al. 2015]. Mitchell et al. proposed a framework articulating the research outcomes along three directions associated with:

- the improvement of the understanding of a **situation**
- the contribution to the **knowledge** stratification and exchange (e.g. between disciplines, between practice and theory, between descriptive, purposive and normative *strata*)
- the facilitation of **transformational learning processes** investing the different actors involved in the research or potentially affected/interests by its results.

The three outcome spaces of situation, knowledge and learning are closely intertwined and influenced by each other, and also by the practical contingencies of the research (researchers’ skills, project priorities, stakeholder’s engagement, and so on).

These three outcome spaces find their correspondence with the forms of knowledge associated with TD research, as classified by Pohl & Hadorn [2007]. They distinguish the outputs of TD research in **system knowledge, target knowledge and transformational knowledge**, respectively having descriptive, purposive and normative goals. System knowledge is usually related to the empirical or theoretical knowledge transferred by the academia to real-world (through models, methods, or experimental findings), for addressing the lack of knowledge and uncertainties in the understanding of a specific problem relevant at the society level. The target knowledge is related to the clarification of practices and needs of the different actors operating around the research topic for identifying the possibilities of inducing changes in a current problematic situation and allowing them to reach their goals. The transformational knowledge is about:

1) mapping the existing social, cultural, practical, legal, technological constraints determining the problem under study

2) outlining the options for changes, built by assuming a pragmatic stance and exploiting the learning process supported by research [Pohl & Hadron 2007, Pohl & Hadorn 2008, Wuelser et al. 2012]

Building on the substantial convergence of outcome spaces and forms of knowledge as defined in the TD literature, in this thesis I am going to list at the research contributions at the end of each chapter in terms of:

- **system knowledge** referred to academic knowledge
- **target knowledge** concerning the different actors working on/around the problem and beneficiating from a better understanding of the situation
- **transformational knowledge** as insights and operational guidelines to plan, support or implement a change to address the problem under study [see table 2.1].

Table. 2.1 Nature and classification of the thesis research contributions

OUTCOME SPACES & FORMS OF KNOWLEDGE	TYPE OF CONTRIBUTIONS
SYSTEM KNOWLEDGE (ACADEMIC KNOWLEDGE)	THEORETHICAL CONTRIBUTION
	METHODOLOGICAL CONTRIBUTION
	EMPIRICAL CONTRIBUTION
TARGET KNOWLEDGE (SITUATION)	FOR CITY STAKEHOLDERS
	FOR DECISION MAKERS
	FOR TECHNOLOGY DESIGNERS
	FOR TECHNOLOGY PROVIDERS
	FOR URBAN PRACTICTIONERS
	FOR RESEARCHERS
TRANSFORMATIONAL KNOWLEDGE (LEARNING)	USERS
	CITY
	TECHNOLOGY

As regarding the **contributions to the system knowledge**, I adopted the standard classification in **theoretical, empirical and methodological contributions**. It is worthy to underline that because the problem addressed by this work is a deep design problem (and not just problem to be analysed and observed), it is completely normal that the research on the appropriate methods to pursues the research goal is an important part of the research in itself [see Chapter 6]. On the contrary, it is assumed in the literature that in regular TD research the main contributions are empirical or theoretical [Pohl & Hadorn 2007] because the research is carried out by using standard methods and techniques. The academic contributions are referred to the disciplines considered as roots for the study or more in general to the two macro-domains of urban research and informatics [see Chapter 11]. The main contribution to the system knowledge is though represented by the grounded theory of the City Mirror Capabilities [reported in Chapter 10].

As regarding the **contributions to the target knowledge**, I identified a set of targets:

- The classes of **city stakeholders and decision-makers** that had been informant and participant in the research process.
- **Technology designers and ICT providers** that are the actors directly involved in implementing and making available new solutions for city technologies.
- **Urban practitioners** (planners, facilitators, urban designers, community managers) are also a target because often they advise and support the other target groups in their choices concerning the adoption of specific technologies in local development actions.
- **Researchers** engaged in implementing pilots and innovation projects, in partnerships with public and private sectors.

The two-sides evaluation framework constitutes the main contribution to the target knowledge on the correspondence between technology capabilities and local needs of city stakeholders involved in local development actions [see Chapter 10].

I have chosen to state the **contributions to the transformational knowledge** by keeping the three axes that infrastructure my research:

- the representation of **users** as part of multiple urban social structures,
- the model of the **city** as transferred in digital environments,
- and the **role of technology** in supporting coordinative, cooperative or collaborative practices in the city.

Indeed, the envisioned changes to which this research is aimed concern the design of web-based technologies able to reflect how cities works and, in this way, facilitate processes and dynamics to address local problems and enhance local resources. The main contribution to the transformational knowledge is the analysis and discussion of the three case studies reported in Chapters 7, 8, 9 to support a critical reflection on the issues and possibilities of designing new technologies based on new logics and with a new scope.

2.8.2 QUALITY CRITERIA FOR EVALUATING TRANSDISCIPLINARY RESEARCH

Quality criteria for evaluating the output of transdisciplinary research slightly differ from those currently applied to evaluate monodisciplinary or interdisciplinary research. For this reason, there are in literature clear indications about the specific quality criteria for this type of research. The purpose of stating quality criteria is orienting reviewers, evaluators, supervisors and readers (not necessarily used to TD works) to correctly assess the value of TD research outputs [Bergmann et al. 2005, Wickson et al. 2006, Klein 2008, Willetts & Mitchell 2009, Palmer et al. 2018]. In particular, it is highly recommended for PhD candidates to make explicit the quality criteria against which the work is expected to be judged [Willetts & Mitchell 2009, Palmer et al. 2018].

Wickson et al. [2006] developed a set of general recommendations for the evaluation of the TD research by comparing the standard evaluation of academic work with the specific characteristics of transdisciplinary research. The comparison is developed in six points, as summarised in Table 2.2.

Table. 2.2 Table summarising the differences between the standard evaluation of academic work and the evaluation of TD research [redrafted from Wilson et al. 2006].

	Standard Criteria	Quality criteria for TD research
goals	**Clear goals** identified in relation to the knowledge gap of a specific field	**RESPONSIVE GOALS**, defined in relation to the problem context and the stakeholders involved in the research and potentially reframed along the research process
preparation	**Adequate preparation** for a vertical investigation of a topic	**BROAD PREPARATION**, for a transversal exploration of the problem across a broad range of disciplines
methodology	**Appropriate method**	**EVOLUTIVE METHODS**, reacting to the changing circumstances in the context under investigation
outcomes	**Significant results** in relation to the research goals and the academic agenda	**SIGNIFICANT OUTCOMES** contributing to address a problem by satisfying multiple agendas and goals
communication	**Effective presentation** in terms of style and medium for a specific intended audience	**EFFECTIVE COMMUNICATION** to initiate and maintain a two-way exchange with a plurality of audiences, also outside academia
reflectivity	**Reflective critique** on the limitations and future endeavors of the work	**COMMUNAL REFLECTION** on the research process from the perspective of the researcher and from the one of the stakeholders involved in the process

These recommendations had been furtherly developed by Mitchell & Willetts [2009], by focusing on the evaluation of the doctoral research outcomes of transdisciplinary works. I used the evaluation criteria they propose as a guide to structure and iteratively assess the research process in relation to the expected quality standards of transdisciplinary research. These criteria are also reported in Table 2.3 to allow reviewers and readers of this thesis in understanding better the rationale and contributions of the research.

Table. 2.3 Table of the appropriate evaluation criteria for transdisciplinary PhD thesis, readapted from [Mitchell & Willetts 2009].

Standard evaluation criteria	**Readapted evaluation criteria for a Transdisciplinary PhD thesis**
Substantial contribution to the academic knowledge of a specific field	**Original and creative contribution to knowledge and/or practice**, by clearly outlining the nature and significance of the acquired knowledge across different fields and/or in relation to the context and the problem
Well-designed and coherent argument	**Critically aware and coherent argument** synthetized across diverse areas
Engagement with literature of appropriate breadth and depth on the specific research topic	Critical and pluralistic engagement with the appropriate literature on the research problem **balancing breadth and depth**, and **engagement beyond literature** with artefacts, research contexts and multiple stakeholder perspectives within it
Evidence of critical reflection about the limitations of the research	Evidence of **critical reflection** about the limitations and challenges of exploring multiple disciplines in complex settings, and **reflexivity on the researcher's work** within a research process that involves a personal transformation in the researcher's perspective about the problem, the context, and the involved stakeholders
Grasp of theoretical perspectives or grasp of methodology	Understanding of theoretical perspectives and methodologies from different fields **and alignment between theoretical perspectives, methodology, and enquiry space** in the research design.
Mastery of topic	**Mastery of the research process and/or outcomes** in the exploration of the topics associated with the problem under study
Effective and well-finished presentation meeting the expectation of a specific academic audience	**Effective communication** for diverse audiences, academic and not academic, by using multiple languages and tools to communicate across disciplines (including visual communication)

2.9 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 2 to the three outcome spaces outlined in section 2.7, by briefly describing them in the table below.

Table. 2.4 Mapping of the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 2
SYSTEM KNOWLEDGE	THEORETICAL CONTRIBUTION	[SECTIONS 2-5-6-7] This chapter provides the structure of a **research framework for the integration of disciplines belonging to the urban and informatics domains** based on their conceptual and methodological convergences. The research framework is used in this thesis for investigating web-based technologies for local development actions, but it is transferable to the study of other urban and city technologies.
	METHODOLOGICAL CONTRIBUTION	[SECTION 2.4] This chapter presents the **TIDS protocol,** a research protocol for addressing complex and deep design problem through a transdisciplinary approach. The protocol is developed by readapting the TIPS protocol, formulated for strategic evaluation of complex urban issues, to the specificity of a design problem in which each design object constitutes in itself an alternative instantiation of the problem or model. The value of the TIDS protocol is to enhance the rigour (and make it evident to the reader) of design and research methods applied in domains characterised by a high level of uncertainty, without limiting their richness and flexibility into simplified schema.
	EMPIRICAL CONTRIBUTION	
TARGET KNOWLEDGE	FOR CITY STAKEHOLDERS	
	FOR DECISION MAKERS	
	FOR TECHNOLOGY DESIGNERS	
	FOR TECHNOLOGY PROVIDERS	
	FOR URBAN PRACTICTIONERS	
	FOR RESEARCHERS	[SECTION 2.2] Highlights on the **disciplinary homologies** and/or **complementarities** between informatics and urban disciplines.
TRANSFOR-MATIONAL KNOWLEDGE	USERS	
	CITY	
	TECHNOLOGY	

PUBLICATIONS

Part of the contents or concepts presented in this chapter are also included in the following publications and/or presentations.

- *Under Review.* Lupi, L. ***Design of City Technologies: A Transdisciplinary Methodological Framework*** *[Journal Paper]*

- In press - Lupi L., (2020). ***Moving from Urban to City technologies: envisioning future trajectories for urban research*** – URBANISTICA, Special Issue "The dark sides of smart cities" *[Journal Paper, Planning]*

- Lupi L., (2019). ***A transdisciplinary perspective on the design of city technologies: Touchpoints between Informatics and Urban Disciplines***. Proceedings of the AESOP Conference 2019, July 2019, Venice (IT). *[Conference paper and presentation, Planning]*

- Lupi L., (2018). ***Mirroring the City. Toward Web-Based Technologies to Support City Stakeholders in Local Development Actions***, Swiss Inter- and Transdisciplinarity Day 2018 – Inter- and Transdisciplinarity in a Digital World, Lausanne (CH). *[Extended abstract and conference presentation]*

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CHAPTER 3.

PROBLEM REFRAMING AND DESIGN PROPOSAL OF THE CITY MIRROR

CHAPTER 3. OVERVIEW

Chapter 3 provides the background for analysing, destructuring and isolating the **facets of the problem of having web-based technologies not yet supporting local development processes and the related collective actions.** Building on this analysis, Chapter 3 make explicit a series of **design constraints** to be considered for future web-based technologies aimed at improving synergies among the actions of the diverse stakeholders operating in the city context. The analysis also supported the **theoretical definition of the problem** leading to develop the design **proposal of the City Mirror as a conceptual construct to address the problem** from a research and design perspective. The formulation of this design proposal is the first step in the development of a design theory on the capabilities of technologies aimed at supporting collective actions.

Chapter 3 is organised into seven sections, as follows.

- Section 3.1 explains the **approach to the analysis of the problem** built by readapting simple well-known analytic tools such as the PEST and SWOT frameworks. These tools had been used to structure the discussion and highlight the main aspects of a systemic problem from a strategic perspective.
- Sections 3.2 reports on the **background analysis of the problem** developed by taking into account the instances of technology users and providers in the context of cities.
- Section 3.3 provides the assessment of the factors highlighted in the background analysis to identify the **design constraints** to be considered in the definition of alternatives to current technologies.
- Section 3.4 completes the problem faceting from a research perspective, by defining at a conceptual level the ***"Disconnection Problem"*** between technologies for cities and city dynamics, and then reframing the initial real-world problem into a knowledge problem defined as ***"Recomposing Problem"***.
- Section 3.5 outlines the **design proposal of the City Mirror** structured according to the three dimensions of the Recomposing Problem and taking into account the high-level design constraints defined in section 3.4.
- Section 3.6 reformulates the **high-level research questions** stated in Chapter 1 under the light of the analysis and the design proposal, breaking them down in a set of sub-questions.
- Section 3.7 summarises the **chapter contributions** to the outcome spaces of transdisciplinary research.

Connection with the previous chapters. Chapter 3 deepens the analysis of the problem introduced in Chapter 1. Consistently with the Transdisciplinary Research Framework presented in Chapter 2, the analysis of the problem is presented in Chapter 3 by taking into account the aspects characterising this real-world problem from the two perspectives of technology users and providers, and then progressively transforming the real-world problem into a knowledge problem by abstracting and reasoning on its facets.

Connection with the following chapters. Chapter 3 illustrates the design proposal of the City Mirror that leads the entire investigation process. The proposal will be furtherly specified in Chapter 4 in its technical aspects in reference to the state of the art of web-based technologies commonly applied in urban activities. The proposal will then be theoretically expanded in Chapter 5 through the conceptual modelling of users, city ecosystem and the role of technology in web platforms instantiating the concept of the City Mirror.

CHAPTER 3. TABLE OF CONTENTS

3.1 APPROACH TO THE PROBLEM FACETING

The starting point of this work, as stated in Chapter 1, is the identification of two intertwined real-world issues affecting information technologies for cities. On the one hand, smart city technologies have a narrow scope and limited impact. On the other hand, web-based technologies have an enormous impact, but are currently underexploited as infrastructures for collective actions. The result is that the **available information technologies for cities are not able to support collective actions in local development processes.** Nevertheless, web-based technologies have the potential for providing effective solutions in this direction because they are accessible, pervasive, versatile and intrinsically aimed at connecting people, even though commercial products based on these technologies are not yet oriented toward collective actions. Trying to explore this problem, this work aims to improve our understanding of how to design web-based technologies for supporting city stakeholders in the orchestration of their actions at a local level. I have also specified that pursuing this goal corresponds to addressing a **deep design problem, which also implies systemic design interventions oriented toward creating a technology-supported political space for city stakeholders.** The nature of this problem requires to combine:

a) **research on city dynamics for informing the design of future technologies**

b) **interventions in the context through the design of prototypes for making observable the factors potentially impacting on setting up alternatives** to the current ways of arranging the interactions among city stakeholders by introducing new forms of technology mediation [see Chapter 1].

Chapter 2 made explicit that the exploration of this Research & Design problem is conducted within a **transdisciplinary research framework.** Chapter 2 also describes the **TIDS research protocol** developed to pursue a comprehensive and rigorous investigation of this problem across multiple disciplines. The **first step** of this research protocol [Fig. 3.1.] involves the **analysis of the complex multi-dimensional problem** understudy to decompose it in interrelated sub-problems and **isolate the main facets** that can be conceptualised and investigated through research [see Chapter 2].

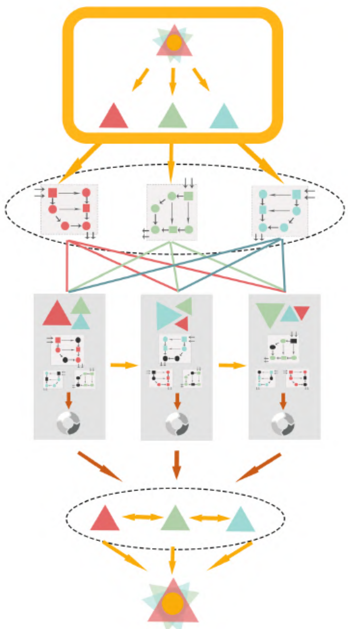

Fig. 3.1 Mapping of the problem faceting in the TIDS protocol

This chapter is going to report the first step of the TIDS protocol, or rather the faceting of the problem through a holistic analysis of the factors contributing to its definition. Consistently with the nature of the problem as a deep design problem, **the analysis highlights current design constraints for future city technologies and provides inputs for reframing the problem in a form that would allow focused research explorations within the domains of informatics and urban disciplines**. Design constraints and theoretical definition of the problem are then integrated into the formulation of a design proposal concerning web-based technologies intentionally designed to support city stakeholders in the orchestration of local development actions.

3.1.1 RATIONALE OF THE APPROACH

The **goal of the analysis** presented in this chapter is two-fold. Firstly, it provides an overview of the **background elements** to understand reasons and practical contingencies for the marginality of current information technologies in facilitating synergies among local stakeholders in the city context, by structuring a collection of shreds of evidence in an organic way. Secondly, the analysis helps outline the **boundaries of the intervention space for research and design explorations** and the significant constraints to be considered for defining alternative city technologies. In line with these goals, the analysis had been conducted by reviewing the different types of factors impacting on the relationship between city activities and technologies, and then assessing these factors under the light of a *"solution-oriented approach"* [1] [Cross 2001] in line with a pragmatist epistemology [See Chapter 2, section 2.6.2].

There are no established approaches to executing analysis to define the boundaries of a deep design problem. Analogously, **there are not so many examples of preliminary analysis for systemic design problems**, a task still commonly dismissed by implying that it would be too complicated and preferring to move forward potential solutions. Luckily, the preliminary analysis in some orientations of planning practice is de facto assimilable to the one for addressing systemic design problems, but still, it is certainly not formulated in these terms or documented in the academic literature. Lastly, **the idea of designing a political space and involving the use of web-based technologies to give it its materiality is an original perspective of this work.**

Against this background, I have initially turned toward well-known conceptual tools used to identify the **constraints of common design problems**, such as the one outlined by Lawson [2006]. In his framework, Lawson states that each design problem is defined by **radical, practical, formal and symbolic constraints**, that respectively pertain:

a) structural elements of the context
b) the available materials or technologies
c) the visual arrangement of items
d) the meanings associated with the object of design.

[1] As mentioned in Chapter 2, there are two possible paths for addressing this kind of problem: 1) focusing on analysing one specific aspect of the current state of affairs, or 2) building a potential solution based on the understanding of the current state of affairs for investigating limits, directions, opportunities of transforming the current situation. The two approaches are conventionally distinguished in *"problem-focused"* and *"solution-oriented"* [Cross 2001]. I decided to firmly position this work on the second research path (see Research Epistemology and Research Axiology, sections 2.6. and 2.7). The analysis presented in this chapter outlines the constraints considered for building potential solutions to investigate the intervention space. In this sense, the analysis is intended to offer only a general overview of the problem by organising a collection of evidence in a structured and organic way, and not an exhaustive examination and discussion of all the factors concurring to the complex relationship between digital technologies and city activities that is beyond the scope of this work.

Lawson's model also points out that these constraints can be internal or external. They can vary in relation to different subjects involved in the design process, such as designers, client, users, and legislator [Lawson 2006]. However, this classification of the constraints of a design problem defines already a pre-interpretation of the contextual factors impacting on the problem, without orienting the actual identification of the constraints. This schema also remains too much attached to the idea of a physical product to be defined, instead of a complex socio-technological system as in city technologies. Moreover, it does not integrate either research concerns about the reasons and relations among specific geometries of constraints and their effects.

In **Urban Studies**, other conceptual models help in outlining the type of constraints and factors characterising spatial and temporal dynamics in urban development processes that can be considered by extension as systemic. For instance, the ASID model [Moulaert et al. 2016] proposes to organise these factors around the four clusters:

1) *"**actions** that steer or interfere with the development processes"*
2) *"**structures** that both constrain and enable action"*
3) *"**institutions** that guide or hamper action and mediate the relation between structures and action"*
4) *"**discourses** and discursive practices that are part of these interactions"*.

Even though this model is general enough to provide useful analytical lenses to investigate a wide range of urban phenomena, it does not help in identifying the type of evidence and factors to be analysed. Most important, the ASID model is oriented to analyse past and present, but not to build non-existent solutions for the future. It includes neither a specific framing of tools, artefacts, or systems mediating and disintermediating the relationships between actions, structures, institutions, and discourses[2]. Lastly, while the axes of "structures" and "discourses" are completely distinct, there are significant overlaps between "actions", "institutions[3]" and "discursive practices". These two points make more complicated transferring and using this framework for the purpose of analysing the boundaries of a research & design problem, even though the problem concerns local development dynamics in cities.

In the domain of **Urban Planning**[4], a slightly different model elaborated by Janin Rivolin [2012] addresses these two issues (absence of tools and unclear definition of practices) and provides a better fit for the purpose of this analysis. The Janin Rivolin's conceptualisation is focused on spatial planning systems framed as *"institutional technologies"*, or rather as social constructs regulating the interactions among different stakeholders mediated by a planning system (that is the corpus of laws, practices, strategies, tools for the management of urban transformations). This model has been conceived to enable the comparison among planning systems based on the clear distinction between **Structures, Tools, Discourse, Practices** and their connections across the sphere of the governance and the social experience of the city over time[5]. Because of the strong operational orientation and clarity of this model, it can be appropriated and transferred from the analysis of planning systems to the analysis of the interactions mediated or supported by digital artefacts in the context of the city, acknowledging that digital technologies in cities are embedded in a complex

[2] Exactly the same issue can be identified in the Ostrom's IAD framework, see chapter 5.
[3] The term "institutions" is always used in this dissertation in the sense of norm regulating social life. These norms can be formal or informal, thus crystallised in the form of regulations and organisations, or based on social conventions. The terms "institutions" is not used as a synonym for Public Administration.
[4] As mentioned in Chapter 2, the substantial difference of Urban Planning from Urban Studies is that the first is clearly oriented to support actions, transformations, changes. Urban studies instead include the sub-communities of social sciences engaged on urban topics, and as common in social sciences are more focused on studying what is in place, instead than directly how that can be changed.
[5] The division in the three layers of structure, discourse and practice is a mental schema very common in the way reality is framed and interpreted by planners. The conceptualisation provided by Rivolin, however, is a clear arrangement of those concepts in an operational form, and I have chosen to refer to this model for these reasons.

system of institutions. Thus, the four layers of this model (structure, practices, discourse, tools) can be disconnected from the specific matter of interest of spatial planning systems (i.e. land use) and redefined and expanded by relying on the broader definition of socio-spatial factors in urban development processes of the ASID framework [Moulaert et al. 2016], as follows:

- **Structures** remain the constraints due to institutions, resources and context
- **Practices** are intended as the ways people and organisations act in the city in relation to structures and tools
- **Discourse** is considered as the set of representations and meanings attributed to structures, practices, and tools.
- **Tools**, in this case, include technological systems deployed in cities, focusing on ICT and web.

The radical, practical, formal and symbolic constraints indicated by Lawson in relation to design problems [Lawson 2006] extensively overlap with the schema divided into structures, practices, discourses, and tools based on the work of Janin Rivolin's on planning systems and the ASID model [Janin Rivolin 2012, Moulaert et al. 2016]. However, **while the first constraints' group is oriented to guide design actions but not necessarily research complex design problems, the second one aims to support reflections and theoretical analysis on socio-technological systems in cities but not necessarily design actions. In both cases, they do not focus on digital technologies.**

In the domain of **Information Systems** and related fields, there are conceptual models to identify the constraints for the design of new digital technologies and the analysis of their integration in the context of their use. In particular, for web-based technologies, the most popular approaches are based on the paradigm of the *"service-oriented computing"* [Papazoglou & Georgakopoulos 2003]. According to this paradigm, **every information system's architecture should be structured by mapping steps and aspects of the process or service to be supported through its functionalities.** Similarly to the Lawson model, the various models based on the service-oriented computing paradigm [see Molnár & Ádám 2019 for a detailed survey] provide support for circumscribed design problems (that we should actually define as engineering problems), but not for the analysis of complex design problems also requiring the investigation of the context of intervention.

In general, it is worth pointing out that these models take into account **factual elements of the context (e.g. business processes, organisational arrangements, data, other available systems)**. But they do not integrate ill-defined and less tangible or implicit elements, such as cultural, social and political factors that are fundamental for my purposes. Using the concepts introduced before, we can say that **the constraints for the design of information systems are defined based on explicit structures and explicit practices, but not on the discourses and informal structures and practices developed around the use of technology in the context**[6].

Another important point is that current models supporting the identification of the design constraints for technological systems do not include the analysis of other contextual factors defining the socio-technological system in which a specific information system is just one of the components [Chatterjee et al. 2017]. However, technologies to be deployed in the city context are different from software intended to be used in a specific company or from generalist applications such as a rooting application. The design of these types of technologies integrated within local development processes cannot ignore the broad context

[6] The consequence of the lack of attention to these aspects conventionally results in low rates of adoption and appropriation of technologies, a well-known problem that is a central concern for research communities such as Information systems, software engineering and others. For instance, the field of CSCW emerged specifically by proposing to build the design of digital technologies on the understanding of the practices, in their explicit and implicit aspects. However, the discursive dimension is very marginal also in CSCW, because so far, the focus of CSCW research was on working environments and working tasks that are not necessarily deeply affected by the different points of view of the people and organisations involved in the practices under examination.

of intervention or do not consider discourses, practices and structures as factual constraints because city technologies inevitably intervene in the political space of cities.

Noting the limitations of these frameworks as exclusive tools for the background analysis of the problem, **I searched for analytical tools able to provide a rich picture of the context of intervention of city technologies and, at the same time, offering inputs for outlining the type of design interventions to be developed.** Indeed, while urban approaches tend to be focused on the context of intervention, informatics approaches tend to focus on the type of intervention. Therefore, my judgement was that **a tool appropriate to facilitate a bridge among these different disciplines is a tool merging these two distinctive orientations, going beyond the horizon of specific methods and disciplinary languages.** Nevertheless, implicit academic conventions demand the use of tools that proved their existence and applications in scholarly production. Secondly, the adoption of a transdisciplinary research framework also implies the commitment of the researcher to advance the **understanding of a problem in terms that are accessible** and potentially relevant for the target groups supposed to benefiting of the research outcomes, including a general audience. Lastly, I had to consider the goals of **addressing a research and design problem**, requiring the combined analysis of these two perspectives to strategically understanding address the problem, and not to describe it.

Guided by these considerations, **I decided to reinterpret in scope and readapt methodologically two analytical tools such as the PESTEL framework (and its derivations) and the SWOT analysis, and integrating them with the elements characterising the analytic frameworks described above, as I explain in the next section.** The combination of these two tools supports both the analysis of the context and type of intervention in the first step of the background analysis reported in the next section. Moreover, these two frameworks are simple but solid analytical tools accessible to a general audience and existing in the academic literature, meeting all the internal requirements of this work.

The direct outputs of the analysis performed by using these two tools are a set of **design constraints** to consider for building alternatives to current city technologies. These same outputs also fed the **theoretical reframing of the problem** to orient following research explorations by considering the three polarities of people, city, and technologies (as in Chapter 1) and the lenses of structures, practices and discourses to details the implications of each aspect of the problem.

3.1.2 DESCRITION OF THE ANALYTIC PROCESS

The approach to the analysis and faceting of the problem had been organised as a process in 5 steps [see Fig.3.2]. The five steps are:

1) A **background analysis** organised as a review and discussion of a structured collection of arguments helping to identify the main factors impacting on the limited impact of smart city technologies and the under-exploitation of web-based technologies in supporting synergies among local actions.
2) An **assessment** of these factors in positive or negative constraints for the design of future city technologies oriented to support local development actions.
3) Identification and **conceptualisation of the key issues** emerging from the background analysis in forms that allow their investigation through research activities.
4) Identification of the **knowledge gaps associated with the key issues** and formalisation of the types of knowledge to be generated through the research process to fill these gaps
5) Development of a **theoretical construct to orient the research process** in the form of a design proposal.

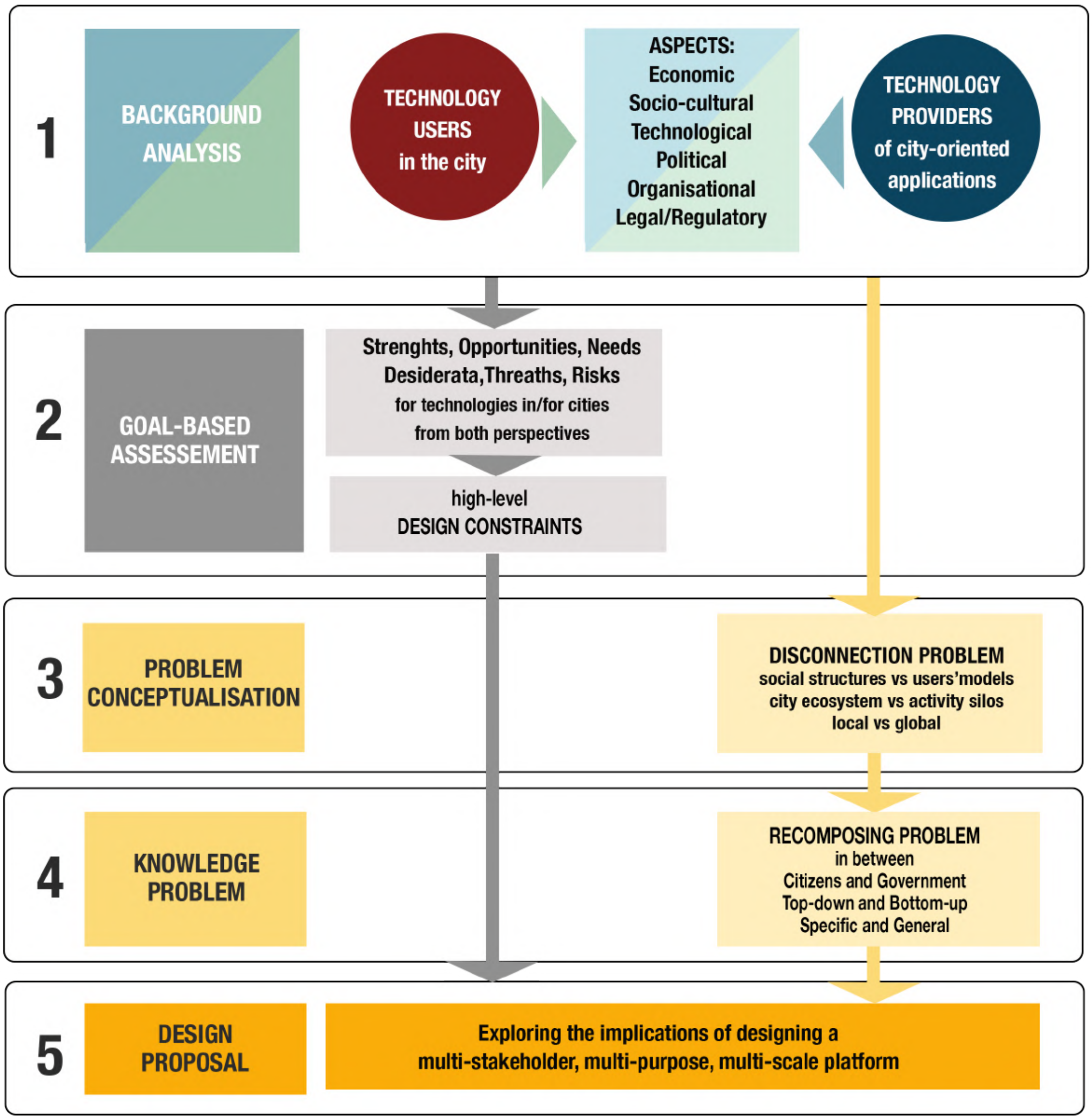

Fig. 3.2 Flow of the background analysis and problem faceting

3.1.2.a. Background Analysis

In the **first step of the faceting process**, the background analysis is organised along to six thematic axes:

- Economic aspects
- Socio-cultural aspects
- Technological aspects
- Political aspects
- Organisational aspects
- Legal and regulatory aspects.

This skeleton for the background analysis is similar to another consolidated framework, the PESTEL framework, used for structuring the analysis of complex contexts in which a specific organisation is planning to intervene. Indeed, as the problem under study is a research&design problem, the background analysis's primary aim is **to understand what potential design interventions can ground the research path on feasible directions**. In this sense, the researcher is in a position analogous to organisations that have to elaborate a strategy for intervening in a new unknown context, even though the objective of a research investigation is generating knowledge and in the second case developing a new business initiative. While the PESTEL framework is widely used in industry for *"scanning"* the context of intervention and defining business management strategies [Rothaermel 2015], there are various examples in the literature proving its versatility to be readapted and applied as a research tool to address sustainability problems, policymaking, governance issues, technology assessment, information systems contextualisation [e.g. Peng & Nunes 2007, Andoh-Baidoo et al. 2012, Srdjevic et al. 2012, Gupta 2013, Kolios & Read 2013]

The **PESTEL framework** is a general thematic structure for organising arguments and pieces of evidence supporting the analysis of a context or a multi-dimensional problem. Its value is to help to represent heterogeneous series of facts and topics comprehensively and organically. Basically, it provides a **set of labels to cluster the factors considered in the analysis in homogeneous groups and a guide to do not neglect essential aspects** that can impact on the way we decide to intervene in a context [Ho 2014].

The dimensions considered in the PESTEL framework are the Political, Economic, Social, Technological, Environmental, and Legal aspects, whose initials make up the PESTEL acronym. The flexibility and adaptability of this light-weighted framework led to many different derivations changing the order of the aspects addressed in the analysis (e.g. PESTLE, STEPLE) [Manktelow 2005], or adding new elements to it, or considering only a part of them (e.g. PEST) [Recklies 2006]. In the literature (mainly professional and business-oriented) there are some suggested lists of factors to be considered for each group of aspects. However, the analysis can be performed by setting the level of details as convenient and relevant for the purpose of the analysis in itself.

The reinterpretation of the PESTEL dimensions in this work produced for the background problem analysis kept all the PESTEL dimensions as labels, but in a different order. The Environmental aspects (usually associated with factors related to the physical environment) are replaced by the Organisational aspects, linked to the organisational environment in which technologies are used or developed. The result is that **the acronym of the analysis reported in this chapter is ESTPOL**. In the analysis of each aspect, and according to this work's purposes, I focused on the **factors relevant and potentially impacting the design of future web-based technologies aimed at infrastructuring collective actions in cities.** I decided not to consider other settings (for instance, the distribution or production of these technologies).

The background analysis had been performed by considering the **instances of the users of technologies in the city** (city stakeholders) **and technology providers** (delivering their solutions to city stakeholders). As mentioned before, the Lawson's model indicates that the design constraints need to be defined by considering the perspective of clients, users, designers and legislator [Lawson 2006]. In my analysis, the perspective of the legislator is considered as one the ESTPOL axes. The profile of clients and users are considered jointly. The perspective of the designer is replaced by the one of technology providers. Indeed, the choices concerning design and distribution of technologies do not usually pertain to a single designer, and the constraints are traceable at a higher level.

Consequently, **I carried out the "ESTPOL analysis" from both perspectives. I highlighted some recurrent issues reported in official and non-institutional sources**. In the process, I tried to identify structural constraints and trends determining the current state of affairs of the application of information technologies in city activities, as well as potential spaces for intervention.

The identification of these constraints relied on factors strictly dependent on the operational context of technology users and providers (**intrinsic factors**), and factors characterising the environment set by their counterpart of each group and therefore overdetermined (**extrinsic factors**) [7]. In other words, by considering the perspective of the technology users, the intrinsic factors are related to the nature of city activities and their operational constraints, while the extrinsic factors are related to the forms and characteristics of the available technological offer. On the contrary, by considering the perspective of the technology providers, the intrinsic factors are related to the nature of the business environment for information technologies, while the extrinsic factors are related to the urban context in which they should be integrated. The distinction between intrinsic and extrinsic factor characterises the Lawson's model and other common analytical tools in Information Systems.

The **sources chosen for the analysis included public and industry reports and experts' assessments of the ongoing trends, as well as recent phenomena and facts documented on media.** The use of these "grey sources", while not conventional, helped in identifying obstacles, issues, failures, challenges and directions for the integration of digital technologies in cities. In particular, the inputs coming from these "grey sources" allowed to overcome the lack of specific research products on all the different aspects of the problem. Indeed, the phenomena shaping the technological landscape in cities change very rapidly and are overdetermined by unpredictable social, economic and political factors. Not necessarily academic research documents or anticipates them.

The **outputs of this first step of the problem analysis is a grid of factors outlining the major practical constraints to be considered** for the use and development of web-based technologies intended to support city activities at a collective level.

3.1.2.b. Goal-based Assessment

In the second step of the approach to the problem faceting, the factors identified in the background analysis had been categorised in evidence of:

- **on-going positive trends**
- **limitations and problems of current solutions and situations**
- **obstacles to potential alternatives to the current state of affairs**
- **opportunities for improvement and changes**
- **unmet needs**
- **emerging desiderata.**

The categories for assessing the outputs of the background analysis reinterpret and readapt the standard categories used for performing a SWOT analysis. Indeed, the SWOT analysis framework classifies the set of factors impacting a problem or decision in Strengths, Weaknesses, Threats, and Opportunities [Hill & Westbrook 1997, Friesner 2011, Rothaermel 2015, Bull et al. 2016]. As well as the PESTLE framework,

[7] The Five Forces Model is another general framework indicating that to understand the context of intervention it is important to consider the obstacles to entry in a market, the power of suppliers, the power of buyers, the potential substitutes of the proposal under study and the level of rivalry of competitors [Rothaermel 2015]. In the background analysis, I considered only the two macro-groups of users and providers of technology. The first group includes the "buyers", but also more generically the users of technology that not necessarily are the buyers (e.g. Public Administration buy technologies, citizens are the intended users). The second group includes the technology providers in general, and the rivalry among providers, the substitutes and the power of suppliers are among the factors considered in the analysis on this side. It was out of scope to further detail the analysis by distinguishing between suppliers, substitutes and competitors on the side of the technology providers.

also the SWOT analysis is a tool developed in industry, but frequently used in research [Helms & Nixon 2010].

In this step of the analysis, four of the six categories indicated above are mapped with the axes of the SWOT analysis as following: Positive trends (Strengthens), Limits and problems (Weaknesses), Obstacles (Threats), and Opportunities. Needs and Desiderata are two additional dimensions essential for establishing the boundaries of a design problem [Manzini 2015]. They respectively correspond to the expectations that could be potentially addressed also in the current situation by realigning technology users and providers on the same page, and to the expectations that cannot be met without changing the current situation. For brevity, the resulting acronym of this analysis is SWOT+ND.

The PESTLE analysis is frequently associated to a SWOT analysis because of the complementarity of their focus and applications [e.g. Ha & Coghill 2008, Andoh-Baidoo et al. 2012, Srdjevic et al. 2012, Shabanova et al. 2015]. Indeed, **the PESTLE analysis is oriented to depict the potential factors impacting a problem, decision, or environment. Its focus is on building a "big picture" of a multi-dimensional issue or complex** context [Manktelow 2005]. On the other hand, **the SWOT analysis explores and classifies these factors under the perspective of a specific goal** [Pierce & Giles 1998, Pickton & Wright 1998].

Analogously, in this work, an analytic framework similar to the PESTLE is combined with a qualitative assessment tool containing the dimensions of the SWOT analysis. **Their combination is functional to compose a general overview of the practical constraints of the context of information technologies in cities, and then to highlight the critical elements to be considered for developing a specific research&design path associated with the formulation of alternatives to current technologies for cities.**

The **output of this second step is a table classifying the factors highlighted in the background analysis according to the six dimensions of the SWOT+ND analysis**, keeping distinct the perspectives of technology users and technology providers. The classification and interpretation of the analysed factors define a set of high-level **design constraints to be considered** for elaborating web-based technologies oriented to support the orchestration of city stakeholders in local actions.

3.1.2.c. Problem Conceptualisation

Outlined the design constraints, the third step of the problem faceting process starts the conceptualisation of the problem for enabling focused research explorations. **The factors identified in the background analysis have been classified by considering the lens of "People", "City" and "Technology"**, commonly applied to study the components of the socio-technical systems associated with the user of technology in urban environments [Nam & Pardo 2011, Foth & Choi 2011] and already used in Chapter 1 to expose the nature of the problem under study. **This meta-analysis led to defining the problem of the marginal impact of information technologies in supporting collective actions in city activities as a problem rooted in the disconnection between:**

- **the real social structures in the urban environment and their representation mediated by current technologies (People)**
- **the actions enabled by current technologies and the operative frameworks of city activities (City)**
- **the types of solutions provided by current technologies and the needs or expectations associated with technologies in cities (Technology)**

These three forms of disconnection are analysed at a theoretical level by considering their assumptions and implications on technology users and technology providers in terms of structures, practices, and discourses.

The **disconnection between existing social structures in urban environments and their representation mediated by current information technologies** could be associated with the polarisation in individuals and high-level organisations (such as local governments). They are overrepresented both in the sources considered in the background analysis and in the user's models informing architecture and functionalities of current platforms.

The **disconnection between the interconnected nature of urban activities and the silos-approach of urban technologies** is associated with the polarisation in `a) technologies oriented to support top-down programmes related to the implementation of specific smart city visions through ad-hoc thematic solutions, and b) generalist technologies used by individuals and local groups for their initiatives in fragmented online environments.

The **disconnection between the scope of technologies and the expectations related to their application in urban domains** could be associated with the polarisation of the existing technological landscape into global solutions (usually unaware of context specificities) and hyper-local tools (difficult to transpose in other contexts).

The output of this third step is the **faceting of a real-world problem** that is wicked and apparently unaddressable, **into three sub-problems** that can be partially addressed by understanding how to realign the existing disconnections with models more consistent with reality.

3.1.2.d. Definition of the Knowledge Problem

The fourth step of the problem faceting process corresponds to the identification of the type of knowledge required to address the three aspects of the "Disconnection problem", formulated in step 3. The three lenses of People, City and Technology have been specified in functional terms by considering:

- People as **Subjects** acting in the City through technology
- the City in itself as **Object** and space of actions mediated or supported through technology
- the Technology as a **Means** to act in the City and to interact with the city.

This level of abstraction highlights that:

- there are Subjects acting in the City, potentially also through technology, not represented, underrepresented or misrepresented, and they include all the social structures not reducible to individuals or high-level organisations.
- the City as Object and space of actions is not organically represented, in particular as regarding all local actions and processes that go beyond bottom-up temporary initiatives and specific top-down projects.
- Information technology as Means to act in the City and interact with the City is misused or underused compared to their enormous potentialities because of the difficulties in defining forms of support in-between global and hyper-local solutions.

Hidden social structures, hidden local processes, and missing scales of actions crucial in city dynamics are finally identified as the **three knowledge gaps to be investigated** for trying to define future web-based technologies aimed to create synergies among city stakeholders at the local level. This knowledge problem is defined as the "Recomposing problem". It is defined as the problem of understanding how to recompose the disconnection between the representation of actions in the city and the actions mediated by technology.

The **output of this fourth step is the conversion of the three sub-problems** corresponding to the three facets of People, City and Technology **into three knowledge gaps** that can be partially filled through research activities.

3.1.2.e. Formulation of the Design Proposal

The problem faceting process is concluded by **using the three facets of the Recomposing problem for elaborating a design proposal** to drive the Research & Design explorations associated with the aim of understanding how to design web-based technologies supporting city stakeholders in the orchestration of their actions. **The design proposal is expressed in the form of a set of meta-requirements for city technologies aimed to reveal the hidden social structures, represent the hidden local processes, and cover the missing scales of actions** and, therefore, directly address the key issues identified before. The design proposal also takes into account the high-level design constraints outlined through the background analysis.

The previous analysis steps pointed out that current technologies do not provide an environment in which a plurality of social structures and activities are represented consistently with their reality in an offline setting. On this basis, the design proposal sets **the baseline for defining alternative solutions. This baseline corresponds to providing at least a representation of users, city context and urban activities reflecting the logic of local dynamics.** This digital environment is hypothesised as multi-stakeholder, multi-purpose and multi-scalar, as detailed in section 3.5.

The **output of this fifth step is the formulation of a design proposal** for investigating limits, implications and spaces for the improvement of current technologies, both theoretically (see Chapters 5, 10) and empirically (see Chapters 7, 8, 9). According to the **"anatomy" of a design theory** proposed by Gregor & Jones [2007], this design proposal constitutes the first building block of a design theory on the City Mirror capabilities.

3.1.2.f. Summary

The problem faceting process started with the breakdown of the real-world problem addressed by this work into sub-problems. These sub-problems had been conceptualised into knowledge problems explorable through design by instantiating the design proposal formulated at the end of the process.

The progressive transformation and reframing of the core problem of this work from being a wicked problem to become a partially treatable problem relied on a **reasoning-based flow. This flow moves from "particular" evidence** (describing the operational context in which the output of the research should be integrated) **toward more general dimensions to orient research and design activities.** These dimensions are respectively centred on the substantive triads of People, City and Technology on one side, and the functional one of Subject, Object and Means on the other side.

This formulation of the problem is not intended to state or to describe the problem of the marginality of information technologies in city activities in itself. It is intended instead to provide a critical interpretation of facts oriented to extract useful insights and directions for working toward technologies to support collective actions in cities (see the research epistemology, Chapter 2, section 2.6.2).

The following sections report and discuss the steps of the problem faceting process.

3.2 BACKGROUND ANALYSIS: OUTLINING THE INSTANCES OF TECHNOLOGY USERS AND PROVIDERS

The background analysis, based on the literature and grey sources, is aimed at outlining the instances of technology users (city stakeholders) and technology providers (ICT companies) in relation to smart city and web-based technologies. In urban contexts, technology users can be public and private organisations, civil society and other actors. When possible on the basis of the available sources, I focused mainly on the contexts of Italy and the United Kingdom (as regarding examples and specific constraints), because of direct knowledge of these two environments and their relevance for the following parts of this work that are associated with three case studies developed in these two countries. As mentioned before, the purpose of the analysis is to organise a set of evidence in a structured way, to highlight some of the factors concurring to the marginality of information technologies for cities in supporting synergies among local actions, both because the limited impact of smart city technologies and the consolidated uses of web-based technologies.

3.2.1 ECONOMIC ASPECTS

3.2.1.a. Unprecedented Funds for Digital Technologies in Cities

The market of smart city technologies is one of the fastest-growing economic sectors at a global level, with the US, Europe and China leading the investments. This trend is also favoured by an **unprecedented availability of funds on research and development projects concerning the design, implementation and application of digital technologies in cities**.

The **European Urban Agenda**, adopted through the *"Pact of Amsterdam"* [Council of the EU 2016], makes official the strategy of strengthening the "urban dimension" in EU decision-making processes. Cities are assumed taking the priority in funding in order to ensure the maximum utilisation of their growth potential to successfully tackle social, economic and environmental challenges. Even before the approval of the European Urban Agenda, **the "digital transition" in cities has been considered one of the top priorities for urban development by the European Commission.** It allocated over 1.7 billion euro (1.2 of which dedicate to societal challenges) from 2014 to 2017, and 1.9 billion euro from 2007 to 2013 for urban research and innovation projects [EU Commission 2014]. This is also remarked by numerous funding programmes focused on the challenges of urban areas, such as "Smart Cities and Communities"[8] and "JPI Urban Europe"[9] within the Horizon 2020 - EU Research and Innovation Programme[10], or "Urban Innovative Actions"[11] and "URBACT"[12] as programmes relying on the European Regional Development Fund[13]. Within this framework, ICTs are considered as the enabler of *"collaborative processes involving all key stakeholders, from public and private organisations to concerned individual citizens"*, in order to establish new *"participatory and co-created forms of urban governance"* [JPI Urban Europe 2018]. In line with this goal, understanding how to rethink the public agency of city stakeholders in the long and short term and how the use of ICTs can enhance their capacity to collaborate are considered open questions to explore in the next years even by the EU Commission [JPI 2016].

[8] https://ec.europa.eu/inea/en/horizon-2020/smart-cities-communities
[9] https://jpi-urbaneurope.eu/
[10] https://ec.europa.eu/programmes/horizon2020/en
[11] https://www.uia-initiative.eu/en
[12] https://urbact.eu/
[13] https://ec.europa.eu/regional_policy/en/funding/erdf/

National governments are investing in additional smart city programmes, as the Smart Cities and Communities Calls promoted by the Italian Ministry of Education in 2012[14], or the Transforming Cities Fund allocated by the UK government since 2017[15] to continue the Future City Demonstrator initiative[16] at a larger scale. In all these initiatives and projects, digital technologies are called to imagine viable alternatives to the present problems in every domain and every city.

Local authorities and municipal institutions, who have the responsibility to manage these national and international funds to support local development actions, are experimenting new forms of local partnerships with privates and civil society organisations for designing and implementing shared visions of the future of cities [Borsekova et al. 2016, Silva 2017]. In both cases, the allocation of funds to support local initiatives is often oriented to reinforce the social cohesion and built contextualised cases for understanding how to rethink roles and responsibilities of city players in urban development strategies. However, the results of these partnerships are still uncertain, due to management and organisational issues and the difficult coordination of goals, interests, activities [see e.g. Codecasa & Ponzini 2011 for Italy, and Cornforth et al. 2015 for the UK] limiting the potential impact of available funds. In this context, the integration of digital technologies in these processes is increasingly promoted, also where it is not the central focus of local initiatives, to **amplify the impact of joint initiatives and facilitate the creation of public value for all the involved actors** [Neuroni et al. 2019].

The **private sector** (large companies, bank foundations, and other financial institutions promoting social and cultural development) entered into the arena of urban transformation management and local development by adopting **funding policies specifically oriented to support city innovation initiatives and smart city projects.** The experimentation of new digital technologies and systems is often endorsed or explicitly requested as an essential component to empower people and local communities. Examples of these new approaches to philanthropy are becoming common in many cities and countries, among them: the Compagnia di San Paolo or the Fondazione del Monte in Italy, the Lloyds Bank Foundation and Santander Foundation in the UK; or at a larger scale the Knight Foundation and the Rockefeller Foundation in the USA; or Nokia and Deloitte among big corporations investing in city or community-centred projects through philanthropic initiatives.

Unprecedented **investments of major ICT corporations on research and development for urban technology** led to large scale experiments involving, in some cases, even the construction of new sectors of cities for real-world testing of solutions (e.g. New Songdo in South Korea, or the projects for future smart cities of Microsoft or Google available online). One of the main drivers in these investments is the idea that cities are naturally "data machines" and data are one of the most valuable resources of our time. Thus, it is worth making new cities to study and make more efficient the production of data in urban settings to generate more economic value from data. However, so far, these endeavours have had **limited success** [see Antholopoulus 201, Scola 2018, Antholopoulus et al. 2019] and attracted **intense oppositions** [Goodman & Powles 2019].

Indeed, **the investments of entities such as the European Commission or other local authorities in digital technologies for cities keep following a model for value generation that significantly differ from the one pursued by ICT company, despite comparable financial efforts** [Dameri & Rosenthal-Sabroux 2014]. In the first case, the value of digital technologies is associated with the extension and **increase of the**

[14] http://www.istruzione.it/archivio/web/ricerca/smart-cities-and-communities-and-social-innovation.html
[15] https://www.gov.uk/government/publications/apply-for-the-transforming-cities-fund
[16] https://futurecities.catapult.org.uk/wp-content/uploads/2018/03/Hyperconnected_smart-city-demonstrators_v3.pdf

capabilities of city stakeholders and not necessarily linked to the direct revenues of the use of technology (but linked to the revenues for city stakeholders). In the second case, the use of technology itself is the main source for the generation of value [Walravens & Ballon 2013, Pereira et al. 2017].

3.2.1.b. Smart Services and Digital Economy

The **definition and delivery of new services** are one of the fundamental aspects of smart city initiatives, especially the ones envisaging the development and deployment of web-based technologies, under the perspective of users belonging to the public sector or financing these initiatives. Creating new technology-driven services is becoming one way to have a tangible impact in supporting local development processes, combining functional and social concerns in a sustainable way. Anttiroiko et al. [2014] conceptualised smart services as **technology-enabled services intended for individual use and consumption processes**, but **ideally supporting the cooperation among different organisations** for the service production through the exchange of information, coordinated interaction and facilitated transactions among connected services. The authors ground their conceptualisation on three trends: 1) the opportunity to **digitalise manual services or redefine local services at a global scale**; 2) new models for the production, delivery and consumption of services based on networks of producers; 3) the liberalisation of services previously managed in a monopolistic way at the national and local level [Anttiroiko et al. 2014].

These trends are related more in general to the emergence of the **digital economy** that, on one side, **decreases the costs of services through digitalisation**, and on the other side, **challenges the division between producers and consumers** because both groups base their actions on the access to digital information [Valenduc & Vendramin 2016]. Indeed, digital goods and services are intangible and non-rival. In other words, they can be possessed without necessarily being owned, and they can be unlimitedly used without costs of reproduction [Rifkin 2014]. Thus, their total costs can be significantly lower than the correspondent non-digitalised services [Tapscott 2015]. Then, the so-called "two-sided market" calls the customers to actively contribute in the delivery of services through non-compensated work that enables the consumption of services at conditions more advantages than traditional services [Rochet & Tirole 2003, Valenduc & Vendramin 2016].

The emergence of **new technology-driven monopolies** is one of the results of the combination of these two aspects. Indeed, producers frequently compete until a specific configuration of the provided digital services outperforms the competitors gaining a position of **predominance at a global level**. This phenomenon **limits or eliminates the possibility to impact on the terms, nature and organisation of services at the city level.** Indeed, even though the definition of new digital services is considered central in smart city initiatives, this process is practically hindered by the need to rely on global providers, setting the conditions for the use, reuse, integration of their services. The options of technology users are then reduced to adopt the dominant provider (especially for web-based technologies and services such as Google, Facebook, Amazon) or to the choice among a few providers of equivalent services (CISCO, IBM, SAMSUNG for smart city technologies).

Conversely, it is also important to underline that the digital economy disrupts the link between the size of cities and economic opportunities for their development [Kumar& Dahiya 2017]. This important change opened up for technology users the access to services and resources previously associated with the social and material infrastructure of major cities. This phenomenon virtually determined a **spatial redistribution of socio-economic opportunities**.

3.2.1.c. Sharing Platforms and Smart City Technologies

Coming back to the concept of smart city services as services for individual consumption relying on a network of providers of web-based solutions, it is worth to highlight that in the last years the concept of **smart economy and sharing economy progressively overlapped** [Kumar& Dahiya 2017]. However, sharing platforms constitute a specific type of web-based technologies and are not usually considered as part of smart city technologies (see Chapter 1 and Chapter 4 for details).

From the users' perspective, sharing platforms enable access to **low-cost personal services** (e.g. restoration, shopping, travelling in platforms such as AirBnB or Uber). At the same time, the mechanisms of sharing platforms are also responsible for causing extreme dysfunctional dynamics at the global and local level, such as critical conditions of the workers engaged in the delivery of these services [see Sholz 2017, Abraham et al. 2018, Sutherland & Jarrahi 2018] or alterations of the housing market in the city centres [Coyle & Yeung 2016]. These side effects are mainly due to **models pursuing and supporting the competition among platform users** (both service providers and customers) through centralised management of services [Constantiou et al. 2017]. Under this paradigm, web-based technologies become an additional selling channel for traditional businesses, exacerbating uncooperative behaviours personally and at the organisational level.

This mechanism is also rooted in the most **common business models for smart city technologies**, focused on Public Administration as main clients. In this case, part of the cost of smart city initiatives is oriented to **transform public agencies and local government departments in service providers for third parties, or to establish partnerships between ICT providers and public sector binding the provision of services to the exclusive access to local resources** [Bélissent 2010, Knickrehm et al. 2016]. While increasing the economic sustainability of investments in smart city initiatives, these models hinder inter-organisational cooperation among multiple public agencies or city administrations. At the same time, these business models strongly reduce the possibility to enhance local capital (e.g. social capital, institutions, local businesses) because the main technology providers, operating at a global scale, reserve the exploitation of local resources (information and infrastructures). Lastly, assuming the Public Administration as the only client of technology providers of urban technology prevent them from rethinking and testing more fluid business models opened to a diversified range of clients among city stakeholders.

There is a growing awareness of the risks and unwanted effects of business models centred on competitive dynamics, and how they could negatively impact on pursuing innovation and socially relevant goals related to local development processes. **New pillars for rethinking current business models of technologies in cities** are the **social sustainability** of technology-enabled services and the **community grounding** of their definitions and implementation, based on **hybrid enterprises** combining public and private activities [Jabłoński & Jabłoński 2020]. These future business models are envisioned as fluid and also adaptable to enhance the potential of non-technological small and medium enterprises [Warren & Fuller 2015], as well as non-profit organisations and informal groups [Jabłoński & Jabłoński 2020]. However, the experimentation of new business models prioritising users against technology providers is still rare. Interestingly, in the Italian context, that is considered particularly behind in the digital economy in comparison with other European Countries [Bauer & Erixon 2016], there are already a few attempts in this direction in cities like Milano and Bologna [Caperna et al. 2017, Rizzo et al. 2015]. The transversal element between these initiatives is the integration of technologies to serve activities and initiatives already in place and involving a plurality of actors. Differently, the UK digital economy is historically characterised by the strong attention to commercial services driven by industries already structurally integrating technologies in their activities [Bauer & Erixon 2016], and less engaged in elaborating alternative business models with public and non-profit organisations.

3.2.2 SOCIO-CULTURAL ASPECTS

3.2.2.a. Parallel Visions of Smartness and Web-based Technologies

The spread of web-based technologies, including social media and other locally-focused platforms (see Chapter 4), rapidly increased the opportunity for those residing and working in cities to get information of local relevance having impact on their lives. Cultural changes and social sensibilities pushed indeed for publicly enhancing the **value of informed decisions at an individual level and collective level** on matters going from behaviours and personal choices about food and mobility [Pappas et al. 2017, Valdez et al. 2018], to the general governance of the city or more practical issues related to the basic management of urban resources and infrastructures [Murphy et al. 2017, De Tuya et al. 2017].

At the same time, cities had been invested since the starting of this century by a renovated interest of a diversified audience (going from grassroots formations to intellectuals, local businesses to schools) in being actively engaged to identifying and addressing community issues and social challenges at the local level. Especially in recent years, the principle of the *"right to the city"* formulated decades ago by Lefebvre and intended as the **right to access and self-manage urban resources beyond conventional schema** [Lefebvre 1996], had been adopted and reinterpreted in multiple forms. They can include in some cases confrontational orientations nurtured by the conflicts between consolidated elites governing the city and anti-system groups, but more frequently the **definition of new spaces for action and collaboration into the public domain among various social forces** [see e.g. Uitermark et al. 2012, Iveson 2013, Islar & Irgil 2018]. In this framework, the access and exchange of local information became a sort of precondition and integration to exercise the right to the city [Shaw & Graham 2017]. Web-based technologies worked as amplifiers of this renovated interest in improving the quality of life in cities or transforming places configuring a hybrid online space connected to offline actions to aggregate and compose social differences around common local issues [Antoniadis & Apostol 2014]. The growing interest of tech activists, designers, and researchers toward the forms of technology-support to this kind of initiatives also led to numerous experimentations to build ad-hoc locally-focused digital tools to address specific issues and challenges at the community level [see e.g. Hespanhol & Tomitsch 2019, Bedo 2019].

The relationship between this socio-cultural phenomenon and the nature of smart cities initiatives is ill-defined. Indeed, on one side, two of the pillars of the dominant paradigm of smart city are the ones of smart citizens and smart communities [Chourabi et al. 2012] allowing to suppose that self-organisation, civic activism and extensive interpretation of citizens' rights can be included under this paradigm. On the other side, this perspective deeply contrasts with the canonical vision of smart citizenship deeply focused on citizens as individuals in a one-to-one relationship with the local government [Cardullo & Kitchin 2019], instead than oriented toward collective engagement, the building of social resilience, inclusive participation and bottom-up tangible changes at the local level. This second "social" interpretation of smart citizenship had been recently associated with the concept of *"civic hacking"*, intended as *"a particular articulation of citizenship in the network era"* enabled by the availability of urban technologies and driven by collaboration principles [De Lange & De Waal 2019]. However, beyond the current debate on whether smart citizenships can include or not self-organised collective forms of action in and over the city, the existence of multiple parallel visions of smartness and scope of technologies in cities is evident.

As mentioned already in Chapter 1, other parallel visions of the smartness are rooted respectively in part of academia and industry. They are respectively centred around smart governance, smart communities, smart living in one case, and on smart infrastructures, mobility, and environment on the other case. In both cases, the integration of digital technologies in cities is not directly associated with the implementation of everyday urban activities and collective actions, as in the vision of smartness seen before as technology-enabled self-organisation of people and communities.

From the perspective of technology providers, technological products and services having urban applications do not differ substantially from other business or commercial applications. The **strategic focus of technology providers remains driven by the assessment of the market evolution, the optimisation of their offer and positioning on the market, and the decision to invest or disinvest based on the economic performance of products and services** [Paroutis et al. 2014]. As mentioned in the previous section, in the case of urban applications in smart city initiatives, the main client of smart city solutions is the Public Administration to whom technology providers sell a vision of smartness centred on the promise of efficiency in the management of infrastructures and essential services achieved to the production and analysis of an unprecedented amount of data continuously generated [Aoun 2013, Vanolo 2014]. The attention to emphasise the importance of these services for people and local communities is present in the communication policies and marketing strategies of most of the ICT firms in the smart city market. Nevertheless, the so-called *"corporate-oriented vision of smartness"* [Hollands 2015] does not include a clear picture of social and cultural phenomena in cities and how technology intervenes in shaping the dynamics of collective actions. The social and cultural specificities of cities are not part of the elements taken into account by technology providers because in contrast with expansion models based on the local replication of the same solutions for recurring problems (e.g. water control, energy efficiency, public lights managements) at the global scale [van de Buuse & Kolk 2019].

Interestingly, this specific approach is also the one limiting the ambitions of technology providers to extend their reach and market segments. Indeed, as showed and advocated in recent works [e.g. Paroutis et al. 2014, Hollands 2015, Van den Bergh & Viaene 2015, van den Buuse & Kolk 2019], also the corporate vision of the role of technologies in cities is called to provide solutions adapted as the social ecosystem of cities.

3.2.2.b. Impact and Transferability of Technology-Supported Initiatives

On the opposite side of global solutions replicated at the local scale and provided by major ICT firms, there are other smart city initiatives attempting to contextualise technological innovation at the local level. In these cases, they take into account social and cultural specificities, but fail in scaling up beyond pilot projects and limited trial sites [Van den Bergh & Viaene 2015, Gil Garcia et al. 2016].

This situation is due to the nature of promoted innovations, relying on the **limited supply of hardware and software components, unstable prototypes, and narrow hyper-local scopes**. All these factors are combined with the **structure of funds allocation based on short term working plans and temporary partnersh**ips. The consequence is that even promising initiatives cannot be consolidated to reach tangible and constant results or to have an appreciable impact [Caragliu & Dal Bo 2019], making preferable consolidated (and often outdated) alternatives. As emerging from the reports and documents of the Italian Smart Cities portal[17] edited by the National Association of Italian Cities (ANCI), a net majority of projects oriented to integrate digital technologies as functional tools for the local development struggled in providing evidence of the added value of these solutions and their long term sustainability.

On the other side, there is **growing attention to increasing the exchange of good practices and shared solutions** between different cities. New national forums are set up specifically to support the scaling up

[17] http://www.agendaurbana.it/

from pilot projects towards systemic changes [FPA 2012]. In this context, **interoperability, transferability and modularity** can be identified as the three characteristics of future urban applications of information technologies to address the need to operate within a shared framework and overcome ad-hoc solutions. Interoperability, transferability and modularity require though a careful analysis of the social, cultural and institutional peculiarities of different cities to understand how and to what extent certain solutions can be replicated in different contexts and scaling up.

Another aspect related to the need to increase the impact of digital technologies on city management is linked to the **intrinsic difficulty of evaluating its impact** and combining the **social and economic values generated for all city stakeholders** [Caragliu & Dal Bo 2019]. Indeed, there are not solid and generalised assessments of the value generated by ICTs in city management. This situation makes it problematic to enable the involved parties in evaluating the appropriateness of a specific technology with current local goals.

Linked to the need of increasing the impact of urban applications of information technologies on local communities, there is also the problem of compensating the gap between the immediate results raising from businesses intelligence applications in commercial domains and the **high expectations of rapidly improve the local quality of life associated with the urban applications of technology**. However, the quality of life is subjective and difficult to measure, differently from revenues increases. Therefore, assessing the impact of digital technologies in everyday life is a problem only very partially covered by the myriad of assessment frameworks focused on the quantifiable factors of the smartness [see Aribiloshoi & Usoro 2015, Ahvenniemi et al. 2017]. Instead, a better awareness of the values bounded to the use of information technologies in city activities could rely on a before/after comparison taking into account the social and relational improvement or losses.

3.2.3 TECHNOLOGICAL ASPECTS

3.2.3.a. Reification of Technology

In Italy, the **introduction of digital technologies in city management is still considered a policy in itself** instead of being seen as a *"policy tool to multiply the value of strategies and actions that cities decide to implement"* [Testa 2016]. In the UK, the public discourse on digital technologies emphasises technologies' **instrumental value for achieving important governmental or organisational changes** in urban development processes [Joss et al. 2017].

Both these approaches reify technology incorporating goals and aspiration related to administrative purposes and urban innovation in the act of publicly adopting new digital platforms or building new technology infrastructures. Two examples of these approaches in which technology is intended as a goal or means for indirect goals concern recent extensive public programmes in the cities of Milan (Italy) and Birmingham (UK). In the smart city strategy of Milan, digital technologies were supposed to facilitate the engagement of the population in public calls for reusing public spaces for civic purposes or sustaining more sustainable mobility behaviours[18]. The core of these interventions was tough not related to technology in itself called to make visible the existence of a city strategy on specific topics. Similarly, in Birmingham, the innovation and expansion of the urban ICT infrastructure was aimed at ensuring *"ultrafast connectivity,*

[18] http://www.milanosmartcity.org/

providing open access city centre mobile broadband experience and free Wi-Fi in public buildings"[19]. In this case, the deployment of technology was supposed to improve the potential capacity of public authorities to engage citizens and increasing the liveability of the city centre, but also it was materially proving the predisposition of the administration to do so even without further actions in that direction.

As a result of this reification process, technologies deployed in urban environments are explicitly expected to support technology buyers such as Local Governments in indirectly achieving their institutional missions. On the other side, technology providers focus on the functional and operational aspects of digital services, without putting in place solutions for managing potential side effects at a social and organisational level, especially because these effects are supposed to be independently managed by local authorities and end-users in relation to their purposes.

3.2.3.b. Navigating the Technology Landscape

Effective and meaningful **evaluation frameworks** to assess whether specific digital technologies help their users or buyers reach their goals are **still missing**[20] [Lövehagen & Bondesson 2013]. Thus, it is very **difficult for users to navigate the dense and diversified landscape of smart city technologies** to choose the most appropriate for their intended uses, taking into account context and nature of the activities to be supported through technology.

Continuous advances in technologies aggravate this unintelligibility and difficult assessment of the offer of technology providers. Testing new technologies in working environments requires further investments on hard and soft infrastructures as a precondition for understanding their implications on the management of city services and resources. Indeed, even though most of the new technologies promise to reduce the costs of ordinary operations, the **hidden costs of management, training, organisational restructuring, interoperability issues among different systems, obsolescence infrastructures and resources are mostly unknown in advance** [Nam & Di Pardo 2011b]. As a result, technology users, and buyers in particular, frequently undertake experimental and partial trajectories, hindering the chances to maximize impact and benefits coming from the introduction of new technologies in city operations. In other words, the efforts are focused on the **acquisition of IT infrastructures and licences, instead than preparing the adoption path** (through training, organisational changes, ad-hoc policies) [Mosannenzadeh et al. 2017].

As noted by Gil-Garcia et al. [2015], current **research on smart cities does not provide any support** to technology users for structuring a pragmatic reflection about the role of digital technologies in urban contexts. Gil-Garcia et al. point out that less than the 1% of the literature provides theoretical or conceptual lenses to approach this complex domain and less than the 2% offers a critical review to figure out obstacles and failures of solutions already tested. Unlike other smart city technologies such as AI-driven or IoT systems, web services and platforms are familiar to most of the prospective users and buyers of technologies, and they also are deeply studied by experts in e-government and related domains. However, research insights from these domains are hardly appropriated by decision-makers in local authorities called to identify the adequate solutions for city projects because it is **difficult to contextualise research inputs in contingent situations** or choose among different technologies and providers.

[19] http://digitalbirmingham.co.uk/

[20] Current evaluation frameworks for smart cities [e.g. Lombardi et al. 2012] are based on the use of data potentially coming from smart city technologies, but more frequently from administrative surveys. They are meant to assess the "smartness" of a city accordingly to a set of thematic clusters, but not the effectiveness or impact of technologies in this context.

Moving from the perspective of local governments as main buyers of smart city technologies to their intended end-users, citizens, the issues of connecting digital technologies and everyday urban activities is even more challenging. Indeed, **technologies chosen by local governments and made available for the population not necessarily are grounded on real shared needs or able to meet diversified expectations** [Joss et al. 2017]. Consequently, their use remains limited, and the balancing between public investments and results is unfavourable under the light of economic return and generalised social benefits. A significant example of this situation is given by the proliferation of ad-hoc platforms to collect citizens inputs. These platforms usually remain scarcely used, even if well promoted by local authorities, mainly because their utility in supporting citizens' everyday activities is limited [see Chapter 4].

It is worth noticing that the **perspectives of other classes of end-users** (non-profit organisations, civil society groups, universities and research centres, non-technological local businesses) on the use of technologies in their activities in the city **remain untraced**, both in research and institutional communications.

As regarding technology providers, one of the main challenges in navigating the technology landscape is balancing the **effort toward the commercialisation of consolidated technologies** (in the form of products and services) and the **need of investing in the research and development of new and emerging technologies**, even before that clear paths for their exploitation are fully defined. Indeed, while commercial applications of web-based technologies for cities are predominantly still anchored to the paradigms of "Web 2.0" (*"Social web"* and *"Geospatial web"*) and "Web 3.0" ("*Semantic web*"), the state of the art of research on web-based technologies is already projected toward the theoretical and empirical exploration of new paradigms such as the Web 4.0 ("*Ubiquitous web*") and Web 5.0 ("*Web of thoughts*") [see Chapter 4, section 4.1.2 for a detailed description of these paradigms]. In the first two cases, the focus is on the involvement of users in the production and exchange of digital multimedia and geospatial contents supported by intelligent systems facilitating the management of these contents. New directions are instead oriented toward a more extensive integration of heterogeneous tools and human and non-human agents in the fruition of web-based technologies. The transition from a paradigm to another became progressively faster over the years, forcing each time to rethink the nature and structure of commercialised products and services in a very short time. An additional difficulty is precisely given by the fact that technological advances pioneered in research domains entail **unquantifiable risks and uncertain trajectories** that could unpredictably hinder the success of a technology [Bowman et al. 2017].

Considering these challenges, numerous technology providers of city applications, especially small and medium-sized enterprises, focus their effort on **incremental innovations and optimisation of consolidated technologies** (especially in data management and visualisation). In this way, they can leverage on the relative low cost of web resources and services, the organisational and technological infrastructures already available, and the networks of suppliers and providers in place [Di Maria et al. 2018, Flor et al. 2018, Shuen 2018], even though the risk is going out of market for the obsolescence of the proposed solutions in the medium term.

3.2.4 POLITICAL ASPECTS

Political considerations about the nature and effects of integrating web-based technologies in city life are gaining increasing importance in orienting decision-makers and the public opinion in favour or against their adoption. These considerations pertain the role of technology as an amplifier of the political influence of specific stakeholders operating within cities, but also the political influence of cities at a regional, national and even global scale.

3.2.4.a. Cities as Glocal Hubs Supported by Technology

The political importance of cities is dramatically growing in the last two decades, and it is projected to furtherly be affirmed in this century, already called the "century of cities" because of the combination of globalisation and urbanisation phenomena [Martins & Reis 2017]. Urban areas have always played an essential role in supporting economic and social development by providing, in a concentrated space, a set of tangible and intangible resources to solve local issues and trigger innovation processes later spread at an international level. Even though the central vision of nation-states as cradle and driver of the development dominated for more than three centuries [Sassen 2019], nowadays **cities are called to act as political entities** (often instead of States)**, plan "glocal" strategies** (locally-focused but globally-oriented)**, implement policies and concrete actions to address transnational problems through trans-municipal networks**[21] [Chan 2016].

In this scenario, **digital technologies are interpreted as the means to enable the implementation of these glocal strategies and actions**, reinforcing and widening their effects, and making them sustainable from a social and economic perspective. For instance, by setting the global standards to achieve sustainable development, the New Global Urban Agenda also reaffirms the decisive political role of cities in addressing future challenges and driving innovation. At the same time, the New Urban Agenda indicates the critical responsibility of ICT in enabling the society at large in exercising civic responsibilities, and fostering a more open, inclusive and responsible governance of cities as starting point for the wider democratisation of developed and developing countries [UN – Habitat III secretariat 2017]. In this sense, cities are explicitly charged with the responsibility to pave the way for new directions concerning the management of economic, environmental and social issues, but most crucially for consolidating democratic mechanisms at the local level that can scale up to the country level.

3.2.4.b. Technology as a Political Instrument

Narrowing the view inside cities, digital technologies and especially web-based technologies such as social media are also seen as **instruments** to enable a segment of city stakeholders governing and controlling civil society, **replicating power asymmetries and hierarchies** [Maulana 2020].

More in detail, studies started already over 20 years ago to investigate the impact of new technologies over national and local politics, highlighted the complex **tension between the politicisation of every issue** due to their over-exposition enabled by technologies and the **avoidance of political dissensus and disagreement** made possible by confining the space for expression and action within a technology dimension [Barry 2001].

[21] A recent example is the attempt of the UK cities network to participate as an independent actor in the EU-UK Brexit negotiations in 2018 due to the impact of this deal over the economic model of the country driven by a few metropolitan areas. (link: http://speri.dept.shef.ac.uk/wp-content/uploads/2018/11/Brief-1-The-impact-of-Brexit-on-the-City-and-the-British-economic-model.pdf)

The rapid and increased **access to information** indeed facilitates the wide activation of all the interested parties to **get a voice in the debate and therefore influence public decisions** on specific topics that can concern small groups only or the society at large. However, these **potential new forms of participation to cities and countries' political life are restrained or potentiated by the intrinsic characteristic of most of web-based platforms and tools based on the pre-selection of information for their users**. As highlighted by Hindman et al. [2003] in the concept of "googlearchy", the fact that information is available or public does not mean that information can be easily found by the people who need it or would benefit from it. As regarding the city context, it is also known that publicly available information can be used to **highlight and addresses problems that could be perceived as a priority by the collectivity**, but at the same time, **main problems and issues can be denied or hidden through the selection of the quantity, quality and distribution of specific information** better serving the intended purposes [Leszczyinski 2016].

As a result, the actual **level of democratic participation to public life** enabled by digital technologies is strictly **dependent on the socio-demographic background of users** (and their ability to critically process information acquired through education, training, professional status) **combined with their technical skills** (to navigate and effectively use a plethora of tools and platforms) [Min 2010], leaving behind and out of the political debate large portions of the population. In urban settings, where it is directly evident that everyone contributes to the growth and development of the city independently from socio-demographic backgrounds and technical skills (through work, taxes, and personal choices), the exclusion of a large portion of the population entails issues going beyond the participation to public life and local decisions, to invest the recognition of citizens as political actors. As advocated in several studies, the realignment between collective forms of offline political participation to the public sphere and their projection in the online space of web-based technologies is one of the most promising paths for defining truly democratic forms of political engagement supported by technology [Gil de Zúñiga 2010 et al., Fung et al. 2013]

Going back to the asymmetries of power and visibility, it must also be considered that the political dimension of **publicly relevant decisions can also be intentionally obfuscated by leveraging on emotional aspects and personal promotion of political representatives and governors, downplaying rational analysis** [Papacharissi 2015]. In this case, again, wide reach technologies as web tools can be instrumentally used to amplify the voices that are already the stronger in the public arena.

Looking at technology providers in relation to technology as a political instrument, two opposite trends can be highlighted. On one side, ICT firms operating in the context of smart city programmes have prospects highly dependent on the political commitment of local administrations to pursue the integration of technology in city management [Karvonen et al. 2018, van den Buuse & Kolk 2019]. One of the effects is that changes in political agenda and orientation at the local level can deeply impact positively or negatively on the contracts between technology providers and cities [Visvizi et al. 2019] and the overall strategies implemented by ICT firm to survive this uncertainty [van den Buuse & Kolk 2019].

On the other side, especially in the last years, some major technology providers are increasingly expressing visions with a clear political orientation as a driver of technological choices for their products and services [Vaidhyanathan 2018]. The consequent creation of a parallel political system with its own institution and democratic or antidemocratic mechanisms enabled by the ownership of technologies is still a new phenomenon, underexplored but to be considered as potentially relevant in the future. It points out that the use of technology as a political instrument, traditionally associated with political bodies and organisations, can also be replicated and readapted to serve the agenda of other actors in the political ecosystem.

3.2.5 ORGANISATIONAL ASPECTS

The organisational aspects are the most determinant to understanding the main limitations and problems of integrating digital technologies into localcollective actions.These constraints, especially as regarding the side of city stakeholders, are associated with:

- the **profile of human and material resources**
- the established **protocols and decisions** about internal and external activities
- the **early or late adoption** of technologies.

Most of the literature on the topic, and grey resources as well, examines the relationship between public sector organisations (local government and public agencies) and digital technologies in cities. Other relevant classes of technology users, such as local businesses, non-profit organisations or universities, are instead still understudied. Thus, this analysis will focus primarily on the constraints of public administrations that seem to be the only ones generally taken into account.

3.2.5.a. Human and Financial Resources

An ageing population of public servants characterises the profile of human resources in Public Administrations. As a matter of fact, the average age of public employees in Italy is over 50 [MEF 2018] and in the UK over the 54% of public employees belong to the age group 45 to 64 years old [HMRC 2018]. This demographic profile entails a **digital divide problem** that affects the difficult matching between the skillset of the administrative workforce and the rising expectations and challenges related to the application of digital technologies in city services and activities. In this context, the introduction of new digital technologies often increases the overload for the staff of Public Administrations, instead of helping them improve public services, as also highlighted in studies about e-government solutions [Warf 2018].

The current profile of human resources in the public sector also results in a **lack of internal staff with training, expertise and competencies to bridge technological innovation and organisation innovation** [OECD 2017, Blackwell 2017] to support the effective and extensive integration of ICT in urban management. On the other side, the lack of bridging competencies across technology and organisations in charge of the city management extensively affects also technology providers making the development of appropriate technologies more difficult [Shavinina 2003].

Additional difficulties in integrating the human capital into the public sectors in the short and medium-term are determined by the **turnover block or its slowdown due to austerity measures** of the last decade and internal restructuring of public agencies [EU Commission 2017]. This situation **worsened the operative conditions of the public secto**r in most of the European countries, Italy and the UK included.

Austerity measures also determined a significant **shrinking of regular public resources** in Italy and in the UK. This shrinking re-oriented priorities and scope of the ordinary activities of Public Administrations [Citroni et al. 2019, Morris 2019]. At a more general level, budget rationalisation and funding cuts are preventing public investors from implementing radical changes in structures and public functions or in the delivery of local services. These **financial constraints** can also constitute an incentive in the adoption of digital technologies, that in public administration had been traditionally motivated by the need for reducing internal costs. However, in this context, the **priority is given to solutions to improve the efficiency of existing public services and not to address new problems**.

At the same time, these financial constraints made the **engagement of the public sector by technology providers increasingly difficult** and subjected to long term planning and dilution of resources, especially as regarding experimentation and tools not directly connected to externally funded projects and potentially leading to technological and non-technological innovation in the provision of public services [Halvorsen et al. 2005, Fuglsang & Sundbo 2016].

This point does not contradict the large availability of funds devoted to smart city projects, but it underlines that the access to these funds relies on competitive procedures through bids and proposals that make even more critical to internally developing the appropriate skill set to secure additional resources for public operations.

3.5.2.b. Organisational Protocols

The **compliance of the operative protocols** linked to the introduction of new digital technology in ordinary activities with the internal regulations and legislative mandates is essential. The constraints related to compliance requirements impose a **strict process of risk assessment** to public sector organisations [Hellström 2003]. Consequently, Public Administrations need to develop **new standards, rules, and policies for the introduction and use of new technologies within public functions** [Arduini et al. 2010], as they actually did for introducing social media in ordinary activities related to public engagement [Crump 2011, Criado et al. 2013]. As emerging in recent influential studies and analysis, the **adoption of new technologies in the Public Administration is often higher** or more significant than in the private sector [Mazzuccato 2015]. Still, it is **usually slower** precisely because of the effort for their standardisation and integration in existing protocols and the limited resources dedicated to this process [Blackwell 2017].

On the side of **technology providers, meeting compliance requirements is a continuous challenge due to their variability in different countries and even at the level of different cities**, while the nature and supply of digital services tend to be invariable to the context [see Shavinina 2003]. This situation usually increases the risks of failure in technological projects because of adoption constraints related to social and organizational issues, and not necessarily due to the intrinsic qualities and performances of the provided technology solutions [see e.g. Shaikh 2016, Obal 2017, Ubaldi et al. 2019].

The **reactivity of technology providers and the adaptability of their products is highly variable in relation to the enterprise size**. Large technology corporations tend to develop by default a set of variants for the same solutions adapted to specificities of different markets, but at the same time the agility to deeply reconfigure their services (beyond the given customisation options) is limited, and the search for brand consistency and protection is often a priority. Differently, small and medium technology providers can exploit more agile organisational structures and independent profiles to develop concurrent solutions for similar kinds of problems or needs. However, in these cases, the implementation and marketing efforts force to narrow the range of their offer to balance investments and resources for the sustainability of the enterprises. Another case is the one of tech activists frequently working outside the market, relying on individual and groups efforts not bounded to internal organisational protocols. In their case, specific causes and local problems can trigger the search for appropriate and contextualised solutions, easy to adapt to compliance requirements, but challenging to adopt because of limitations in the reliability of the supply from a legal and financial perspective.

3.5.2.c. Early or Late Adopters

The same processes of risk assessment and rules formalisation mentioned above also determine structural organisational issues in Public Administrations that **limit their potential role as primary drivers and early adopters of new technologies.** The preferences of Public Administration are usually oriented toward **consolidated technologies instead that emerging technologies** [Gill-Garcia et al. 2014], more challenging to assess in their implications over the management of public services.

On the other hand, the public sector can contribute to consolidating the use of emerging technologies into the public domain exactly for the intense effort of developing *"safe protocols"*. The most significant example is offered by the spreading of social networks [Bryer & Zavattaro 2011]. In the beginning, online social networks were intended primarily for personal and informal use. Then, the Memorandum on Transparency and Open Government of the US government in 2009 [Obama 2009] is widely considered as the pivot act that paved the way for a public-oriented, generalised and institutional use of social media that rapidly grown in many countries. For instance, the Public Service Intelligence Report of 2014 stated that 416 of the UK's 433 local city authorities (96%) have at least a twitter account, and probably after years this number is still increasing. Another study in Italy estimates a penetration of social media in over 90% of medium and large municipalities [Montanari et al. 2013], probably higher nowadays.

This background points out, implicitly, the importance of **other local actors**, such as the private and third sector, to act as **primary drivers and early adopters of new technologies** to be experimented for enabling local changes. Indeed, public administrations are organisations with more rigid constraints and profiles than the business and third sector. Conversely, it is also necessary to consider that businesses and civil society **cannot guarantee continuity in their commitment** to specific objectives, differently from the public sector [Taylor Buck & While 2017]. Within the framework of these respective organisational constraints, the intervention space for expanding the impact of digital technologies on urban activities is given by settings inter-organisational partnerships effectively exploiting their complementarity and mutual dependence in local development processes.

3.2.6 LEGAL AND REGULATORY ASPECTS

The lack of *"smart laws"* for smart technologies in urban environments is a well-known problem [Decker 2016], as well as the frictions between the normative frameworks of smart city initiatives and ordinary challenges in city management [Goodspeed 2014]. These two issues are still underexplored in the research on smart cities [Gil-Garcia et al. 2015, Jewell 2018], while determinant for connecting the availability of technologies to city management and local development processes.

3.2.6.a. Law on Smart Technologies and Web Standards

Recent models for developing regulatory instruments for smart city technologies proposes that the scope of "smart laws" should cover three main themes [Reins 2019]:

- Governance and democracy
- Market regulation of new devices, systems and services
- Data issues.

On the contrary, laws and regulations on smart technologies currently focus instead on three concerns: **privacy protection**, the **security** of systems used in critical services, and improvement of the **citizens' safety** [Elmaghraby & Losavio 2014, Edwards 2016]. For instance, the EU General Data Protection Regulation (GDPR[22]) represents a significant example of a law changing the rules for the privacy protection of European citizens accessing or traced in digital systems, intended to contrast the indiscriminate commercialisation and reuse of data without the explicit consent of users [Edwards 2016]. Similarly, security issues are addressed at the level of international standards and national regulations and for the management of digital systems in specific sensitive sectors (health, finance, public services) to facilitate the identification of *"cyber threats"* [Baig et al. 2017]. The topic of the citizens' safety is instead addressed at a local level by looking at digital technologies as additional tools of police authorities for preventing and contrasting crimes, facilitating law enforcement, and therefore able to make cities safer places (even though by setting up a generalised surveillance system) [Re 2016].

These earlier regulations of smart city technologies result to be:

- focused on IoT, autonomous cars, robots and other devices physically present in urban environments, but **not really considering the landscape of web services and platforms** [Reins 2019]
- centred on **individuals and technology companies** as the only subjects covered by regulations
- oriented to **establish the parameters for a correct management** of these technologies in compliance with other regulations and civil rights [Edwards 2016], instead than defining or assuming a specific standpoint respect to technologies that enhance or diminishing users' liberties [Brownsword 2016]
- configured as **new barriers for a part of technology users and providers**, less equipped to comply with new regulations (in terms of legal and financial support)[23] . These barriers often contrast with public interest aims, discouraging beneficial innovations that could be enabled by technologies [Schellekens 2016].

What clearly emerges is that the *"social resourcefulness"* of legal instruments is not yet prioritized for shaping norms able to address the social complexity of city environments in which digital technologies are becoming pervasive [Levy 2017]. The gap due to the lack of wiser laws on urban technologies exposes technology users to potential manipulative uses of technologies consolidating inequalities and facilitating the control and abuse over citizens [Leszczynski 2016], in contrast with the potential empowering capabilities of digital technologies.

Regarding web-based technologies, they remained out of the matters of legislators' concerns for decades, at a national and supranational level. Recently, laws revising the taxes profiles of technology companies providing web-based services had been largely debated to contrast the inequity over these enterprises' duties and responsibility compared to others in the business sector. However, **web-based technologies and web services are not subjected to specific restrictions or orientations because they are still seen strictly as digital products and not related to the kind of services they enable**[24].

On the other side, it is essential to highlight the relentless effort all internal to the world of technology providers in reaching a wide **consensus over standards to be met in the development and provision of web**

[22] https://eugdpr.org/ , unofficial portal for the dissemination of the contents of the GDPR.
[23] An example of this phenomenon concerns small voluntary groups or even schools' groups called to comply with the GDPR for everyday communications, even though the policy is aimed at limiting abuses of large ICT companies.
[24] A well-known case is the one of the Airbnb platform, that cannot be considered as subjected to the obligation and responsibilities of all the other providers of hospitality services at the city and national level because recognised simply as a web platform and not directly as a hospitality provider.

services, as well as in elaborating **sectoral regulations** on a wide range of aspects going from the security to the distribution of services, from the interoperability of data structures and services to internal quality control policies [Tessoy 2000, Tusikov 2016]. The peculiar aspect of these **standards and regulations having a global coverage is being entirely developed by privates and on the basis of market-driven principles**, instead than public interests' principles such as in the case of supranational, national and regional legislations [Tusikov 2017]. The interests of consumers and clients of web services are safeguarded by these regulations, but not necessarily their rights or collective rights. Moreover, the emergence of web technologies monopolists radically reduced pluralism or democratic mechanisms in the establishment of new regulations and standards. They frequently result in anti-competition measures protecting major firms and consolidating barriers to market for newcomers (forced to meet rapidly changing standards and ask for authorisation to access the market as in the case of web application on general apps stores). On the opposite side, these regulations can also be shaped as pro-competition measures crashing the attempts to test innovative services and alternative business models.

3.2.6.c. Normative Frameworks for Digital Technologies In Cities

There is **no ban to develop new city management regulatory instruments for new purposes** in the Italian corpus of urban laws [Fiale & Fiale 2017]. This situation leaves open a vital intervention space for legal and technological tools aimed at integrating short and long-term technology-supported urban transformations implemented by public and private actors, or coordinating city initiatives, or monitoring the application and evolution of local decisions and projects. Tools addressing these tasks could complement the scope of traditional regulatory planning instruments more focused on land use issues, building rights, and public services planning, and bridge the operational domains of smart city initiatives and city government. Indeed, the only binding condition set by the Italian normative framework is that **new instruments do not replace or assume the same name of planning instruments already required by national and regional laws that must remain stable in their contents and scope** [Consiglio di Stato 2003, Fiale & Fiale 2017]. A similar setting, even more open and flexible, characterise the British context, in which planning instruments are not city laws, but policy documents outlining a shared vision to inform the operational decisions of public and private actors [Punter & Carmona 1997]. Nevertheless, the absence of mandatory obligations to adopt new technology-supported city management protocols prevents from setting up a systematic effort in this direction driven by city administrations.

At a more general level, urban laws and regulations, as well as sectorial laws on smart city technologies, do not yet cover the equitable distribution of the benefits coming from the deploy of digital technologies in cities or their adoption in urban activities to enhance local development processes. It is also worth to highlight that the normative framework of smart city initiatives is completely different from the one regulating urban planning and city management activities, or the government of cities more in general.

Smart City initiatives are usually short-term experimentations, limited in scale and scope, setting specific goals not necessarily oriented to meet public interests' finalities or citizens' needs [Cowley et al. 2018]. On the contrary, institutional instruments for the **planning and management of cities are based on long-term projections extended to the urban areas as a whole** (such as the general plans in Italy) [Colavitti et al. 2013] or with a **broader socio-economic scope within a defined territory** (such as the neighbourhood plans in the UK) [Allmendinger & Haughton 2007]. While smart city initiatives can address a variety of topics and problems unrelated to the spatial aspects of urban environments or their transformation, commonly urban planning and management normative tools deal with the transformation of the city and the regulation of the plus values and negative externalities determined from these transformations[25].

Smart City projects are usually approved by city governments resolutions (by Municipality or Local Council assemblies) and frequently associated with **external funds** (Regional, National, European, International funds). **City management instruments are instead often overdetermined by regional regulations and national laws** and rely on the **internal budget of municipal administrations**. In other words, smart city projects are regulated by contracts among the partners of the project consortium, including local government as one of them. Urban laws and regulations are instead a set of binding rules for the operations of both public administration, privates and citizens.

3.2.6.c. Responsibilities and accountability management

The differences between smart city and city management regulations are central to understanding the normative constraints preventing a better integration of smart city initiatives and the associated technologies in cities' ordinary activities. These constraints are related to the attribution of **responsibilities over decisions impacting on the public sphere**, and the **accountability for their outcomes**. City management, as well as urban planning functions and local development programmes, are under the exclusive responsibilities of Public Administrations, both in Italy and the UK[26]. What is important to emphasise is that Public Administrations have not only the responsibility of urban decisions as part of their institutional missions, but that they are fundamentally the only accountable subject for the outcome of their implementation in front of the citizens-voters-taxpayers. On the opposite side, in Smart City initiatives, the responsibilities are shared among project partners in front of the other city players directly or indirectly involved in the project. In this case, the accountability of each partner and the consortium as a whole must be proved in front of the funding body and not the citizenship.

These two models of responsibility roles and accountability are apparently irreconcilable. The result is the lack of coordination between the ordinary government of the city and smart city initiatives, and in general, between public and private actors. Accountability issues for Public Administration are a key concern in challenging the current forms of urban management and defining the role of information technologies as a problem or opportunity to reinforce and refactor public sectors missions. From a different perspective, smart city initiatives are also a testbed for setting up new models for sharing responsibilities among public and private actors in the implementation of local development strategies. These two parallel tracks' coexistence contributed to increasing the fragmentation and sectorialisation of urban actions (policies, programmes, plans, projects, services). This fact contributes to making more confuse the competencies and agencies of distinct city players, and jeopardising the efficient use of local resources, including social capital [Castlenovo et al. 2016].

This short overview of the normative frameworks having an impact on the integration of new digital technologies in cities highlighted the lack of instruments to actively support technology users, while the focus is on protecting citizens from potential abuses related to technologies. The analysis also pointed out

[25] Most of the topics currently addressed by smart city technologies, such as the mobility management or the reduction of energy consumptions, are very vaguely correlated with urban planning measures and in general under the competence of distinct authorities and departments.

[26] For an in-depth analysis of the historical and political accounts of this situation, I suggest the specific literature in urban laws: Fiale & Fiale 2017 for the Italian context, and for the Uk context or Rydin 1998 (to have a comprehensive analysis) or https://www.planningportal.co.uk/directories to directly consult the normative.

the lack of laws and regulation over city management tools, complementary to established instruments for the territorial government. Lastly, this background also suggests assuming the concepts of responsibilities and accountability for technology-mediated actions impacting the public sphere as starting points to reflect on how to configure future technologies in compliance with current normative constraints.

3.2.7 SYNOPSIS

Table 3.1 and 3.2 summarise the elements considered in the analysis of the problem of the limited integration of information technologies into city activities, under the perspective of technology users and technology providers. The first column indicates the aspects included in the ESTPOL framework, and the other two columns list the intrinsic and extrinsic elements for each aspect. In table 3.1., the intrinsic elements are related to the operational constraints of technology users in the city environment, while the extrinsic elements are related to the forms and characteristics of the available technological offer or to overdetermined situations that are independent of users. In table 3.2., the intrinsic elements are the constraints dependent on the operational context of technology providers, while the extrinsic elements concern the challenges, issues and constraints of providing services for cities.

Tab 3.1. Key points of the ESTPOL analysis from the perspective of city stakeholders as technology users in the city

	Technology USERS / CITY STAKEHOLDERS	
	INTRINSEC ELEMENTS Dependent on the users' environment	EXTRINSEC ELEMENTS Non-dependent on the users' environment, partially dependent on technology providers or on the broader context
ECONOMIC ASPECTS	▪ Ei1-U- Multi-level and multi-sector funding programmes for technology in cities (supranational, national, local and both public and private funds) demonstrating high demand and unprecedented dedicated resources ▪ Ei2-U-Local authorities and municipalities in charge of managing supranational and national funds to integrate digital technologies in cities ▪ Ei3-U-Uncertainty about the creation of public value for all city stakeholders deriving from the integration of technologies in a value creation model based on indirect effects on local development ▪ Ei4-U- Attention of privates and other funding bodies to combine technology and social innovation ▪ Ei5-U-Larger access to regular services because of decreasing costs due to digitalisation ▪ Ei6-U-Active involvement of users in the coproduction of digital services in the "two side market", even in competitive dynamics among users	▪ Ee1-U- Transnational agreements prioritising the concentration of economic resources toward cities because of their potential to tackle the big challenge of our times ▪ Ee2-U- Differentiated outcomes for different subjects coming from the digital economy that needs to be balanced ▪ Ee3-U-New modes of production, delivery and consumption of services through the digitalisation of manual services and the scale up of local services ▪ Ee4-U-Limited number of technology providers and centralised platform models ▪ Ee5-U-Independence of the size of the city from its potential development as regarding digital services and products ▪ Ee6-U-The majority of city stakeholders not considered as direct clients of city applications, except for Public Administration ▪ Ee7-U-Costs of smart technology contracts covered through the reserved access of global companies to local resources ▪ Ee8-U-Hybrid enterprises emerging as alternative to technology providers

SOCIO-CULTURAL ASPECTS	▪ Si1-U- Value attributed to informed decisions at an individual and collective level ▪ Si2-U- Strong attention to city issues amplified by the rapid access to local information ▪ Si3-U- Demand for technology to support self-organisation and activism, and wide range of past and on-going experimentations ▪ Si4-U- Digital divides by age, class, income [see also organisational and political aspects] ▪ Si5-U- Concurrent paradigms of smartness focused on individuals or collective actions ▪ Si6-U- Limited impact of pilot projects for the integration of technologies in city management ▪ Si7-U-Integration of technology ideally connected to the improvement of the quality of life at the local level	▪ Se1-U-Evolving social needs not necessarily promptly addressed by technologies ▪ Se2-U-Adverse structural conditions to support the scaling up of locally developed solutions ▪ Se3-U-Offer of technology solutions covering only limited issues having a global distribution ▪ Se4-U-Attention to the transferability of practices and technological solutions ▪ Se5-U-Lack of evaluation frameworks to assess the impact of technologies on city stakeholders and justify the effort for their adoption
TECHNOLOGICAL ASPECTS	▪ Ti1-U- Reification of technology as concrete proxy or placeholder for abstract missions, purposes, actions ▪ Ti2-U- Uncertainty in navigating and assessing the technological landscape to choose the appropriate solutions for a particular city context or issue ▪ Ti3-U- Efforts on technology acquisition instead than adoption preparation (management, training, organisational changes) ▪ Ti4-U-Difficulty for Public administration to identify local needs that could be met through the integration of new technologies	▪ Te1-U-Lack of evaluation frameworks for technologies taking into account the potential goals of local authorities and end users ▪ Te2-U-No bridge between research and policy domain over the interdependencies between city setting and digital technologies, or rather Scarce actionability of research inputs for assessing technologies ▪ Te3-U-Difficulty of identifying and investigating priorities and needs of other city stakeholders ▪ Te4-U- Continuous advances in technology requiring also investment in infrastructures
POLITICAL ASPECTS	▪ Pi1-U- Openness to participation and democratization enabled by technology ▪ Pi2-U- Instrumental use or mismanagement of technologies to support the interests of one segment of society over others or personal purposes ▪ Pi3-U- Fears of total control over society and power asymmetries in favour of one segment of city stakeholders ▪ Pi4-U- Uncertainty on the implementation of collaborative forms of urban governance enabled by technologies [linked to economic aspects and goal of the investments]	▪ Pe1-U- Cities as political players from a regional to a supranational scale, nowadays also leveraging also on the capabilities of information technologies ▪ Pe2-U- Digital technologies as amplifiers of political issues ▪ Pe3-U-Digital technologies as marketing tool in politics

ORGANISATIONAL ASPECTS	▪ Oi1-U- Ageing population of public servants and digital divide problem in public sector organisations ▪ Oi2-U- Lack of bridge competences between organisations and technology providers to orient innovation processes ▪ Oi3-U-Workload worsened by workforce and budget cuts due to austerity budget management strategies ▪ Oi4-U-Overhead issues linked to the introduction of new technologies ▪ Oi5-U-Molteplicity of organisational protocols covering the use of technologies and variability across different contexts (e.g. city departments, cities, regions) and themes (e.g. food, environment, police) ▪ Oi6-U-Risk assessment and standardisation norms for the introduction and use of technology into the public sector	▪ Oe1-U- Austerity measures adopter at a national level and shrinking of regular pubic resources at the city level ▪ Oe2-U-Cascade effect for the adoption of new technologies by privates and non-profit sector after the standardising operate in the public sector ▪ Oe3-U-Business sectors as potential early adopter of new solutions ▪ Oe4-U-Uncertain long-term commitment of non-public actors to sustain the experimentation of new technologies in the long term
LEGAL & NORMATIVE ASPECTS	▪ Li1-U- Parallel normative frameworks for smart city initiatives and city planning & management ▪ Li2-U- Centrality of responsibilities and accountability management in the action of local governments, extended also to technologies and smart city initiatives ▪ Li3-U- Absence of specific legal barriers related to the introduction of new digital technologies and technology-enabled new processes	▪ Le1-U-Lack of "smart laws" ▪ Le2-U-Existing regulations focused on privacy protection, system security and citizens' safety, but not yet governance, democratization, effects of technologies in cities ▪ Le3-U-Existing laws and regulations focused on IoT and devices embedded in the physical environment, but not concerning web services and platforms ▪ Le4-U- International regulations and management framework for smart city projects not taking into account local specificities

Tab 3.2. Key points of the ESTPOL analysis from the perspective of technology providers

	Technology providers	
	INTRINSEC FACTORS Dependent on the operational context of ICT providers	EXTRINSEC FACTORS Non-dependent on technology providers, but partially dependent on the context of cities
ECONOMIC ASPECTS	▪ Ei1-P-Direct investments of ICT corporations in research and development over technologies for cities, also entailing the construction of new sectors of cities ▪ Ei2-P-Value-creation model of technology based on direct revenues coming from the acquisition or use of technology ▪ Ei3-P-Low costs of production of services and reproduction of digital products ▪ Ei4-P-Raising of monopolist for specific digital services and urban technologies ▪ Ei5-P-Existence of direct and indirect competitors for equivalent services ▪ Ei6-P-Business models centred on the Public Administration as the only client of technology for cities and individual customers for all the remaining commercial tools	▪ E1-P-Limited success of technology-centred city prototypes ▪ Ee2-P-Intense oppositions to technology-driven developments ▪ Ee3-P-Consolidated schema of public-private partnerships for the exchange of digital services with the reserved access to local resources
SOCIO-CULTURAL ASPECTS	▪ Si1-P-Market-driven definition of product and services for technologies applied in cities, not linked to the specific social or cultural context ▪ Si2-P-People and communities central in communication policies but not in the definition of technologies and strategies ▪ Si3-P- Difficulty to address public concerns on the ethical aspects and the accountability of technology providers [see also political aspects] ▪ Si4-P-Internal sustainability models based on the local replication of global solutions	▪ Se1-P Increasing social, cultural and institutional complexity to address through the diversification and customisation of products and services ▪ Se2-P- Structural obstacles for scaling up from pilot initiatives to large scale adoption of contextualised solutions going beyond the global replication model ▪ Se3-P-Corporate smartness vision in contrast with other emerging paradigms
TECHNOLOGICAL ASPECTS	▪ Ti1-P-Scarse attention in managing the side effects coming from the access and use of technological products and services ▪ Ti2-P-Effort toward the commercialisation of consolidated technologies ▪ Ti3-P- Rapid obsolescence of solutions, products and services ▪ Ti4-P- Tension toward the optimisation and the cost reduction of existing solutions ▪ Ti5-P- Adoption of standard models for the production and delivery of	▪ Te1-P-Emergence of new paradigms in the research on digital technologies, especially web-based technologies ▪ Te2-P-Risks and uncertain trajectories for investments in emerging technologies ▪ Te3-P-Preference given by the market and customers in the public sector to incremental innovations of consolidated technologies [see also organisational aspects]

	services, relying on networks and infrastructures already available ▪ Ti6-P- Interoperability issues among technologies and web services to develop effective end-user platforms ▪ Ti7-P- Low cost of primary web services and resources	
POLITICAL ASPECTS	▪ Pi1-P- Emerging political ambitions of ICT firms enabled to directly use technologies as political instruments, in parallel to other political arenas	▪ Pe1-P-Strong dependency from politics and political agenda of choices and contracts for technology provision
ORGANISATIONAL ASPECTS	▪ Oi1-P-Difficult engagement of public administrations in adopting new technologies ▪ Oi2-P-Difficulty in meeting compliance requirements with public sector protocols, varying from a city to another ▪ Oi3-P- Lack of bridging competences and limited awareness of the organisational settings of perspective clients ▪ Oi4-P-Limited reactivity of large corporations to specific local needs, but provision by default of multiple variants and customisation of the same products and services ▪ Oi5-P-Adaptability of small and medium enterprises, but focus on narrow ranges of services and product ▪ Oi6-P-Out-of-system providers unreliable for potential adoption of highly contextualised solutions	▪ Oe1-P-Priority given by customers to solution improving existing services ▪ Oe2-P-Limited ordinary financial resources devoted by Public Administration to the internal digital transformation ▪ Oe3-P-Compeilling request to demonstrate the impact of solutions over workload and internal human and material resources ▪ Oe4-P-Public administration as slow and late adopter of technologies ▪ Oe5-P- High risk of failing the adoption ▪ Oe6-P-Different market behaviours of monopolists, activist groups and small-medium enterprise in between.
LEGAL/NORMATIVE ASPECTS	▪ Li1-P-Standards and regulations concerning web resources, web services and web platform established by industry consortia ▪ Li2-P-Private regulations hindering or imposing disadvantageous conditions for the access to market for independent providers ▪ Li3-P-Rules and regulations meant to protect the interests of tech monopolists	▪ Le1-P-Norms and legislations changing in every country and oftedn at the city level, making difficult to ensure by default the compliance of the proposed solutions with the intended deployment setting ▪ Le2-P-Strict high-level regulations such as GDPR and variable interpretations ▪ Le3-P-Unclear management of responsibility and accountability issues in smart city partnerships ▪ Le4-P-Global coverage of web regulations

3.3 FROM THE BACKGROUND ANALYSIS TO THE DESIGN CONSTRAINTS FOR FUTURE ALTERNATIVES

In the previous section, I have analysed the instances and visions of technology users and providers regarding the application of web-based technologies in the city context accordingly to the six axes of the ESTPOL framework. In this section, I am going to highlight how these factors emerging from recent literature and grey sources can be related to prospects and issues for informing the design of future city technologies explicitly aimed to support local development actions.

I carried out a "revisited" SWOT analysis (including the two additional dimensions of Needs and Desiderata, SWOT[+ND]) on the outputs of the ESTPOL framework. The analysis had been performed looking at the overall goal of the research: understanding barriers and intervention space to improve the integration of information technologies (and more specifically web-based technologies) in city activities as tools for the orchestration of local development actions. The results are summarised in the following two subsections.

Tables 3.3 and Table 3.4 reports the classification of the extrinsic and intrinsic factors accordingly to the dimensions of the SWOT+ND framework for the city stakeholders intended as users of city technologies, and technology providers as subjects to be engaged in the design of city-oriented technologies.

3.3.1 GOAL-BASED ASSESSMENT OF THE INSTANCES OF TECHNOLOGY USERS

Table 3.3 reports on the classification of the extrinsic and intrinsic factors considered in the ESTPOL analysis accordingly to the dimensions of the SWOT+ND framework by focusing on the instances of the city stakeholders intended as users of perspective city technologies.

Tab 3.3. SWOT[+ND] - Technology Users

	TECHNOLOGY USERS IN THE CITY	
POSITIVE TRENDS	**Unprecedented financial resources, open policy context and public growing interest supporting the integration of technologies in cities**	▪ Extensive, continuous and increasing **financial resources** to sustain local development integrating technologies in city activities through direct funds and innovative mechanisms to value local resources *[ref: Ei1-U; Ei4-U; Ee7-U]* ▪ Transnational and local **favourable policy context** pushing for prioritising innovation in cities, independently from their size and centrality in the global urban network *[ref: Ei2-U; Ee1-U; Ee5-U; Pe1-U; Li3-U]* ▪ **Growing interest** of public and private sector to be directly involved in exploring the potentialities of digital technologies to open the management and transformation of cities *[ref: Si1-U; Si2-U; Pi1-U]*

LIMITS AND PROBLEMS	**Difficult match or alignment between the proposals and conditions for the successful integration of technologies in city activities and the operational contexts of technology users and their specific organisational and normative constraints**	▪ **Limited offer of technology** solutions for cities due to the difficulty of formulating the demands for solutions appropriate in different contexts and at the same time economically sustainable for providers *[ref: Ee4-U; Se2-U; Se3-U; Oi2-U]* ▪ **Limited understanding** of how to combine technology-driven smart cities initiatives and territorial government instruments *[ref: Si5-U; Li2-U]* ▪ **Strong organisational constraints** for the public sector (human resources profile, material resources, risks assessment), slowing or hindering the smooth adoption of technologies *[ref: Oe1-U; Oi1-U; Oi3-U; Oi4-U; Oi6-U]* ▪ **Multiplicity and variability of the organisational constraints** bounding the receptivity of non-public actors to technology integration *[ref: Oe4-U; Oi5-U]*
NEEDS	**Need of moving beyond pilot projects and toward a tangible social impact of technologies applied in city activities**	▪ **Need of improving the effectiveness and impact of technologies** applied in cities to fairly benefit a wide range of city stakeholders *[ref: Ei3-U; Ee2-U; Ee6-U; Se5-U; Si6-U; Te1-U]* ▪ Need of adopting **interoperable, transferable** and **modular** technology solutions responsive to specific contexts but adaptable at scale, learning from past and current experiences as well as from research advances *[Se4-U; Te2-U]* ▪ Need of more easily **navigating the technology landscape** to identify the solutions in line with local needs and the strategies to minimise potential risks and side effects hindering local development strategies *[Ref: Te4-U; Ti2-U; Ti4-U; Le1-U; Le2-U; Le4-U]*
THREATS AND OBSTACLES	**Misuse and mismanagement of technologies applied in cities causing concerns about the priorities, values, purposes and risks associated with their integration in local activities**	▪ **Communication purposes predominant over operational purposes** and efforts in the deployment of technologies in cities *[Ref: Ti1-U; Ti3-U; T34-U]* ▪ Fears for **instrumental use or mismanagement of technology** to support priorities and values unrelated with wider local development goals, considering a domain and actions mostly unregulated by existing norms *[Ref: Pi2-U; -U; Pe2-U; Pe3-U; Le3-U]*
OPPORTUNITIES	**Consolidated practices of multi-actor partnerships in technology development and integration**	▪ Multi-player **hybrid partnerships** for the definition, delivery and use of technology-supported services *[Ref: Ei5-U; Ei6-U; Ee3-U; Ee8-U]* ▪ **Cascade effects and coalitions** among different players for the experimentation and integration of technologies in domains allowing a fluid definition of roles and responsibilities *[Ref: Oe2-U; Oe3-U; Li1-U]*
DESIDERATA	**Improving quality of life and local economy through technologies supporting new models of city governance**	▪ Technology supporting **new forms of social arrangements and governance mechanisms for the management of city activities** *[Ref: Si3-U; Pi4-U]* ▪ Technologies adaptable and responsive to the **evolving needs** of different actors *[Ref: Se1-U; Se8-U]*

3.3.2 GOAL-BASED ASSESSMENT OF THE INSTANCES OF TECHNOLOGY PROVIDERS

Table 3.4 reports on the classification of the extrinsic and intrinsic factors considered in the ESTPOL analysis accordingly to the dimensions of the SWOT+ND framework by focusing on the instances of technology providers as subjects to be engaged in the design of city-oriented technologies.

Tab 3.4. SWOT[+ND] - Technology Providers

	TECHNOLOGY PROVIDERS	
POSITIVE TRENDS	**Openness and receptivity of the global market to the offer of technologies for cities based on affordable digital services**	▪ **Openness and receptivity of the global market to the offer** of technologies for cities, driving substantial investments in research and development *[Ref: Ei1-P; Ei2-P; Si4-P]* ▪ **Readiness and relative affordability** of a wide range of **digital services** integrable in solutions targeted for city needs *[Ref: Ei3-P; Ti7-P]*
LIMITS AND PROBLEMS	**The unsolved enigma of city protocols and rules and the challenge of formulating new propositions in line with them**	▪ **Difficult engagement of the Public Administration** considered as primary client of current solutions *[Ref: Ei6-P; Pe1-P; Oi1-P; Oe2-P; Oe4-P]* ▪ **Difficult navigation of organisational rules and resolution of normative compliance issues** at the local level undermining the chances for adoption *[Ref: Oi2-P; Oi3-P; Le1-P; Le2-P; Le3-P]* ▪ **Difficult penetration of solutions alternative to the consolidated ones** or proposing new services, especially in the public sectors *[Ref: T12-P; Te3-P; Oe1-P]*
NEEDS	**Increasing the flexibility and adaptability of the current models for the production and delivery of technology services in cities urban applications**	▪ **Contrasting the rapid obsolescence of products and services** relying on flexible solutions and supply infrastructures *[Ref: Ti3-P; Ti6-P]* ▪ Defining evolving **clients-users-providers dynamic in fluid contexts** driven by impact results *[Ref: Ti5-P; Oe3-P]*
THREATS AND OBSTACLES	**Internal blocks to innovation and conflicts due to the raising monopolists indifferent to local instances**	▪ Raising of technology **monopolies** limiting the access to new providers and orienting or limiting innovation proposed by more fragile or unstructured providers within and outside the industry sector closer to local processes *[Ref: Ei4-P; Ei5-P; Oi4-P; Oi5-P; Oi6-P; Li2-P; Li3-P]* ▪ Aggressive response of major corporations **against public opposition** to technology-driven development through the creation of **parallel legitimisation mechanisms for a corporate-centred vision of the city** *[Ref: Ee2-P; Si3-P; Se3-P; Pi1-P]* ▪ Misalignment between the centrality of people and communities in the marketing strategy and the definition of product and services *[Ref: Si1-P; Si2-P; Ti1-P]*

OPPORTUNITIES	**Balancing between agility and structuration, between experimentation and technical feasibility in approaching emerging technological paradigms**	▪ **Agility** of technology providers to react at emerging paradigms for digital services through the formulation of **new standards** to orient enterprise choices in a common framework *[Ref: Te1-P; Li1-P; Le4-P]* ▪ Balancing between **experimentation and technical feasibility** in transferring new paradigm into services and products outside monopolies *[Ref: Te1-P; Oe6-P]*
DESIDERATA	**Balancing diversification and standardisation of the offer of technologies for cities**	▪ Understanding how to **balance diversification and standardisation** of the provided services for cities to reduce risks and increase chances of successful integration *[Ref: Se1-P; Ti4-P; Te2-P]* ▪ Mitigates the shortcomings and **risks of global replication models and local bottlenecks** *[Ref: Ei1-P; Se2-P; Oe5-P]*

3.3.3 DESIGN CONSTRAINTS FOR ALTERNATIVE CITY TECHNOLOGIES

The outputs of the background analysis combined with their goal-based assessment allowed me to identify the plausible **future prospects and the open issues to be considered for the design of web-based technologies intended to support local development action**s, going beyond the current limitations and marginality of commercial applications and solutions associated with smart city initiatives.

Tab 3.5. Synoptic view of the results of the SWOT[+ND] – Technology Users and Providers

	Technology Users	Technology Providers
POSITIVE TRENDS	Unprecedented financial resources, open policy context and public growing interest supporting the integration of technologies in cities	Openness and receptivity of the global market to the offer of technologies for cities based on affordable digital services
LIMITS AND PROBLEMS	Difficult match or alignment between the proposals and conditions for the successful integration of technologies in city activities and the operational context of technology users	The unsolved enigma of city protocols and rules and the challenge of formulating new propositions in line with them
NEEDS	Need of moving beyond pilot projects and toward a tangible social impact of technologies applied in city activities	Increasing the flexibility and adaptability of the current models for the production and delivery of technology services in cities urban applications
THREATS AND OBSTACLES	Misuse and mismanagement of technologies applied in cities causing concerns about the priorities, values, purposes and risks associated with their integration in local activities	Internal blocks to innovation and conflicts due to the raising monopolists indifferent to local instances

OPPORTUNITIES	Consolidated practices of multi-actor partnerships in technology development and integration	Balancing between agility and structuration, between experimentation and technical feasibility in approaching emerging technological paradigms
DESIDERATA	Improving quality of life and local economy through technologies supporting new models of city governance	Balancing diversification and standardisation of the offer of technologies for cities

Starting from the comparison between the outputs of the SWOT+ND repeated to highlight the instances of both technology users and providers [see also Table 3.5], I have clustered them into two groups: a) positive trends, needs and opportunities; and b) limits and problems, threats and obstacles, and desiderata. The elements in the first group reinforce the motivations for starting a study in between city development and technology design (and beyond their parallel paths), outlining an encouraging context for design proposals oriented toward technology solutions to support collective actions in cities. The elements in the second groups represent instead unbending constraints for the design of such technologies and the elements to be considered for research purposes [see Table 3.6.].

Table 3.6 Clustering Prospects and Open Issues

POSITIVE TRENDS	Growing investments in digital technologies to support city development and interest of new players in being an active part of this process	**PROSPECTS AND DRIVERS FOR DESIGN**
NEEDS	Increasing flexibility and adaptability of current models of technology services to have wider and tangible impacts for all city stakeholders	
OPPORTUNITIES	Balancing experimentation and consolidation of new solutions by relying on consolidated models of multi-player partnerships in the development and delivery of technologies for cities	
LIMITS AND PROBLEMS	Normative, organisational and procedural constraints characterising the planning and management of city activities and limit the chances of effective support by appropriate technologies	**OPEN ISSUES AND DESIGN CONTRAINTS**
THREATS AND OBSTACLES	Risks coming from the misuse, mismanagement and potential side effects associated with the introduction of technology in city dynamics	
DESIDERATA	Balancing diversifications and standardisations of technology solutions to ensure their social and economic sustainability to foster structural innovation in the governance of the city	

Positive **prospects for designing alternative technologies supporting local development processes** emerge from considering:

- the **consistency and plausible continuity of positive trends** on both sides, city players and technology providers
- the **complementarity of their needs** to better integrate, extend and adapt everyday applications of technologies in cities
- the **feasibility of tracing alternative paths** for the future.

There is evidence showing that **investments** in digital technologies to support city development are increasing at every level and from multiple sources, as well as the interest of new players in being an active part of this process. Moreover, the need to improve the effectiveness and impact of information technologies on community's life and local development is complementary to the need of the ICT industry to develop **new technologies and business models adaptable to the evolving needs and diversified situations of** urban settings, getting closer to everyday activities in the city. Lastly, the normalisation of **partnerships between public and private actors** in joint actions to implement innovation projects, as well the **readiness and rapid pace of progress for web technologies**, represent concrete opportunities to explore new paths and social demands for the full exploitation of the potentialities of web-based technologies in city development.

While all these elements are underlying drivers for research and design, the open issues highlighted in the second group outline instead the priorities and obstacles to face for hypothesising a synergic approach between city players and ICT industry in addressing local development challenges. They include:

- **compliance issues** of new digital products and services against the normative, organisational and procedural constraints characterising the planning and management of city activities

- the **misalignment** between the potentialities or intended purposes of technologies and their actual use in city dynamics that can be exposed to instrumentalisation, abuse, and rising social conflicts

- the **uncertainty** about the strategies to combine information technologies and local development processes due to a **lack of mutual understanding** between city players and technology providers about priorities and context-dependent factors.

On the basis of these considerations, the main **high-level design constraints** for defining web-based technologies intentionally aimed at supporting city stakeholders in local development actions include the following points.

Respect to the identified **limitations and problems**:

- Considering making explicit the **distinction between responsibility and accountability** mechanisms associated with the platform and its use, and responsibilities and accountability schema in the applicative context of solutions

- Excluding the Public Administration as referent and central user, **focusing the attention on other subjects that can be early adopters** even if not able to sustain long term experimentations

- Relying on **meta-patterns to deal with the multiplicity of protocols and norms** of specific operational settings

- **Designing for replicability of solutions in contexts having the same "geometries" of local constraints.**

Respect to the identified **threats and obstacles**:

- Focusing on **product and services directly related to the implementation of city activities**, instead than limited to their communication to reduce or mitigate the risks of reification of technology
- Trying to minimise the effort for training by **incorporating and reusing elements, objects and functionalities potential users are already familiar with**
- **Limiting the need to revise organisational structures** to enable the integration of new solutions (aiming at the scenario of no-changes required irrespectively of the internal structure)
- Proactively **contrasting by design recurrent dynamics of mismanagement of technology** based on unbalanced powers among different classes of direct and indirect users
- **Make tangible and legible the intangible implications of online actions over offline actions**, or rather make evident their factual and political value
- **Relying on the framing of other governance-relevant services and activities** to define the boundaries of web services and platforms, despite the absence of specific norms.

Respect to the emerging **desiderata:**

- Focusing on solutions enabling **self-organisation of heterogeneous groups**
- Considering to design for the **social acceptability and suitability of solutions**
- **Prioritising modularity and componibility of solutions** as an alternative to fragmentation and extreme customizations unpracticable at scale.

These design constraints actually guide the definition of the purpose and scope of web-based technologies to support city stakeholders in local actions. Additional specific design constraints will be made explicit in Chapter 4, after the review of the main classes of web-based technologies currently applied in city activities [see Chapter 4, section 4.5]. As we are going to see in the next section, there is a strong connection between the main design constraints to be taken into account to formulate an alternative to the status quo and the main knowledge gaps to be explored though research for giving structure and depth to it [see Fig. 3.3].

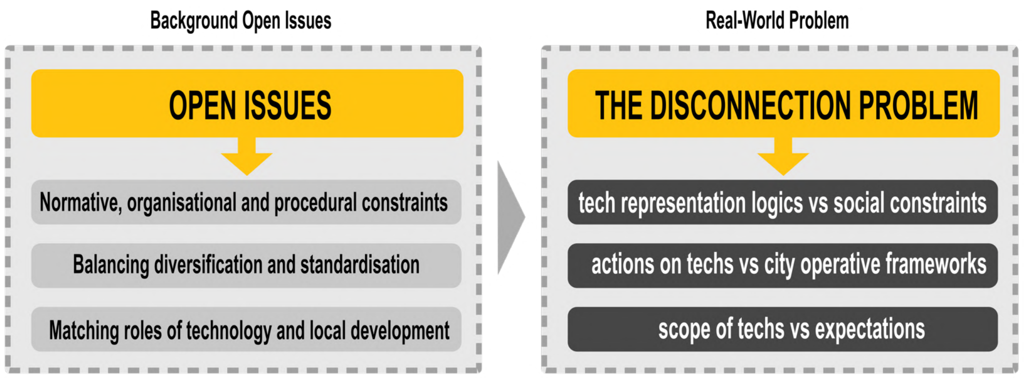

Fig. 3.3 Correspondence between open issues and facets of the disconnection problem

3.4 FROM THE BACKGROUND ANALYSIS TO THE CONCEPTUAL REFRAMING OF THE PROBLEM

In this section, I am going to focus on the most conceptual aspects of the background analysis by adopting the three axes of Users (as Subject), City (as Object), and Technology (as Means) to thematise and organically cluster the factors emerging from the background analysis. Then, I will briefly point out the assumptions and implications of these factors by using the lenses of structure, practice and discourse already mentioned in section 3.1. On this ground, **I here propose a new conceptual formulation of the problem concerning the definition of web-based technologies proactively supporting collective actions in local development processes.** This conceptualisation will help to formalise the problem under study in this work as a knowledge problem.

3.4.1 BACKGROUND ANALYSIS UNDER THE LENSES OF USERS, CITY AND TECHNOLOGIES

Table 3.7 reports on the thematisation of the extrinsic and intrinsic factors considered in the ESTPOL analysis, for both technology users and technology providers, divided into elements reflecting the status quo in the framing of users, city and role of technology.

Tab 3.7. Synoptic view of the thematization of the ESTPOL outputs

	Technology Users	Technology Providers
USERS	▪ Most of the **city stakeholders, other than the Public Administration, are ignored in the literature and in the grey sources** investigating current and potential users of technologies for cities *[Ref: Ee6-U; Te3-U]* ▪ **Unclear needs, priorities of stakeholders other than the Public Administration** as regarding the value generated from technologies in city activities *[Ref: Ei3-U; Ee2-U; Se1-U; Se5-U; Te1-U; Oi1-U; Oi3-U; Oi4-U; Oe4-U]* ▪ **Demand and proactive engagement of a variety of city stakeholders** in funding and experimenting the introduction of technologies in local activities, while in fragmented and discontinuous forms *[Ref: Ei4-U; Pi1-U]* ▪ **Inequalities in the access to technologies, but most important in the direct benefits and risk management over the use (and misuse) of technology in cities** *[Ref: Ee2-U; Si4-U; Ti1-U; Pi2-U; Pi3-U; Pe2-U; Pe3-U; Oe2-U; Oe3-U;]*	▪ **Focus of technology providers on users as clients or customers**, and in particular considering the Public Administration as only or preferential client *[Ref: Ei6-P; Te3-P; Oe1-P]* ▪ **Services and products shaped on the basis of the clients 'needs, but not necessarily the one of the end-users** and their specific concerns regarding technology itself and technology providers *[Ref: Ee2-P; Si2-P; Si3-P]* ▪ **Tension between the constraints concerning the clients' operational framework** imposed to the definition of product and services and **the broader context** in which technology is integrated limiting applications, utility and perspectives *[Ref: Oi1-P; Oe2-P; Oe3-P; Oe4-P]*
CITY	▪ **Misalignments and lack of connections** between, on one side, the offer and constraints in the technology landscape, and on the other side the operational frameworks and constraints of city	▪ **Partial management and limited consideration of the offline services**, processes and activities relying on digital services and products for their implementation, often defined to be

	management [Ref: T12-U; Te2-U; Oi2-U; Oi5-U; Li1-U; Li3-U] ▪ Experimentation and introduction of specific technologies in cities accordingly to the **agenda of local authorities and agencies** [Ref: Ei2-U; Ee1-U; T14-U] ▪ **Criteria and parameters** for the introduction of technology based mainly on the operational framework of public authorities [Ref: Ti3-U; Oi6-U; Oe1-U; Li2-U] ▪ Active involvement of users in the coproduction of digital services in commercial applications and use of current technologies for **spontaneous groups initiatives in the cities** [Ref: Ei6-U; Ee3-U; Si3-U] ▪ Growing number of **activities and issues in city settings autonomously searching for way for benefiting of existing technological solutions** in terms of information access, development of services, participation [Ref: Ee5-U; Si1-U; Si2U] ▪ **Narrow targets and objectives** for the integration of technologies in city activities due to tensions in competing visions of the role of technology in city dynamics and resulting in **discontinued and fragmented experiences** [Ref: Si5-U; Si6-U; Si7-U]	completely independent from the context [Ref: Si1-P; Ti1-P; Oi3-P] ▪ Preference toward **large scale experimentations** focused on the city as a unitary corpus [Ref: Ei1-P, Ee1-P] ▪ Strategic and functional **coalitions to support political agenda** related to the integration and use of technology, also at the city level [Ref: Ee3-P; Pe1-P; Pi1-P] ▪ Focus of technology solutions on **limited domains** where the **compliance requirements** can be met with limited effort [Ref: Se3-P; Oi2-P; Le1-P]
TECH	▪ Trade-off tensions between the opportunities coming from the **experimentation and adoption of global solutions and alienating part of the control of local material and immaterial resources** to players external to the city context *[Ref: Ee4-U; Ee7-U; Ee8-U; Se3-U]* ▪ **Uncertainty in assessing pre-conditions, risks and material and institutional effort to introduce technology-driven changes in local practices** *[Ref: Se2-U; Se4-U; Te4-U; Le1-U; Le2-U; Le3-U; Le4-U]* ▪ **Interscalarity** of city innovation programmes and funding resources for technology-driven initiatives *[Ref: Ei1-U; Ei5-U; Pe1-U]*	▪ Market of technologies applied in city settings dominated by a limited number of technology providers, as well as the Web, where **monopolies establish the rules, standards and conditions** for the implementation and delivery of digital services at the global scale [Ref: Ei4-P; Ei5-P; Li1-P; Li2-P; Li3-P; Le4-P] ▪ Tendency to the **crystallisation of solutions and applicative models globally replicable**, limiting diversification of the offers and pushing for customisations [Ref: Ei3-P; Si4-P; Ti6-P; Ti7-P; Oi4-P] ▪ Alternative **solutions developed locally or at a small scale are hardly sustainable** for providers and users, while their variety and responsiveness to the needs of specific context is higher [Ref: Se2-P; Oi5-P; Oi6-P; Oe6-P] ▪ **High uncertainty** over the correct fit between proposed solutions and local integration, especially in the case of new services based on emerging technologies [ref: Te1-P; Te2-P; Oe5-P; Le2-P; Le3-P]

3.4.2 THE DISCONNECTION PROBLEM

The background analysis certainly did not provide an exhaustive list of all factors explaining the difficulties of web-based technologies in becoming better integrated into local development processes. However, the critical analysis of these factors through the "Users-City-Technology" thematisation let to emerge a specific issue having similar characteristics along the three axes of user, city and technology that can help to conceptualise the problem.

Indeed, this thematisation highlighted a general problem defined here as a "**Disconnection problem**". The disconnection is **between the logics, actions, and scope of current technologies applied in city contexts** and the **constraints, operative frameworks and expectations of the different stakeholders** involved in local development processes that could be supported by information technologies. This problem can be articulated at the level of:

- the **logics of the implicit and explicit representation of the society** conveyed by most of current technologies
- the landscape of **actions in the city context** linked to the integration of web-based technologies in local development initiatives
- the **scope of web-based technologies** polarized between large scale/narrow scope solutions and small scale/wide scope experimental solutions.

At all these three levels, an "intermediate space" between the two polarities emerging in each strand remains hidden, undefined or unaddressed reducing the field of action for all the involved parties.

3.4.2.a Users

As regarding the intended or potential **users** of technologies in cities, the disconnection between the representation of society conveyed by technology and the reality of social dynamics in cities concerns:

- **hidden stakeholders** remaining completely obscured in the dichotomy between public administration and citizens
- a **missing middle level in between large organizations** (Public Administration, ICT providers in primis) **and individuals** (as customers, or voters, or taxpayers, or equivalent)
- the **predominance of one perspective and one set of values** informed by the technology client/buyer (usually the Public Administration) or technology providers themselves, not reflecting or allowing the existence of the plurality of perspectives of other city stakeholders and their values.

These three points hide a specific political vision of technology as support and medium of relationship in society, implicitly proposing an almost mythological projection of the Public Administrations as the subject in charge of the future of cities and their local development. This extremely simplified and conservative vision of the agents acting in the city can be cognitively comforting, reassuring, and gratifying, but it does not correspond to the reality of a more complex distribution of responsibilities and variety of capacities characterising every urban setting and its specific lines of development[27] [see Saragosa 2005, Schragger 2016]. This kind of representation, also crystallised in the online environment proposed by current technologies because of dominant business models centred on Public Administration as the main client, has important effects on limiting their potentialities to support dynamic negotiation processes that intrinsically characterise local development actions.

Hiding existence and instances of city stakeholders other than the Public Administration into the new public space of web-based technologies in cities:

- **negates the structural interdependence of all social forces** in the city, fundamental for its development that it is based on dynamic arrangements of institutions and resources of all social forces in a shared space (*structure*)

- **makes invisible the contribution** of local businesses, non-profit organisations, knowledge professionals to shape city life and the meaning, values, purposes attributed to local actions (*discourse*)

- **limits the agency of people in this new public space** to the one that they can exercise in just one of their multiple roles and identities, that is the one of citizens or customers *(practices)*.

3.4.2.b City

As regarding the **City** as a space for the intervention of technologies, the disconnection between the city as the operational context of local actions and the definition of actions enabled, supported or mediated by technology implicates:

- **hidden local processes** involving city stakeholders in a continuous, structured and evolving way

- a **missing middle level between extensive top-down operations and fragmented episodic bottom-up initiative**s

- the **representation of isolated actions** in a flow of intertwined actions.

The focus on a limited range of applications and a narrow range of domains leave out a number of undressed applicative scenarios for web-based technologies, corresponding to most of the activities regularly carried out in cities as exchanges of goods, services and knowledge. In addition, as outlined earlier in the analysis and in Chapter 1, this issue also led to the under-exploitation of city resources, and in particular the social capital and local institutions shaping the relationships among different stakeholders and the functioning of development processes.

[27] The fact that local development is not dependent only on local government tends to become self-evident in less crystallised institutional contexts such as the cities of emerging countries or the ones having a strong industrial profile.

Leaving unaddressed the representation and support to most of the regular urban activities by focusing on governmental or spontaneous initiatives it is again a problem reflecting a specific political vision of the world that is reflected in technology. Indeed, while this reductionism is consistent with the underlying models and choices concerning users of current technologies, it directly favours:

- **unclear grids and layers of competence** concerning the agents called to implement urban activities and their constraints to action in various domains *(structure)*

- a **confused attribution of roles, responsibilities, accountability** in the few urban actions represented by technologies replicating their potential instrumentalisation and mismanagement *(discourse)*

- a **mismatch between needs and solutions** to ensure the use of technology as a support for intra and inter-organisational practices and the exploitation of local tangible and intangible resources *(practices)*.

3.4.2.c Technology

As regarding **Technology** as an instrument to facilitate the orchestration of local development actions, the disconnection between the scope of current solutions and the expectations associated with the integration and adoption of technologies in cities is rooted in:

- **hidden connections among local actions** (always including the exchange of good, services and knowledge) **and their broader context** (territory, region, country)

- a **missing middle between decontextualised** standardised closed solutions having global replicability and **hyper-local** not-scalable solutions

- the provision of static **vertical problem-fixing applications** instead than **systems aimed at supporting processes of change and relations.**

The problem of the missing scales of actions both for city stakeholders (as potential technology users) and technology providers requires to go beyond customisations and ad-hoc solutions. Indeed, the opposition between global and hyper-local solutions reveals:

- a **development of digital products and services for city guided by rigid business models instead than effective responses to local needs**, pursued by prioritising economic sustainability against social, cultural, institutional sustainability with the result of increased economic risks due to difficult adoption processes and difficult transferability of solutions *(structure)*

- a focus of **technology providers on defensive tactics**, implicitly denying alternatives to the status quo and distracting from inequality issues in the distribution of the benefits coming from the use of technology *(discourse)*

- **lack of clarity over the requirements** to support alternative technology-driven practices *(practices)*.

3.4.3 THE RECOMPOSING PROBLEM

The formulation of the "Disconnection problem" is the result of identifying, isolating and describing the main facets of a complex real-world problem in terms helping to distinguish causes and effects, and envisaging potential actions into the real-world to partially address the problem. Under a research perspective, the formulation of the disconnection problem allows its reframing in forms that can be partially addressed also through research activities [see Fig. 3.4.].

The previous analysis and reflections led to linking the current under-exploitation of web-based technologies in city development to a disconnection between users' representation and urban social structures, top-down or bottom-up activities and the majority of local processes, and global or hyper-local solutions and the various scales of urban actions. The corresponding **knowledge problem** concerns understanding how to reveal, define and address:

- the **intermediate space between Public Administration and citizens** beyond this limiting mono-dimensional relationship
- the **intermediate space between top-down operations and episodic bottom-up initiatives** covering the implementation of ordinary urban activities
- the **intermediate space between global solutions and hyper-local techs** where new models of technologies could be developed.

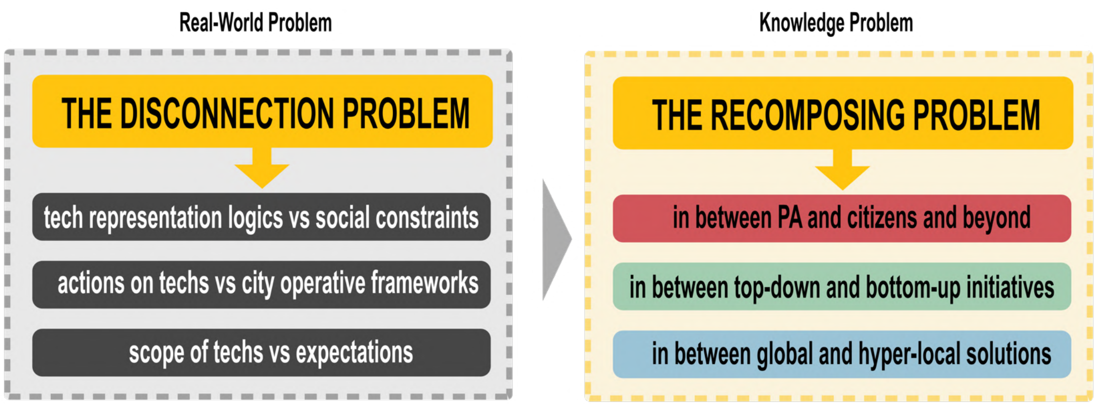

Fig. 3.4 Schema representing the transition from the Disconnection problem to the Recomposing problem

This knowledge problem, defined here as **the "Recomposing problem", addressed the exploration of these three intermediate spaces** (visually transposed in Fig. 3.5, 3.6, 3.7) in order to improve our understanding of **how to compose the disconnected dimensions** highlighted by the analysis of the context of current technologies in cities.

Without denying the importance of the specific relationship between local governments and citizens, as well as the relevance of actions pursued in the city under the frame of this relationship, the formulation of the **"Recomposing problem" pushes for enlightening:**

- the structural components of the interdependence among city stakeholders, the high-level rules framing their actions within and outside the technology space, and the negotaited meaning, values, and purposes attributed to their contribution to local development processes within online environments

- the articulation of the flows of activities potentially supported by city technologies, in relation to the roles, responsibilities, competencies and needs of the different stakeholders operating in various domains

- the mechanisms and patterns characterising the multi-scalarity and inter-scalarity of city activities, as well as their replicability across distinct urban settings through technology.

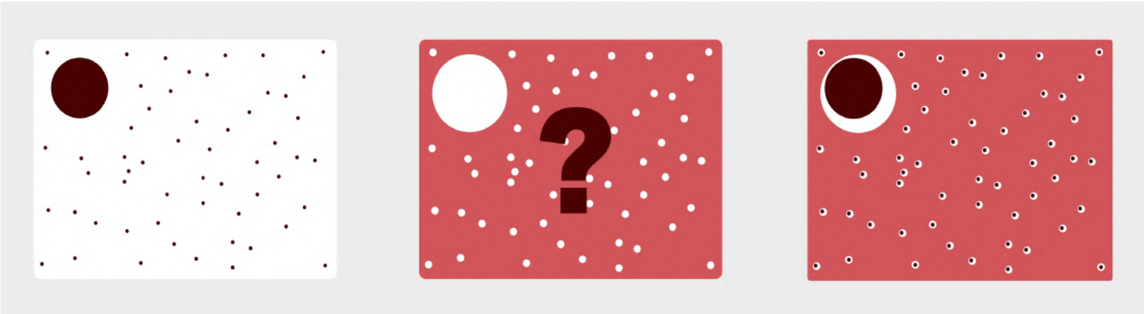

Fig. 3.5 Simplified schema of the gap between the common representation of society in current technologies (left side), the reality (right side) and the missing intermediate space (in the middle)

Fig. 3.6 Simplified schema of the gap between the common representation of city processes in current technologies (left side), the reality (right side) and the missing intermediate space (in the middle)

Fig. 3.7 Simplified schema of the gap between the landscape of current technologies having urban applications (left side), the reality (right side) and the missing intermediate space (in the middle)

3.5 THE PROPOSAL OF THE CITY MIRROR

In this section, **the problem faceting process is concluded by using the three facets of the Recomposing problem for elaborating a design proposal. The formulation of the design proposal is also the first step in the development of a design theory on the capabilities of web-based technologies supporting city stakeholders in the orchestration of local actions.**

Thus, the value of the design proposal is two-fold. As regarding specifically this work, the design proposal oriented the design and research explorations associated with the empirical and applied research activities that will be reported in the next chapter. As regarding more in general the contribution to the knowledge of this work, the design proposal formalises the challenge of designing web-based technologies for cities by taking into account the collective dimension of actions that is essential for their deeper integration in their applicative context.

The **analysis of the real-world problem** highlighted that current technology products hide social structures and local processes essential for city development, and they do not consider the intermediate space between global and hyper-local technological solutions. The **transformation of this problem into a knowledge problem** pointed out the need to understand how to represent these intermediate spaces through technology and on technology. **The underlying implications of this problem reframing leads to hypothesise that having web-based technologies closer to everyday activities and better integrated into city dynamics requires, at least, technologies able to reflect city dynamics by setting an online environment consistent with the offline interactions among city stakeholders in urban activities. In other words, these technologies should, at least, be able to mirror the logic and nature of local actions in city settings.**

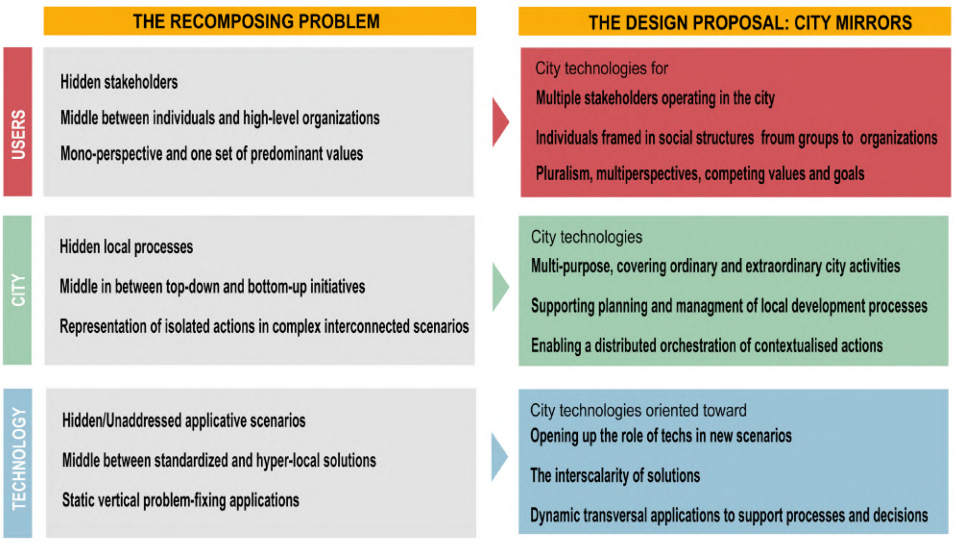

Fig 3.8 Key issues of technologies and main aspects of an alternative proposal for the design of city mirrors

On this ground, the scope and purpose of a City Mirror is to having a platform able to overcome the three gaps of the recomposing problem by relying on:

- **a representation of the different social structures regulating city activities**
- **a more complex and accessible representation of the interaction between places, functions, and meanings associated to them**
- **an operational definition of the role of technology in local actions adapted to the different scales and type of actions in city development.**

A platform having these characteristics should be:

- a **Multi-Stakeholder Environment**
- a **Multi-Purpose Tool**
- a **Multi-scale Space**

A multi-stakeholder platform is intended to be a system structurally designed to allow the dynamic negotiation of needs, actions and interests among the city stakeholders involved in local development, in forms that are also supported, mediated or enabled by technology.

Usually, the concept of stakeholders in relation to digital technology is the same used in product development and management. Or rather, the definition of relevant stakeholders is subordinate to the scope and intended application of a specific tools, as well as their interests are defined against the potential use, adoption or contrast to its integration. On the contrary, in city technologies, it must be considered that city stakeholders are the *"structured and unstructured social entities expressing a homogenous set of goals, values, operational frameworks outlining the nature of their interests in city dynamics and defining the boundaries of their collective agency over local development processes and in relation to other stakeholders operating at the local level"* (see also Chapter 1, section 1.4.2, and Chapter 5, section 5.3.4). In other words, the definition of the interests of city stakeholders is not dependent on a specific tool, but on the reciprocal positioning of different stakeholder in the city ecosystem. **Web-based technologies modelled as city mirrors** are meant to be integrated in this frame defining a **pluralistic space opened to competing values and goals, giving visibility and voice to the hidden stakeholders in current technologies, and helping them to pursue their legitimate interests in local development processes, possibly by coordinating their effort or cooperating.**

In this sense, the design of a multi-stakeholder environment entails to proactively pursue a sort of ***"political soundness"*** of web-based technologies, **intended as the appropriateness of the design solutions to fit with long-term visions, short-term goals, the fluidity of roles and hierarchies, and the operational frameworks of a plurality of stakeholders into the public arena of cities.** Clearly, the concept of political soundness is quite distant from the dominant paramount of the "cognitive ergonomics" orienting the design of commercial web tools by focusing the design efforts on usability. But precisely for this reason worthy of being explored by combining research and design experimentations for technologies aimed at supporting local development processes. Indeed, local development implies the **expansion of individual and collective opportunities** to access to improved conditions for education, work, housing, political participation, and human flourishing more in general [Sen 2001]. As mentioned already in Chapter 1, these **empowering dynamics in cities are framed in a "sum zero game"**, based on increased and decreased power capacity among different stakeholders.

A multi-purpose platform is intended to provide systemic support to local development processes taking into account the interdependence of urban activities across different sectors and domains, through solutions designed by following logic and structure of processes, while adaptable also for extensive top-down programmes and episodic initiatives.

Such proposition does not imply or suggest the goal of having tools covering every kind of urban activity, but keeping in mind that the purposes and actions covered along entire processes can vary for every subject involved in different roles. Thus, even sectorial tools need to be multi-thematic and evolutive.

A multi-scale platform is intended to be a system reflecting the interscalarity of the form of support provided to local actions, that while operated at the hyper-local scale can be replicated at upper scales in the territory. At the same time, a multi-scale platform is intended as facilitating transversal applications in processes and decisions of city stakeholders, relying on the modelling of the principle of actions instead than their spatial coverage.

3.6 LOW-LEVEL RESEARCH QUESTIONS ON THE INTERDEPENDENCE BETWEEN USERS, CITY AND TECHNOLOGY

At the beginning of this thesis, I have formulated the problem-driven question addressed by this work in the following terms:

how to design web-based technologies to support city stakeholders in the orchestration of local development actions?

This overall question had been split into two high-level questions, reflecting the complementarity between investigating city dynamics and design of appropriate web-based technologies consistent with them. The first one of these two questions is:

RQ_A: How to translate the interdependence between people, their local actions and the city context into the design of web-based technologies?

The elaboration of the design proposal of the City Mirror is the starting point for exploring the interdependence between:

a) the representation of users as part of urban social structures
b) the model of the city as an ecosystem of activities
c) the role of technology in mediating the interactions among users and between users and city.

Indeed, the analysis presented in the previous sections highlighted that we do not know in what ways we can represent these social structures or the variety of city activities in an online environment exploiting the potentialities of web-based technologies to support better coordination, cooperation and collaboration among users and activities.

The elaboration of the design proposal of the City Mirror led to rephrase the previous question in:

RQA*_How the interdependence between users' representations, city context and local actions can be coherently transposed in the digital environment provided by a City Mirror?

This question can be broken down in low-level research questions specifically focused on one of the three interdependent aspects (user, city and technology) at the time [see Fig. 3.9]

RQ1_What characteristics of the users involved in local activities are significative and acceptable to be represented in a City Mirror for enabling city stakeholders to understand the social context of their actions?

The potential characteristics of users to be represented can include organisation, roles, and competencies of different types of social structures in an urban environment, but the obstacles and implications of representing these characteristics in a public and shared online environment are not completely clear. In particular, we do not know if the representation of some of these characteristics can be negatively correlated to the acceptance and use of new technologies exposing these types of information because of the risks of sharing them in an open multi-stakeholder environment. Moreover, it is also important to understand what users' characteristics can actually improve technology-mediated interactions among different actors involved in local activities. Thus, addressing this research question can partially enlighten or provide some indications about the conditions to be set by City Mirror-like technologies to facilitate the coexistence of multiple stakeholders in the same virtual environment, exactly as they coexist in the urban environment.

RQ2_What factors should be considered for matching the specificity and uniqueness of local development actions in urban environments with the openness and generality of the online environment provided by a city mirror?

The identification of these factors is also the key to understand how to create a common ground for technology-mediated communications, decisions, and actions despite the variety of domains, purposes, scales, and timings of local activities.

RQ3_What type of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a city mirror in comparison with other existing tools?

Process and decisions will be considered in association with local practices, in particular, multi-actors coordinative, cooperative or collaborative practices whose planning and management could be mediated and enhanced by using a shared web platform.

The second set of low-level research questions associated with RQB will be exposed in the next Chapter, after the analysis of the practical design challenges posed by the design proposal of the City Mirror [see Chapter 4, section 4.6].

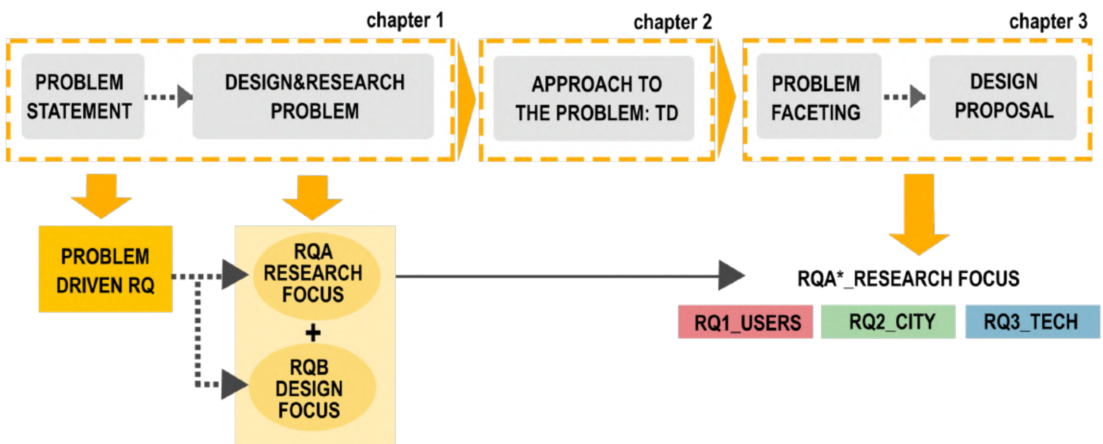

Fig 3.9 Mapping high-level and low-level research questions in the thesis

3.7 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 3 to the three outcome spaces outlined in Chapter 2, Section 2.7. Analogously to the previous chapters, the contributions of Chapter 3 are briefly described in the table below.

Table 3.8 Mapping of the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 3
SYSTEM KNOWLEDGE	THEORETICAL CONTRIBUTION	[SECTION 3.5] The main contribution of this chapter is a **theoretical reframing of the problem of having web-based technologies not yet supporting structured activities in cities and the related systems of relationships among city stakeholders.** This reframing consists in the definition of a **disconnection problem** between the representation of the reality mediated by technologies and the interdependence among users, city and technology. This reframing allows to systemically explore how to recompose representation and reality in the three isolated facets, taking into account that the addressed problem has the characteristics of a deep design problem, thus requiring research and intervention on/in the context. The design hypothesis of a City Mirror is built as a conceptual tool to orient the following combined investigations, besides constituting the first building block of a design theory for City Mirrors.
	METHODOLOGICAL CONTRIBUTION	[SECTION 3.1] This chapter proposed and experimented a **hybridisation** between the conventional approaches used in **urban disciplines to strategically analyse the context of intervention** with the ones used in **informatics to outline the type of intervention** to address a specific problem. The resulting **method for the background analysis**, covering at the same time context and object of intervention, had been inspired by PESTLE & SWOT analytic tools, readapted and extended to comply with the purpose of the analysis.
	EMPIRICAL CONTRIBUTION	[SECTION 3.2] From a more practical perspective, Chapter 3 contributes to the **understanding the problem by organically presenting and linking several pieces of evidence, facts, and trends** shaping the operational context of city stakeholders and technology providers. While not exhaustive or fully comprehensive, the analysis provides a rich overview of the factors impacting on the current limitations of digital technologies in cities.
TARGET KNOWLEDGE	FOR RESEARCHERS	[SECTIONS 3.4-3.5-3.6] By following a **transdisciplinary approach** at the level of vision, goals and methods, Chapter 3 clarifies the process to **transform a complex multi-dimensional problem (wicked and unaddressable by definition) into a knowledge problem that can be partially addressed by generating knowledge** on specific aspects of the relationship between users, city activities, and technologies that are currently underexplored.
	FOR TECHNOLOGY DESIGNERS	

	FOR URBAN PRACTITIONERS	
	FOR CITY STAKEHOLDERS	[SECTION 3.2] The background analysis, developed by using language, tools, and structure accessible to a general audience, can **help city stakeholders in understanding instances and constraints in the provision of technologies for cities**, especially as regarding the intrinsic characteristic of web services, market structure, technology development issues.
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	[SECTION 3.2] The background analysis, developed by using language, tools, and structure accessible to a general audience, can **help technology providers in understanding instances and constraints of different city stakeholders for the adoption of digital technologies in city activities**, especially as regarding the intrinsic characteristic of administrative structures and normative boundaries.
TRANSFORMATIONAL KNOWLEDGE	USERS	[SECTION 3.5] Chapter 3 highlights how the available sources, in academic and grey literature, mainly **focus on the perspective of public authorities over the use of technologies in cities**, consolidating the dichotomy between citizens and government, also widely adopted by technology providers. To overcome the shortcomings deriving from this extremely partial and limited representation of the social system of cities, the proposal of the City Mirror calls for **extending the view over all different stakeholders operating at the local level and incorporating their different needs into the design of future city platform.**
	CITY	[SECTION 3.5] Chapter 3 points out that digital technologies for cities tend to develop solutions for top-down interventions driven by public authorities or for small-scale episodic bottom-up citizens initiatives, relegating out of view all those **activities that necessarily rely on the interaction and cooperation among different social structures, operational domains, and scales**. Considering that nature and profile of city life depend on these interconnected actions, the proposal of the City Mirror suggests the possibility to assume them as the **starting point to recompose the distance between the city represented on digital technologies and the real city pursuing the design of a multi-purpose platform.**
	TECHNOLOGY	[SECTION 3.5] Chapter 3 emphasises that the **missing intervention space for city technologies** is the one between: 1) supporting basic level actions considerable as invariable at the global scale and admitting global solutions, and 2) developing hyperlocal solutions, highlight contextualised but not transferable. Instead, the City Mirror proposal is aimed to explore **the properties of this intermediate space for malleable forms of technology support on a multi-scale platform.**

PUBLICATIONS

Part of the contents or concepts presented in this chapter are also included in the following publications and/or presentations.

- *Under review*. Lupi L., (2020). ***Mapping the context of Smart City technologies and initiatives: a preliminary outline*** [Journal Paper]

- Lupi L., (2019). ***Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development,*** IASDR 2019, Manchester, United Kingdom. [Full Paper]

- Lupi L., (2019). ***Post-smartness: recomposing the disconnected representation of the city ecosystem mediated by smart city technologies.*** AESOP Conference 2019, Venice (IT) [Extended abstract and conference presentation

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CHAPTER 4.

STATE OF THE ART AND DEFINITION OF THE DESIGN CHALLENGES FOR CITY MIRRORS

CHAPTER 4. OVERVIEW

Chapter 4 provides a **review of the state of the art of web-based technologies currently applied in city activities** to discuss their main limitations in reference to the problem of supporting city stakeholders in local development actions. Connecting the results of this analysis on existing technologies to the design proposal of the City Mirror for alternative city-oriented technologies, Chapter 4 clarifies the design challenges of this type of proposal and the specific research questions arising from attempting to study the way to shape and integrate City-Mirror-like platforms in urban activities.

Chapter 4 is organised into seven sections as follows.

- Section 4.1 explains the **approach to the review of the existing web platforms applied in urban settings**
- Section 4.2 describes the **factors considered for the review** of current technologies and the resulting classification schema.
- Section 4.3 provides a **short description of the eight macro-families** of web technologies applied in urban settings, by briefly analysing the essential elements of a representative example for each class.
- Section 4.4 discusses the **potentialities and limitations of the reviewed technologies** in reference to the problem of supporting city stakeholders in local development actions.
- Section 4.5 outlines the specific **design challenges to be addressed for building technological alternatives** such as the option of a City Mirror, adding a second building block to the design theory of the City Mirror capabilities by defining the *"principle of form and function"* of the artefact object of the theory.
- Section 4.6 lists three additional **low-level research questions associated with the specific design challenges** of a multi-stakeholder, multi-purpose and multi-scale platform, by connecting them to the other research questions concerning the interdependence between users representation, city model and role of technology listed in Chapter 3.
- Section 4.7 summarises the **chapter contributions**, accordingly to the outcome spaces of transdisciplinary research.

Connection with previous chapters. Chapter 4 complements the analysis of the operational context for city technologies presented in Chapter 3. It contains the critical reviews of the main classes of existing technologies under the light of the goal of defining web-based technologies to support local development actions. Building on this review of the state of the art, Chapter 4 converts the design proposal of the City Mirror defined in Chapter 3 in a specific research object: a web-based platform designed as multi-stakeholder, multi-purpose, multi-scale.

Connection with the following chapters. The research object defined in Chapter 4 as a web platform providing a multi-stakeholder, multi-purpose and multi-scale digital environment will be explored in detail through the case studies reported in Chapters 7, 8, and 9. Before that, the design challenges associated with this research object are examined at a theoretical level in Chapter 5 through the development of three distinct core models to orient the empirical and applied part of the research. Chapter 6 presents instead the strategy elaborated for studying the research object in different settings and for highlighting the implications of intervening in urban activities with a multi-stakeholder, multi-purpose and multi-scale web platform.

CHAPTER 4. DETAILED TABLE OF CONTENTS

4.1 APPROACH TO THE REVIEW OF WEB-BASED TECHNOLOGIES FOR CITIES: RATIONALE, CONSTRAINTS AND FOCUS

Understanding nature, logics, constraints and issues of existing web-based technologies is essential to sketch feasible alternatives oriented to better support city stakeholders in orchestrating local actions. As discussed in Chapters 1 and 3, web-based technologies provide already indispensable support for everyday activities in urban settings, as a complement in the experience of the city, and as a work environment, relationships space, place for civic expressions and personal engagement in local initiatives. Nevertheless, the **application of web-based technologies to permanently infrastructure local actions at a collective level is still an underexplored path**.

Exploring this path is the central aim of this work and developing a design theory on web-based technologies oriented to support collective action is the objective of the work. In this chapter, I am going to identify the specific **challenges for the design of alternative web-based technologies** by reviewing the state of the art of existing platforms commonly applied in urban actions and exposing the limitations of current solutions as regarding the potential support to different city stakeholders in local actions. On this ground, I am going to outline the **second building block to the design theory of the City Mirror capabilities by defining the *"principle of form and function"* of the artefact object of the theory**. In other words, I am going to specify the formal and functional principles for a web platform meant to address the three forms of disconnection between forms of technology support and city dynamics analysed in Chapter 3.

The three forms of disconnection concern:
- the representation of users disconnected from the social structures they belong to
- the model of the city as an aggregation of disconnected components and activities
- the technology in itself as disconnected from the interscalarity of local activities.

In the following sections, analytic lenses projected from the three facets of this problem (users, city and technology) are used to outlining what specific design choices in web platforms consolidate this problem. Then, the focus will move on what challenges should be addressed to recompose the misalignment between the characteristics of online environments and urban contexts. In the TIDS protocol, this step connects the problem faceting to the development of the core models for each facet [see Fig. 4.1].

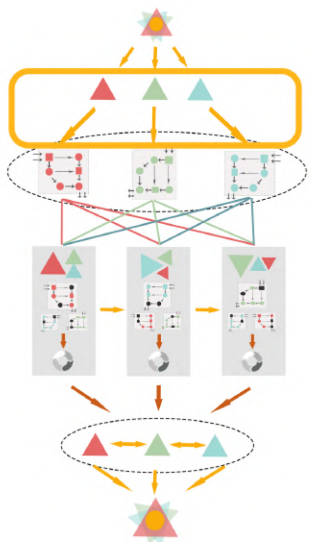

Fig. 4.1 Mapping of the review of the state of the art and definition of the research object in the TIDS protocol

4.1.1 RATIONALE

The primary motivation for undertaking this review is **complementing the analysis of the operational context** for city technologies **with the analysis of the classes of technology that are related to the specific object of this study**. Indeed, in Chapter 3, I have highlighted that there is a disconnection between technologies and urban actions concerning the representation of the actuators of actions (users), the context of their actions (city) and the role attributed to technology in these actions. This distance could be filled by opting for a representation of users, city and technologies more consistent with urban reality as hypothesised in the design proposal of the City Mirror. In this chapter, that design proposal is opposed to the solutions and technological boundaries of current web-based technologies. As a result, I am going to define the specific **research object of this work that is a multi-stakeholder, multi-purpose and multi-scale web platform.**

The second motivation for presenting the state of the art of web platforms applied in urban actions is **continuing the construction of the bridge between informatics and urban disciplines**, the two macro-groups of disciplines considered as roots for the study (see Chapter 2). The purpose is establishing a **common ground for looking at web-based technologies taking into account the specificities of the city dynamics**. On one hand, clearly distinguishing these technologies and discussing their characteristics in practical terms can facilitate urban researchers to further analyse their shortcomings respect to the consolidated knowledge of city dynamics in the domains of urban research and planning. On the other hand, the discussion of the recurrent functionalities of these technologies respect to the goals and activities of urban processes can facilitate researchers in informatics to connect the design choices implemented in existing platforms to their social and operational implications[1], and reflecting on potential alternatives.

The third motivation for connecting the **understanding of existing technologies** to the definition of alternative solutions relies on the need to **effectively address a design & research problem in a combined way**. As regarding the design part of the problem, the analysis of what had been already produced is a common practice to possibly avoid repeating inappropriate solutions and accurately frame the space for intervening with an alternative. As regarding more strictly the research part of the problem, studying the current applications of existing technologies and the related issues is a way to incorporate the lessons learned from past experiences and narrow topics and aspects to be investigated. **This step is also functional to the objective of the work, that is outlining a design theory for City Mirror, contributing to define the "principles and forms" of the research and design object** [see Chapter 1, section 1.1.3, and Chapter 10, section 10.1].

4.1.2 CONSTRAINTS

The classification of web-based technologies applied in urban activities is particularly challenging for two main reasons: a) the continuously increasing number of platforms and tools, b) the distance between the research on web-based technologies and the solutions currently available on the market.

Preparing an exhaustive list of all web platforms potentially applied in urban settings is an impossible task. Their number is continuously increasing, as mentioned before. In addition, most of them are difficult

[1] As already highlighted in Chapter 3, urban disciplines generally focus on the context and informatics on the objects. Thus, the strategy to build a bridge between them is to connect the analysis of the context with the analysis of the objects in the context at a meta-level.

to be discovered because of language barriers, indexing issues and short lifetime. Indeed, not necessarily these platforms are available in English because meant for local uses in settings with different prevalent languages. Often these platforms are niche tools, appearing after many pages in the results on search engines and web browsers. Moreover, in many cases, these platforms frequently disappear (for instance because of the failure of their business model) or change name and domain over time (e.g. "MindMixer" transformed in "MySidewalk" and then split in two, https://www.mindmixer.com and https://mysidewalk.com/). In other cases, these platforms remain merely prototypes developed at the local level for contingent purposes (e.g. voting platforms for the participatory budget of a neighbourhood project) or prototypes used mainly for research activities (e.g. PlanYourPlace, Hunter et a. 2012). Lastly, it is very complicated to set a rigid boundary about what is to be included and what is not pertinent. Many tools sometimes are readapted or reused for new purposes related to urban actions, even though they had been originally designed with a different scope and are mainly used for other reasons, such as Facebook or Twitter.

To have a general idea of the number of web platforms supporting urban actions in various ways, it is useful to mention some of the more recent initiatives to map this complex landscape. For instance, the *"Civic Tech Field Guide"* (https://civictech.guide/) is a project aimed at collectively mapping, describing and tracking the activities of different types of technologies having civic purposes. This initiative covers platforms ranging from advocacy to decision making, to political campaigning and self-organisation tools. The platforms recorded in the Civic Tech guide are over 2000 (last check May 2019). Similarly, *"Participaedia"* (https://participedia.net/) is a portal listing and gathering information about over 300 platforms for public participation and engagement and related case studies and initiatives. Other institutional and private projects focused on Open Data Portals only, surveying over 550 portals in one case (https://dataportals.org/, https://www.europeandataportal.eu) and over 2600 in another one (https://opendatainception.io). The Australian Urban Research Infrastructure Network mapped over 100 planning support systems (https://docs.aurin.org.au/projects/planning-support-systems/) also meant to support various forms of public engagement in planning actions. Numerous recent research surveys focus on platforms with specific characteristics. For instance, Falco & Kleinhans [2019] surveyed over 110 platforms supporting co-production practices in urban development. Lastly, there is the unknown number of commercial applications available for individual use and the systems acquired by local administrations, public agencies and privates for specific applications in urban settings (e.g. apps for monitoring parking slots, energy consumption, waste collection, and so on).

On the other hand, it also essential to consider that **the landscape of web-based technologies is particularly dynamic. There is a constant refactoring of web tools functionalities with the integration of new cutting-edge technologies**, such as artificial intelligence, virtual reality, or data analytics solutions. However, the advances are faster in applications with a high commercial value such as e-commerce platforms or personal assistant online services. The pace of change is instead much slower for applications having less remunerative purposes such as citizens' engagement platforms or open data portals.

As a result, **almost the totality of web-based applications associated with local initiatives or urban actions are platforms based on the old paradigm of the Web 2.0. At the same time, the research on web technologies moved forward new paradigms (Web 3.0, Web 4.0, Web 5.0) and their preliminary applications**.

Web 2.0 technologies, defined as the Geospatial web [Scharl & Tochtermann 2009], are characterised by a focus on **geospatial functionalities and user-generated contents**, often implemented through map-based interfaces and crowd-sourcing tools deeply explored regarding urban experiments [Goodchild 2007, Scharl & Tochtermann 2009, De Longueville 2010]. These two specific characteristics made them particularly compatible with the practices of urban practitioners (often relying on maps as communication and operational tools) and the purposes of providing the opportunity to enlarge the participation in sharing opinions, perspectives and contents in local initiatives [Hacklay et al. 2008, Antttiroiko 2012, Sieber et al. 2016]. Thus, as a matter of facts, web-based technologies intended to be used or currently used in urban settings are built under the Web 2.0 paradigm. We do not have yet specific examples and documented uses of other tools designed accordingly to new paradigms.

The scenarios outlined by the **Web 3.0**, usually defined as the **Semantic web** [Berners-Lee et al. 2001], are based mostly on the capability of emerging platforms to perform semantic analysis and aggregations of contents automatically. These new capabilities should facilitate users in the exploration of online contents (that is a well-known critical issue in many Web 2.0 tools). Secondly, semantic web solutions are engineered to integrate and harmonise multiple sources of information, of which user-generated contents are just one of them.

Web 4.0 technologies will go further by integrating "intelligent agents" to assist or partially execute operations on behalf of the user by following given patterns. These technologies are defined as the **Ubiquitous Web** [Uwa Consortium 2002, Pendyala & Shim 2009, Choudury 2010] because intended to support human experiences in the context of users'actions [Dourish 2001, Sheth 2010]. It is important to highlight that the first examples of Web 3.0 technologies are dated around 2015-2016. R&D experimentations on Web 4.0 solutions are still on-going, covering narrow scope applications for personal use only (e.g. SIRI, the intelligent assistant of Apple devices).

By looking at the horizon of the next 10-15 years, **Web 5.0** technologies are envisioned as responsive to the users' emotions and adaptive to the different contexts of user actions. In some ways, they are envisioned as "conscient" technologies [Benito-Osorio et al. 2013, Patel 2013]. These future internet technologies are also described as the **Symbiotic Web,** because intended to make possible synergy between machines and humans [Aghaei et al. 2012]. Only very recently, tech companies started to publicly disclose their interest in working toward new forms of collaboration between AI agents and humans through ubiquitous technologies and indicating that this seems to be a path that will be explored in the future web technologies applied in urban contexts. Indeed, so far, AI applications in cities pushed forward only monitoring capacities in smart city technologies.

The key point of this summary of the emerging trends in web-based technologies is to make clear that they are not yet instantiated in commonly available new tools supporting urban activities. Thus, there are neither documented urban initiatives associated with Web 3.0 (with some early exceptions), Web 4.0, Web 5.0 solutions at the time I am writing this thesis. However, a review of the existing platforms having urban applications cannot simply ignore that the current technological landscape can completely change in a few years accordingly with these new trends. As a consequence, **I decided to carry out my review of existing platforms to support design&research explorations critically assessing what is exposed to probable rapid obsolescence and what would also be confirmed by the emerging trends. On this basis, I have clearly positioned an alternative in reference to these two extremes building on what is already given and what is potentially achievable in the short term.**

Thus, this critical review does not have documentary purposes and do not adopt a static perspective, setting a specific time for the analysis of the state of affairs because its validity is also independent of on-going changes (e.g. survey of mapping platforms between 2005 and 2015).

4.1.3 TACTIC AND FOCUS

The strategy for reviewing the existing web-based technologies for cities had been elaborated by considering the two constraints described in the section before. Following, I make explicit the **tactic to fathom this dense technological landscape** leveraging on personal experience and the family resemblance principle. Then, I describe the **focus of the analysis for taking into account the evolutive nature** of that landscape.

I excluded the options of performing systematic surveys or a blind selection of tools out of the indefinite number and variety of existing platforms. On the contrary, I decided **to select a set of platforms that I consider to be representatives of different classes of tools.** My personal experience working as a practitioner (analyst and designer) with web-based technologies in urban initiatives for over ten years pushed me to get familiar, test, use, and analyse several platforms applied in this field [more details in Chapter 6, Section 6.7]. **Exploiting the expertise coming from this specific background, I decided to analyse the platforms that can better illustrate the recurrent functionalities usually provided by different types of similar tools in reference to their potential to support city dynamics**[2].

The platforms that can be considered as representative of a certain type of technologies are the ones including all the most common functionalities and interactional patterns recurring for that type of technology. For instance, there are thousands of Open Data portals or City Dashboards, but a limited number of key functionalities recurs in most of them, despite the marginal differences or customisations offered by specific tools. In other words, the second aspect of the tactic adopted for reviewing the indefinite number of current web-based technologies for cities is **applying the principle of the "family resemblance"** [Raatzsch 1993]. I classified **different platforms sharing some substantial similarities in homogeneous groups.** Not necessarily there is a complete overlapping among all the functionalities across different tools, and sometimes they can appear partially different even though the functional logic is the same.

The definition of the different "families" and sub-families of web-based technologies for cities required to take into account the fact that the landscape of these technologies is continuously evolving. Thus, I decided to **focus on the invariants** determining:

- the **type of social environment** provided by the technological platforms
- the **type of connection with the context** in which these technologies are intended to be used
- the **type of objects** on which the users' actions are assumed to be performed
- the **type of actions** to be implemented through the support or mediation of technology connecting users, city and technology.

The focus on these invariants allowed me to investigate specifically which components and design options are related to the three facets of the problem highlighted in Chapter 3:

- the misrepresentation of users as part of social structures in urban environments
- the underlying model of the city assumed as the base for structuring users' actions
- the specific role of technology in the most common applications.

The families of technologies identified result from mapping the values attributed to the invariants and the operations enabled or supported by the specific type of platform.

[2] I have not considered the platforms and applications explicitly intended for personal use only or domestic applications (such as smart meters for house energy consumptions or mobility applications), but exclusively the ones supposed to be used by groups of people, communities and collectivities in general. In addition, I did not consider applications such as Google Maps or TripAdvisor, that can be used in cities, but they are indifferent to the nature of the space of actions.

4.2 ANALYTIC FRAMEWORK FOR THE REVIEW

In this section, I am going to describe the "invariants" and how they had been used as lenses for classifying existing platforms. Then, I outline the schema of the four macro-families and 16 sub-families resulting from this analytic process[3].

4.2.1 DIMENSIONS OF THE ANALYTIC FRAMEWORK

I use the term **"invariant"** to literally indicate the global results of choices that **remain unchanged when a type of technology is integrated with new functionalities or shifted under a new technological paradigm**. As we are going to see in the next section, the design of technologies is codetermined by specific assumptions about the context in which technology is applied (and how it should be) and by more trivial contingencies due to the predominant business models put in place for the economic sustainability of technology services. The exposure of some underlying assumptions, paradoxes and inconsistencies can help in reflecting on current technology from a pragmatic perspective.

For the purpose of this study, the invariants concern the three pillars of the users' representation, city model and intervention space of technology in urban actions. These invariants are instantiated into four factors:

1) the prevalent **structure of relationships** among clusters of users, both as individuals or collectivities, defined by the online environment of each type of tools (related to users)
2) the **specificity of the context of actions** represented or considered in structuring the platform functionalities (related to the city as context)
3) the **nature of the object of actions** (related to the city components)
4) the **profile of actions** to be performed on/by/through the platform (related to the role of technology in local actions).

1) The **structure of relationships** had been classified as:
   - **Vertical**, when there is a subset of users that has significant power over other users that is enforced through the platform functionalities
   - **Horizontal**, when the platform is oriented to support relationships among peers without differentiating or attributing specific powers to a subset of users

This classification is based on the observations highlighted in Chapter 3. In particular, on the key issues with current technologies for cities is that they tend to overrepresent users in macro-scale organisations (governments and ICT companies) versus individuals or clusters of individuals. Intermediate social structures remain invisible. This issue results in a polarisation of digital environments in the two extremes: the ones where there is an apparent hierarchy among providers and users (that does not necessarily correspond to the reality of urban dynamics), and the others flattening the structural differences in capacities, competencies, responsibilities, roles. Reviewing the existing platforms starting to divide them in these two macro-groups is the first step for developing a better understanding of what exactly determine these two polarities in the structure of relationships among users.

[3] The classification proposed in this chapter is nor a top-down or a bottom-up process, but a process oriented by the choice of a limited set of factors to be considered in the analysis (the invariants) and a limited set of values attributed to each factor.

The analysis of the design choices and implications of these two models of relationships among users (invariant to technology advances) had been informed by the concept of *"powergram"*, developed in urban design by McGlynn & Murrain [1994]. This simple conceptual tool is meant to help in understanding the representation and mediation of values and interests in the activity of design at the urban level, where specifically any intervention has political implications on the delicate balance of city stakeholders' relationships. The central idea of the powergram is that the **factual analysis of power relationships** requires to clarify:

- what subjects have the power to initiate a process and control its development
- what subjects have the responsibility to implement a process (by norms, contracts, conventions)
- what subjects have an influence on the process
- what subjects have no obvious interest in the process.

I decided to transfer this lens from urban transformations to digital design. Relevant elements to understand the prevalent structure of relationships defined by a web platform come from answers to factual questions such as:

- *There is a specific subject providing the platform to other groups?*
- *Does the provider have the right and competencies to decide whether the platform is available or not for others?*
- *Who set the agenda associated with the use of the platform in a determined setting?*
- *Who set the rules for others?*
- *Who is conditioned directly or indirectly by the use of the platform?*
- *Who benefits from the use of the platform? in which ways?*
- *Who benefits from the information sharing?*
- *The information publicly shared has some utility for the intended users or mainly for the provider? in which ways?*
- *Who is explicitly or implicitly included or excluded by the platform?*

2) The **context of actions** supported by the platform had been classified as:
   - **Specific**, when the area of interest and action for users is an entity clearly defined in the space and distinct from others (e.g. the building X, the neighbourhood Y)
   - **Unspecific**, when the space in which the actions are supposed to take place is defined at an abstract level only as a perimeter (e.g. in the City of Z, at the regional level).

This aspect is relevant for web-based technologies that historically are meant to have a global distribution, even though they started to be frequently readapted in hyperlocal solutions [Androusopoulos 2010]. As discussed in Chapter 3, this polarisation in global versus hyperlocal limits the possibilities of changing current business models to support glocal solutions, meeting specific needs of the specific context in a way that is sustainable and replicable. Reviewing the existing platforms analysing this aspect is crucial to enlighten the frictions between online environments and the nature of different types of actions at different scales.

The key for determining whether the context of actions is specific or unspecific is understanding the connection between the representation of the context of actions in the platform and the actions in themselves. Some questions to investigate this point are:

- *Does the platform confine user's actions within explicit geographical boundaries or areas of interest?*
- *Are these actions enabled and represented in association with specific spatial entities?*

- *Without the connection and visualisation of a specific spatial entity on which the user is acting, the action is still understandable?*
- *Local actions, as represented in the platform, are actually independent of the representation of the context itself?*
- *Is the focus on themes or actions?*

3) The **object of actions** in the city had been classified as:
   - **Tangible**, when related to the built environment seen in its material presence (e.g. buildings, infrastructures, environment, assets and physical resources)
   - **Intangible**, when concerning the social components of city life (e.g. community life, local activities, policies and social norms).

The analysis of this aspect is fundamental for enlightening the implicit vision of the city instantiated by the platform as a whole, but mostly by the specific functionalities or preferential use patterns. In this work, I decided to focus on technologies aimed primarily at connecting people in the city (city technologies and not urban technologies, see Chapter 1, section 1.1.). Nevertheless, the connection mediated by technology can be related to transformations of the physical environment or to social arrangements and exchanges. In both cases, essential questions on the design choices to define the online environment reflecting or supporting these actions include:

- *Is the city the background or the actual object of actions?*
- *Are these actions mediated or supported through technology?*
- *What is the connection between online and offline actions?*
- *Is the city represented as a permanent entity? variation and the transformability of places and relationships are made evident to users?*
- *Are descriptive factors related to the city prevail over perceptive or personal representations?*

The combination of these three "contextual factors" (because related to the representation of the applicative context of technology) is schematised below in the **cube of contextual factors**[4], see Fig. 4.2. and 4.3.

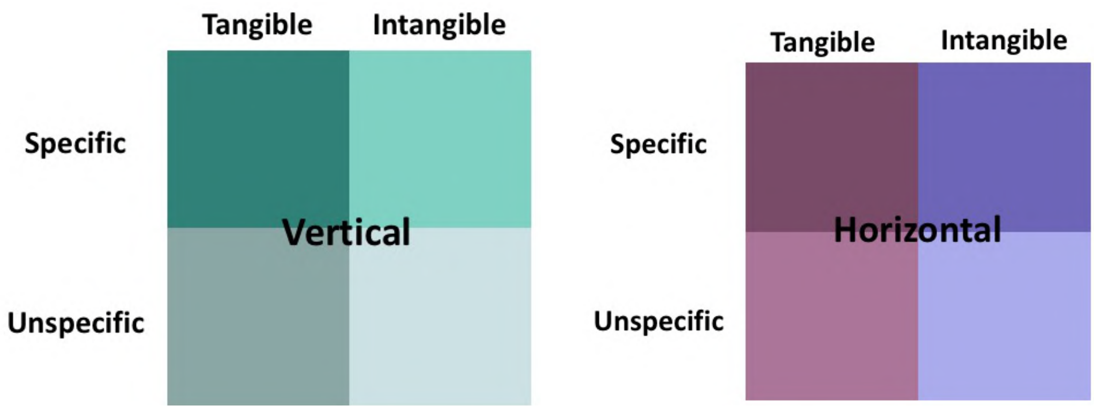

Fig. 4.2 Quadrants defined by the contextual factors used in the analysis of existing web platforms for city activities, by keeping fix the dimension of the hierarchical/horizontal relationships among users

[4] I attributed to each factor only a set of two values to keep the analytic framework simple to use because its application is helping to analyse the platforms and not to describe them.

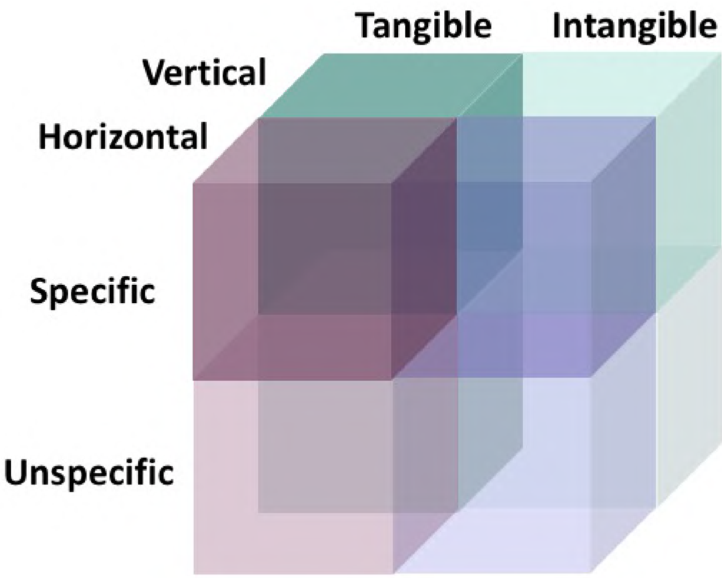

Fig. 4.3 Contextual factors cube

4) The fourth invariant considered in the review concerns the **profile of actions** supported by the platforms. The actions mediated or supported through technology have been classified in:

- **Ordinary**, when the activities are predictable, repetitive, known or formalised in advance and potentially persisting for an indefinite amount of time
- **Extraordinary**, when the activities are not completely predictable of known in advance, are beyond or in contradiction with normal routine, are frequently associated with temporary endeavours and last for a defined amount of time.

This distinction is intuitively reflecting the difference between **projects**, calling for ad-hoc solutions or temporarily protocols, and **processes**, that are locally established relying on consolidated schemas of activities. In relation to this aspect, the analysis also covers the openness of the platform's functionalities to a plurality of purposes and their reuse in multiple settings. Indeed, as seen in Chapter 3, one of the main limits of web-based technologies is the fragmentation of the forms of technology support to users in a myriad of mono-purposes applications or their aggregation in generic containers of contents and activities.

Questions helping to distinguish between the two situations include:

- *Is the use of the platform linked to a specific initiative? Is the platform available for use beyond the end of that initiative?*
- *Does the platform provide support to routine services? Does the platform manage multiple services and types of needs? Are they dynamically defined?*
- *Is the platform configured for a defined purpose in a specific setting?*
- *Is the platform set up transferable to other settings?*
- *Does the platform provide any form of support to coordination, cooperation or collaboration in these actions?*

The analysis combining the contextual factors with the profile of actions resulted in a **goal-based classification of web-based technologies currently applied in city activities**. In other words, a partition of tools sustaining similar types of goals even though their purposes can slightly differ case by case.

4.2.2 CLASSIFICATION SCHEMA

The classification schema for the existing web platforms having applications in urban settings results from the selection of an attribute for each invariant (vertical/horizontal, specific/unspecific, tangible/Intangible, ordinary/extraordinary) for each type of tools under review. As mentioned above, the classification is based on the principle of the family resemblance among platforms. Though, it is not a taxonomy because I do not introduce any principle of hierarchy among different families of web-based technologies.

The similarities among the tools included in the same family do not necessarily concern low-level convergences. Instead, **I focused on the similarities in the instantiation of specific choices related to**:

a) **the space of action of users**
b) **the vision of the city as background or object of the actions**
c) **and the scope of the technology in itself in the supported actions.**

The **macro-level classification** distinguishes four families of technologies, two in the cluster of technologies sustaining vertical relationships among users and two in the other one associated with horizontal relationships among users. In the first cluster, we can find "**Public Dashboards**" and "**Exchange Platforms**" disintermediating or mediating the interactions between users managing the platform and users engaged by the platform. In the second cluster, we can find "**Scouting Platforms**" and "**Segmentation Tools**", respectively oriented to open and disintermediate the access to local information and resources, or to mediate the relationship among users united by common characteristics and themes of interest.

The **medium level classification** furtherly highlights a prevalent type of **goals supported by the technologies** included in each family:

- Helping in the **management of urban actions**
- **Monitoring and controlling** urban indicators
- Gathering **inputs for local decisions**
- Providing an additional channel to **access to local services**
- Supporting the discovery and **exploration of local resources**
- Facilitating the **matchmaking among local needs and resources**
- Enabling informal **management of groups and collectivities** at a local level
- Aggregating people and interests to **build local communities**.

The families of technologies corresponding to the low-level classification are examined in the next section.

Table 4.1 Macro and Medium level goal-based classification of web platforms resulting from the analysis, part I

<table>
<tr><td rowspan="3"></td><td colspan="4">Vertical</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Tangible</td><td colspan="2">Intangible</td></tr>
<tr><td colspan="2">PUBLIC DASHBOARDS</td><td colspan="2">EXCHANGE PLATFORMS</td></tr>
<tr><td rowspan="2">Specific</td><td rowspan="2">Goal: management of actions on the urban environment</td><td>WORKS MONITORING SYSTEMS</td><td rowspan="2">Goal: gathering inputs for local decisions</td><td>VOTING AND PUBLIC DEBATE PLATFORMS</td><td>extra-ordinary</td></tr>
<tr><td>REPORTING PLATFORMS</td><td>CITIZENS PROPOSALS COLLECTORS, CITY FORUMS</td><td>ordinary</td></tr>
<tr><td rowspan="2">Unspecific</td><td rowspan="2">Goal: monitoring and control of urban indicators</td><td>ENVIRONMENT MONITORING</td><td rowspan="2">Goal: providing services on additional channels</td><td>OPEN DATA PORTALS</td><td>extra-ordinary</td></tr>
<tr><td>URBAN MONITORING</td><td>E-GOV SERVICES</td><td>ordinary</td></tr>
</table>

Table 4.2 Macro and Medium level goal-based classification of web platforms resulting from the analysis, part II

<table>
<tr><td rowspan="3"></td><td colspan="4">Horizontal</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Tangible</td><td colspan="2">Intangible</td></tr>
<tr><td colspan="2">SCOUTING PORTALS</td><td colspan="2">SEGMENTATION TOOLS</td></tr>
<tr><td rowspan="2">Specific</td><td rowspan="2">Goal: resources discovery, exploration, learning</td><td>COMMUNITY MAPPING TOOLS</td><td rowspan="2">Goal: groups/ collectivity management</td><td>EVENTS & GROUPS APPLICATIONS</td><td>extra-ordinary</td></tr>
<tr><td>LOCATION-BASED SOCIAL NETWORKS</td><td>WIKIES, LOCAL PORTALS, CITIZENS JOURNALISM</td><td>ordinary</td></tr>
<tr><td rowspan="2">Unspecific</td><td rowspan="2">Goal: matching of priorities, resources and needs at local level</td><td>CIVIC CROWDFUNDING</td><td rowspan="2">Goal: aggregation of people's interests and community building</td><td>CAMPAGNING AND ADVOCACY PLATFORMS</td><td>extra-ordinary</td></tr>
<tr><td>SHARING PLATFORMS</td><td>GLOBAL SOCIAL NETWORK</td><td>ordinary</td></tr>
</table>

4.3 REVIEW OF EXISTING WEB-BASED TECHNOLOGIES FOR CITIES THROUGH SELECTED EXAMPLES

This section will concisely describe the sixteen families of web-based technologies resulting from the classification schema described in the previous section. For each technology family, I am going to introduce one or two significant examples that can help to illustrate the key-characteristics and patterns of the different types of platforms. These characteristics are analysed taking into account the analytic dimensions concerning: a) the framing of users and their relationships; b) the representation of the context in which they operate; and c) the role of technology in their actions.

4.3.1 PUBLIC DASHBOARDS

The label "Public Dashboards" indicates the first macro-level family of technologies. It includes **platforms and tools aimed to enable, facilitate or support understanding and operating on the components of the built environment in cities through a comprehensive representation of trends and real-time information of spatial phenomena.** The corresponding low-level technology families are:

a) Situational Monitoring Systems
b) Reporting Platforms
c) Environmental Monitoring Systems
d) Urban Monitoring Systems or City Dashboards

These four families are mapped in the two quadrants of the contextual factor cube corresponding to the following combination of factors: Vertical Tangible Specific and Vertical Tangible Unspecific [see Fig. 4.3 and 4.4].

- *Vertical Tangible Specific quadrant.* **Situational monitoring systems** of on-going major works, emergencies or rehabilitation programmes are characterised by a focus on a specific area of interest where certain actions are taking place and traced online. Similarly, the most common **platforms for reporting urban issues** explicitly connect online actions and specific components of the built environment spatially defined, such as a street, a building, a piece of furniture. Thus, both technology families represent the city context in its tangible aspects, link specific actions to specific spatial elements in the city context by establishing a clear system of hierarchies, competencies, and agency between users managing the platform and users accessing to the platform.

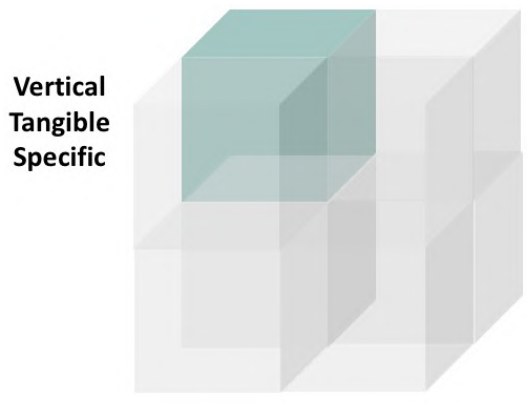

Fig. 4.3 Mapping of the works monitoring systems and reporting platforms in the contextual factor cube

- *Vertical Tangible Unspecific quadrant*. **Environmental Monitoring Systems** are aimed at tracking and documenting the variations of environmental indicators overtime at the local level. **City Dashboards** are more focused on monitoring urban indicators usually related to traffic, energy consumptions, land use, material resources, and so on. In both cases, there is a weak connection between online actions enabled by this kind of information on these platforms (e.g. visualisation and exploration) and the users' actions in the context (e.g. making plans for traffic management or cancelling a pic-nick in the park due to pollution levels). For this reason, the area of interest of these kinds of platforms can be considered unspecific, or rather defined simply as a perimeter or an administrative area to which the displayed information refers to. The relationships among users are characterised by an implicit dependence of the users engaged by the platform from the users managing the platform. Indeed, there are indirect limitations to the actions and decisions of the first group of users due to the choices of the second group of users deciding what information is publicly shared, when, how. However, it is important noticing that the weak connection between online and offline actions makes the two groups of users independent from each other.

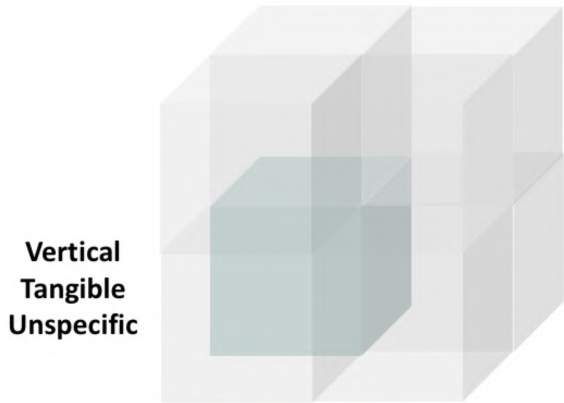

Fig. 4.4 Mapping of the environmental monitoring systems and city dashboards in the contextual factor cube

4.3.1.a. Family 1: Situational Monitoring Systems

An interesting and advanced example of a situational monitoring system is the **USRA platform**. USRA (http://webgis.comuneaq.usra.it/mappa_def.php) is the platform for monitoring the reconstruction and rehabilitation of a city destroyed by an earthquake in 2009, L'Aquila (Italy). It is a significant example of a platform merging the topics of emergency and territorial risk assessment, monitoring of on-going works in the area and documentation of the normalisation process. The platform is an ad-hoc Web-GIS associated with the system for the management of administrative practices for the dynamic update of the visualised information[5] [see Fig 4.5]. USRA is an institutional platform managed by the special task force for the reconstruction that involves local government, national agencies and the University of L'Aquila. The access to the platform is open, even though the consultation of the advancement status of a certain practice is reserved to the applicants only. The platform mediates the asynchronous communication between the task force, residents as interested parties, and the general public.

[5] The specificity of this type of systems is precisely that the contents are not static and that the platform is aimed to monitor changes in the city and not only being an interactive display of geographic information concerning plans, studies or surveys. An example of a WebGIS created for the exploration of static information only is: http://cityplanmaps.goldcoast.qld.gov.au

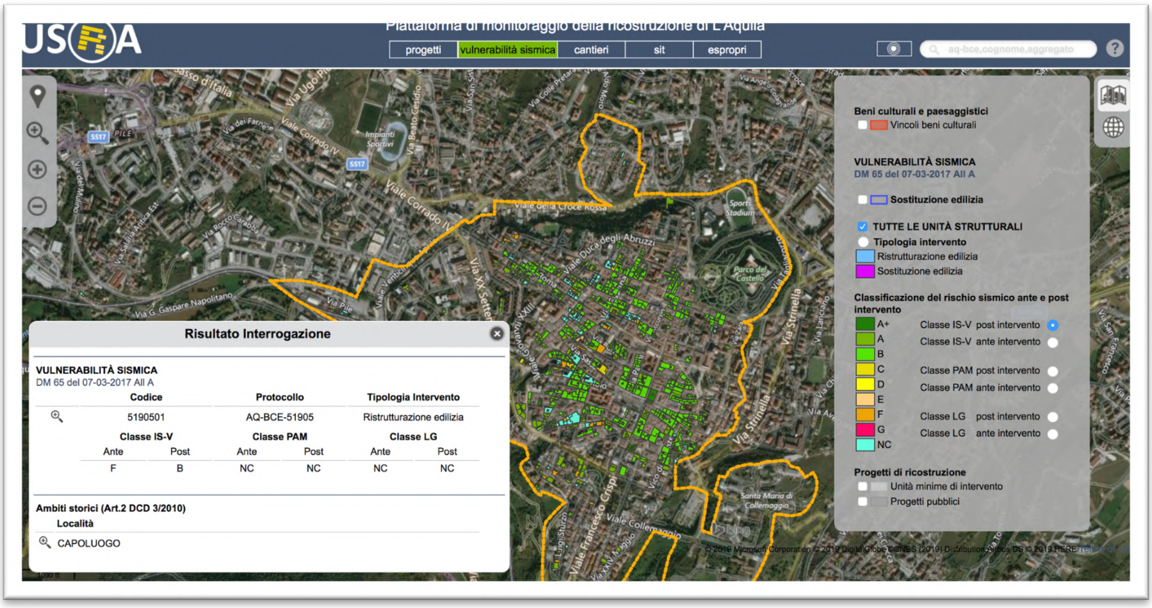

Fig. 4.5 Screenshot of the USRA platform (source: http://webgis.comuneaq.usra.it/mappa_def.php)

Users. The platform clearly distinguishes between users managing the platform and users accessing to it. The first group set the highlights and views of available data, their classification and the way data should be read, the level of detail of the provided information, the frequency of updates. **The users managing the platform maintain complete control of information**, by establishing an indirect relationship with the public, protecting the officers working for the organisation (never individually exposed on the platform, as responsible for specific practices) and avoiding risks due to the uncontrolled independent interpretation of the provided information among groups of users. The public is divided into two sub-groups having access, respectively, to general information about the reconstruction advancement and to detailed information on the specific practice for which individual users have applied. **The agency of the users accessing the platform is limited to the exploration of data**. They can visualise different views and select the categories they are interested in to generate more focused visualisations. None of their actions or decisions concerning the contents on the platform affects the platform administrators or other users.

City. The platform represents the urban environment as a **built environment** only. However, public and private interventions on the built environment are clearly distinguished and **used as proxies for representing rights, competencies, responsibilities of different groups of local stakeholders**: in particular, local governments and residents.

Technology. **The platform enables one-way communication from institutional actors to the public, and many-to-one communications from resident to the cluster of organisations composing the task force**. The communications concern information related to specific spatial objects (buildings) within a specific area. The platform does not provide support to ask further clarifications on the information published on the platform through the platform in itself, nor to other users or to the platform administrators. At a more general level, the platform does not allow to establish a connection among users. Cooperation among institutional actors of the reconstruction task force, if in place, is implemented beyond and independently of the platform. The coordination of private and public interventions is not supported by allowing, for instance, privates updating the advancement of the reconstruction of their assets. Coordination among city residents living in the same area or the dozens of enterprises working to the reconstruction do not find support in the platform functionalities. The collaboration between the professionals engaged in surveying the built environment (architects, engineers, geologists) and the institutional task force for integrating and enriching the displayed information is independent of the platform. In this case, the scope and role of technology in local dynamics is limited to provide a synoptic view of updates on the status of the reconstruction process from the specific perspective of the local administration.

4.3.1.b. Family 2: Reporting Platforms

FixMyStreet and **SeeClickFix** exemplify the two prevalent schemas of reporting platforms [see Fig. 4.6 and 4.7]. FixMyStreet (https://www.fixmystreet.com/) is a platform aimed at collecting reports about issues, mal-functioning or matters of concerns from citizens and sending them to the contact points of local government offices anywhere in the UK. On the contrary, SeeClickFix (https://seeclickfix.com/) is a reporting platform made available by the public administration to the citizens as an additional channel to mail, phone, in-person notifications of local issues. In the first case, the reporting platform is external to the organisational flow, practices and structures of the public administration[6]. In the second case, the platform is structured on the basis of the organisational chart of the offices in charge of managing the reports, and officially integrated into their flow of everyday activities. This difference determines two completely different digital environments, even though the core functionalities appear very similar. Indeed, the access to FixMyStreet and to SeeClickFix (in the cities that adopted the platform) is open, enabling potentially everyone to report a problem and to see on the map what other citizens have already reported.

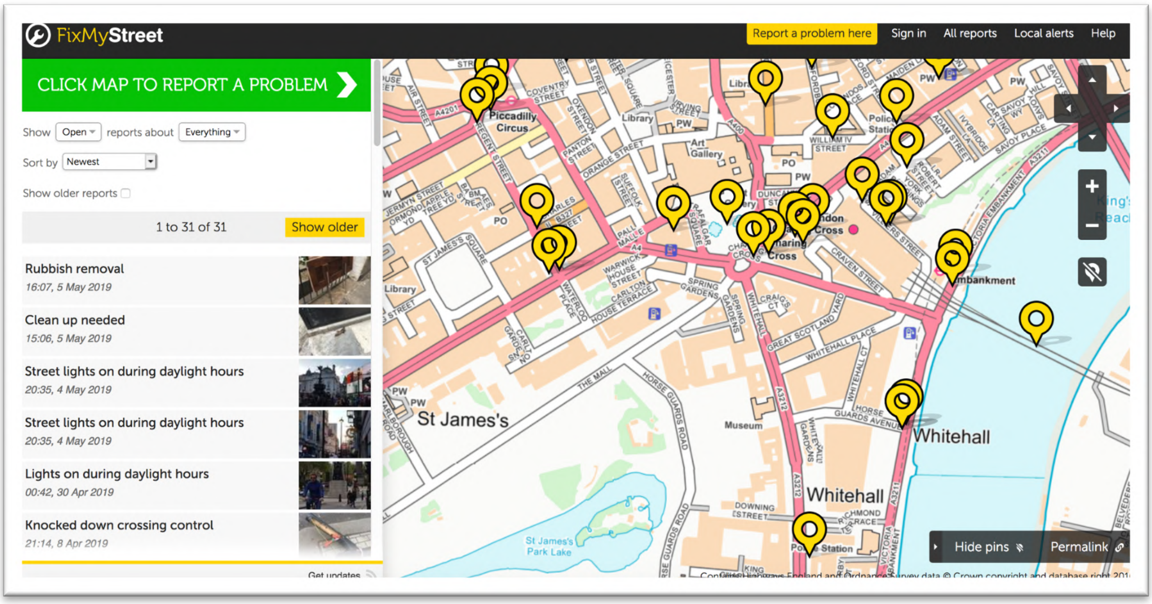

Fig. 4.6 Screenshot of the platform FixMyStreet (source: https://www.fixmystreet.com/around?lat=51.50642&lon=-0.12721&js=1&zoom=3)

Users. The relationships among users determined by the two schemas are structured according to a vertical pattern, but with inverted roles for citizens and public administrations in the two cases. In the first case, in FixMyStreet, **citizens assume the role of "watchdogs" of the public administration** that is considered responsible and accountable for fixing street problems (as also synthesised in the claim of the platform). End-users that are weakly identified or even remain anonymous demand prompt actions to the local government through the platform. At the same time, the platform does not support these end-users in

[6] The version FixMyStreet Pro allows the integration of the platform with the official reporting systems of local councils.

understanding what office they are addressing or should address for specific issues, or the range of competencies over these issues. In addition, the platform enables a sort of public assessment of the performances of local councils by evaluating the time of response to published reports, even though the platform is unofficial. These dynamics determined by specific design choices of the platform and the definition of its scope can generate conflicts between councils and citizens, due to unwanted pressures, misunderstanding of the capacity of local offices, and unfulfilled expectations of citizens[7]. The act of reporting a street issue is practically framed as a request from one side to another, and not as a civic act of citizens voluntarily cooperating to facilitate the maintenance of public spaces. On the contrary, reporting platforms following the schema of SeeClickFix establish a cooperative path for civic purposes between public offices and citizens. In this case, **public offices remain in charge of managing the platform contents** and the flow of activities determined by the collected reports.

In relation to these two different dynamics, it is important noticing that users are completely hidden behind contents in platforms like FixMyStreet, while there is an effort to value the users' contributions in platforms modelled as SeeClickFix. In this case, the name (or affiliation) of the user is highlighted next to the published contents, as well as the acknowledgement as most active contributors ("top users"). However, in the second case, the platform does not distinguish between individuals/citizens and organisations, even though they cover two very different types of roles in the platform and in the process of reporting and addressing street issues. This choice tends to misrepresent local engagement dynamics.

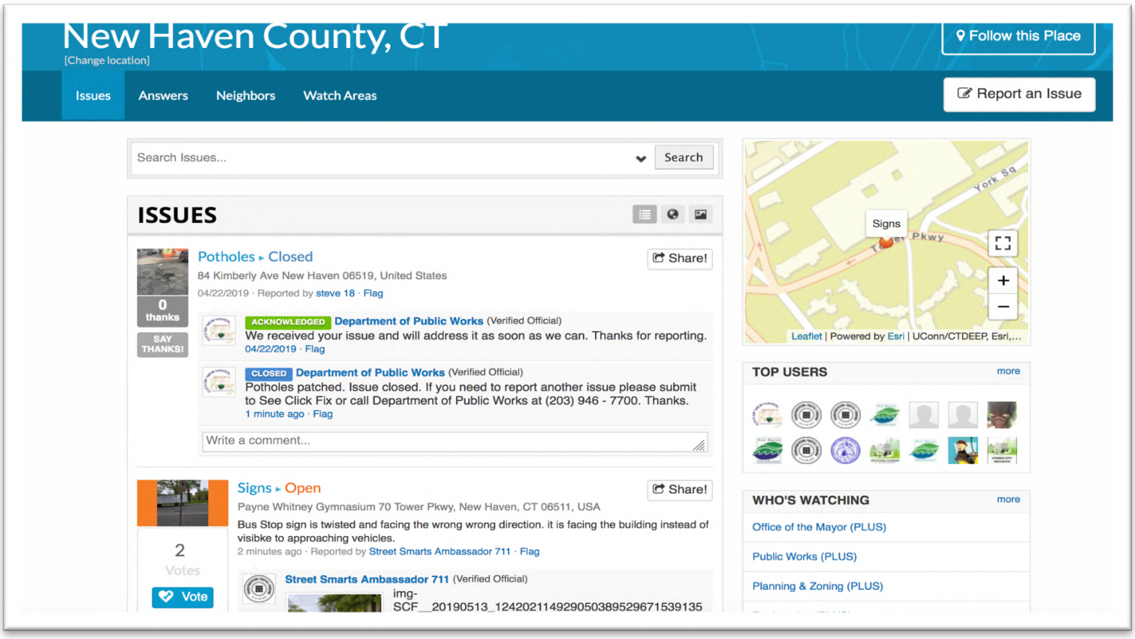

Fig. 4.7 Screenshot of the platform SeeClickFix, New Haven portal (source: https://seeclickfix.com/enhanced_watch_areas/13)

City. In both types of platforms, the focus is on the **physical environment of cities**, and in particular to the damages and issues concerning assets belonging to **public spaces and infrastructures**. The critical difference among the two schemas relies on the possibility to connect the components of this physical environment to the competencies and responsibilities of public offices called to act. Indeed, while in FixMyStreet the

[7] It is significant the effort of the FixMyStreet providers to communicate to the users the importance of not publishing anonymous reports to have "more constructive and less abusive responses" by local councils. From the "house rules" of FixMyStreet: https://www.fixmystreet.com/about/house-rules

user is called to describe the issue independently from a clear referent or city functions, in SeeClickFix the user is supported to connect specific issues in the physical environment to the people and the offices for addressing them [see Fig. 4.8]. In this way, the relationship between user and city mediated by the platform is more contextualised, educational and rich.

Another important aspect concerning the representation of the city mediated by these platforms is the lack of functionalities to manage the time properties of reports, by distinguishing between old and recent issues. The result is often the visualisation of crowded maps that communicate the image of local areas particularly problematic, even when most of the issues had been addressed by prompt administrations. Indeed, crowded maps can be considered actually as evidence of engaged and cooperative citizens. However, they can also communicate the idea of a generalised degradation of the public space due to an overwhelming amount of reported issues. **Staticizing the representation of changes and do not disambiguate negative and positive trends on the map** constitute important limitations of current reporting platforms.

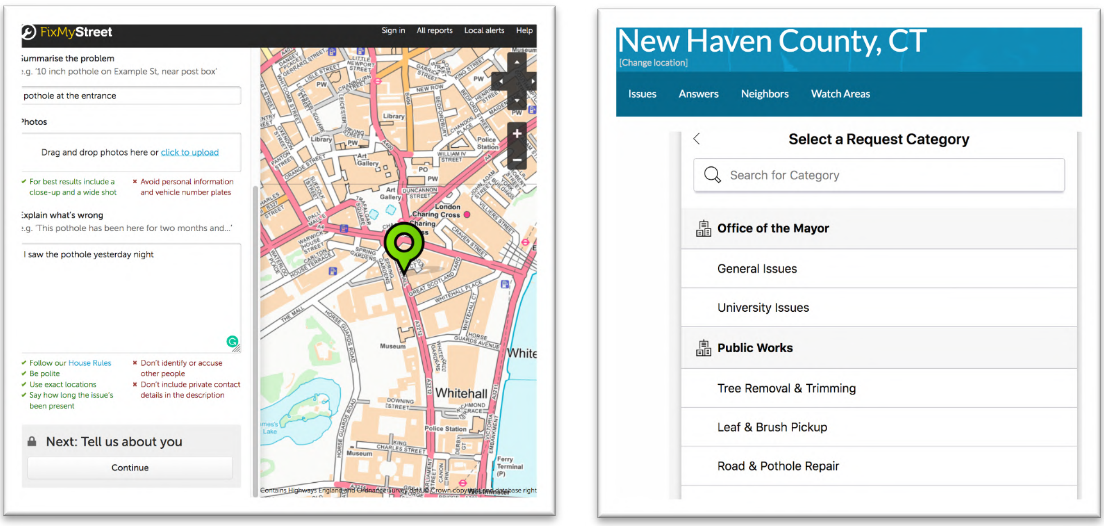

Fig. 4.8 Screenshots of the platforms FixMyStreet, on the left, and SeeClickFix, on the right. In the first case the focus is on the nature of the report, in the second one on the competent office that is supposed to address the issue.

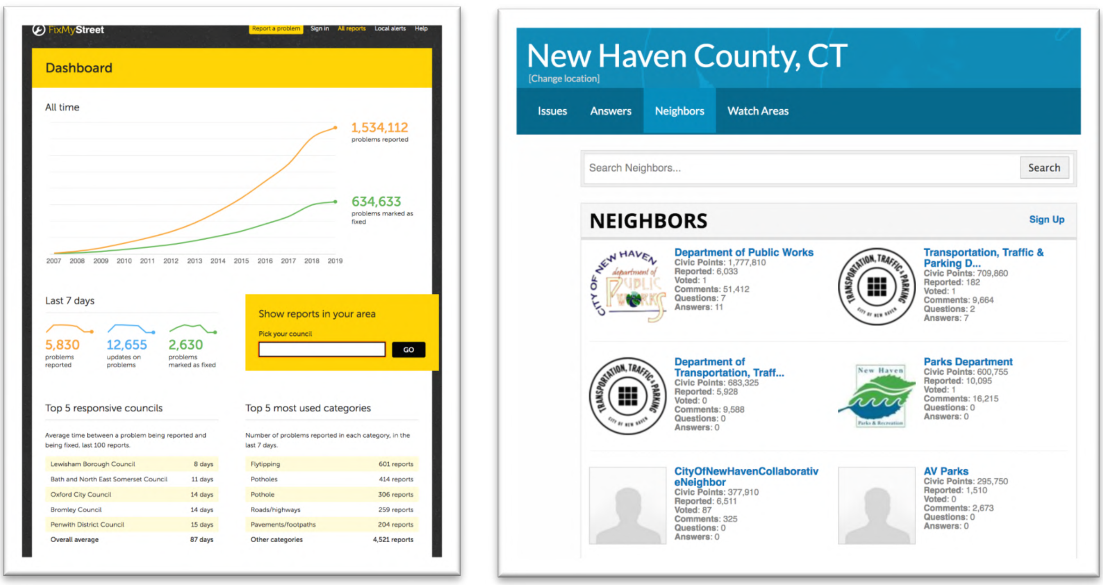

Fig. 4.9 Screenshots of the platforms FixMyStreet, on the left, and SeeClickFix, on the right. In the first case, the dashboard is oriented to evaluate the performances of the local councils receiving the reports, in the second case the civic engagement of platform contributors.

Technology. Reporting platforms work as public dashboards for the ordinary maintenance of public spaces and infrastructures. In FixMyStreet, **the public dashboard shows the performances of the public administration supposed to address the reports shared on the platform** (even though they have no formal obligation to do so). In SeeClickFix, there are two different dashboards: one providing the **map-based overview of all the maintenance operations and their status of advancement** (closed, acknowledged or open) and, more interesting, a second **dashboard showing the "civic points" of each contributor** in the attempt to quantify the level of users' engagement with the platform.

In platforms integrated into the flow of activities of local organisations, the role of technology is supporting the implicit coordination of officers working in different offices or departments by monitoring what reports had been already processed, when, by whom. However, these coordination practices are not traced on interfaces accessible to the public. Similarly, cooperative or collaborative practices of citizens directly intervening to address the reported issues remain untraced and unsupported.

4.3.1.c. Family 3: Environmental Monitoring Systems

The **YUCCA Smart Data Platform** (http://www.smartdatanet.it/) is an open-source platform developed by the Information Systems Consortium of the Piedmont Region (Italy) and serving several cities in the region. Differently from the majority of environmental monitoring platforms accessible only to the authorities managing the system, YUCCA is a platform accessible to individuals and organisations. Public agencies, businesses and research institutions can be hosted as guests, request a working area to elaborate the data available on the platform, or share new data, analysis, applications. Similarly to other platforms in the same family, contents and functionalities of the Yucca platform are exclusively oriented toward the exploration, visualisation and manipulation of static data and data streams, as shown in Fig. 4.10.

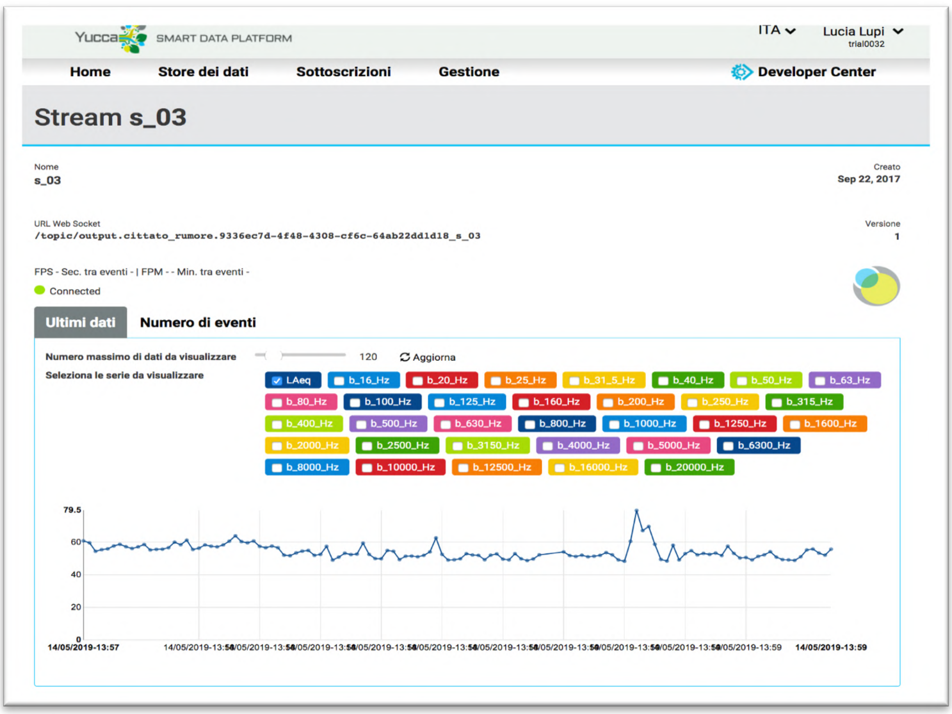

Fig. 4.10 Screenshot of YUCCA, section of the City of Turin, data stream on the level of rumor in the street. (Source:http://www.smartdatanet.it/)

Users. The access to this type of platforms is usually open, but regulated by the users managing the system. In this vertical relationship, the direct contact between individuals and organisations granting the authorisations to access data is replaced by technology mediation. As a consequence, **the users managing the system and the ones accessing to the platform are invisible to each other**, making difficult to connect what limitations are due to specific choices of the platform administrators and which are associated with the platform functionalities. No direct relationship among platform users is supported.

City. The representation of the city in this type of platform depends on the sensing infrastructure (IoT networks) installed in the urban environment. Thus, this **representation is fragmented** in a multitude of properties and measurable indicators for different spatial objects (e.g. trees, streets) and phenomena (e.g. rumour, pollution, traffic level). The representation of these objects and phenomena is though deeply conditioned by **the capabilities of the sensors, and not by the characteristics of the activities in the urban environment that sensors are meant to capture**. In this sense, the area of interest of these technologies is unspecific, because the way places are represented is dependent on the technology only and not based on the specificity of places or activities. This is a critical point distinguishing this family of technologies for cities from platforms as USRA. In situational monitoring systems, the representation of the city is filtered and mediated by humans deciding categories and priorities in the visualisation of information that is contextualised in the processes and operations to be implemented and managed.

Technology. The scope of the platform is virtually **facilitating the public monitoring of urban and environmental indicators** in order to allow a better **understanding of the current state of affairs** of spatial phenomena. This kind of platform is supposed to potentially help in planning future actions (interventions, services, policies). However, as mentioned before, this type of platform does not provide support for coordinating extra-ordinary and ordinary actions of a plurality of public agencies. Similarly, these dynamics are not supported on the side of groups of users such as citizens or businesses, keep separate by design. As a result, these platforms can be considered more **living archive** than infrastructures for city management.

4.3.1.d. Family 4: City Dashboards

The **Sidney City Dashboard** is a significant example of the most common instantiations of this type of technology ideally aimed to give an overview of what is going on in the city. Very similar configurations can be found in the dashboards of London and other UK cities (http://citydashboard.org/london/). More elaborated platforms trying to integrate different views of the city follows the model of the portal “Dublin City Dashboard” (https://www.dublindashboard.ie) providing separate windows for distinct views. Lastly, major corporations such as CISCO or IBM or Samsung have a wide range of customised versions of city dashboards (e.g. Cisco Kinetic or IBM Intelligent Operation centre) that so far are the predominant type of platforms associated with smart city programmes. In this landscape, the Sidney City Dashboard is perhaps not the most advanced example of this family of solutions, but a representative one of various commercial platforms and working prototypes.

The Sidney City Dashboard is a web portal aggregating real-time information on the status of public services (usually transportation), weather conditions, energy consumptions or pollution levels, updates from the official social media accounts of the local authorities, and breaking news from local media. In addition to that, it provides one or more spots for live cameras in the city. It is very common that these platforms have a double visualisation, by grid (as shown in fig 4.11) and on the map.

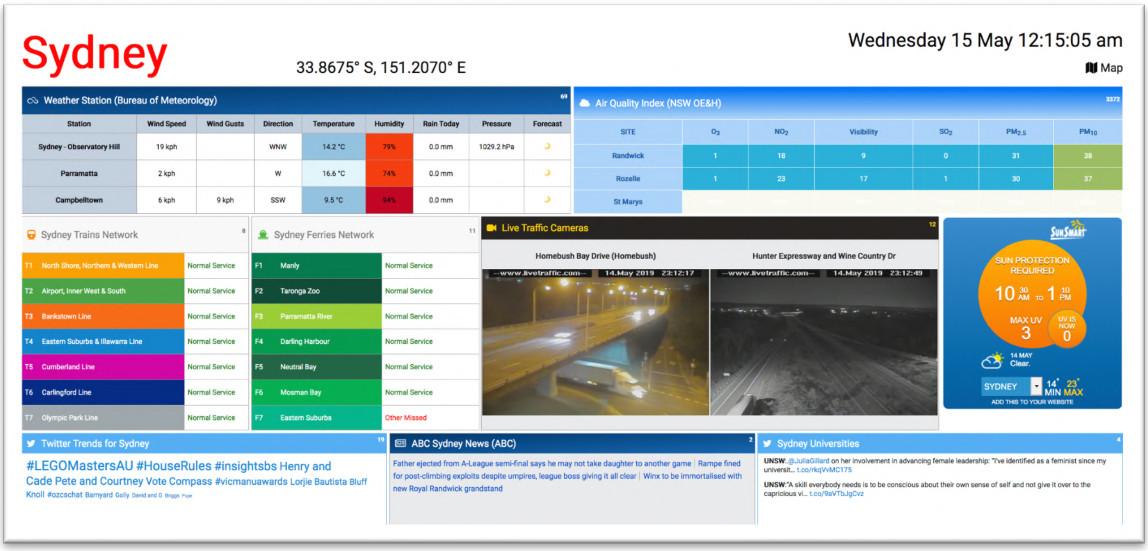

Fig. 4.11 Screenshot of the city dashboard of Sydney. (Source: http://citydashboard.be.unsw.edu.au/)

Users. The contents of the public interface of City Dashboards are in general established and regulated by institutional bodies, that are also the main beneficiaries of the access to such information. In this case, the platform does not support any action on the side of the general public enabled to access to the platform through the web. The **external users of City Dashboards are invisible**, untraced, and hardly supported to have any use of the available information.

City. Analogously to what highlighted for the environmental monitoring systems, also in this case, the representation of the city is determined by the structure of data collected through sensors or the cameras installed in the city. However, the **selection of the information usually displayed is characterised by absolute neutrality respect to the city functions**, or the various agencies operating in the city, or other local stakeholders involved in city management. This selection reflects not a specific representation of the urban environment, but the intentional use of a neutral representation of the urban environment to prevent potential misinterpretation of data. The result is a city that dynamically changes (differently from reporting platforms) but emptied of significant information that could possibly generate conflicts between different segments of platform users.

Technology. This type of platforms, especially in the form of simple web portals disconnected from the organisations responsible for the city management or functioning as a window on city control rooms, has a **symbolic value more than an operational purpose**. Technology in itself is used as media to communicate and project in the public sphere a certain vision of local services as more responsive to urban phenomena and more efficient because using technology to have the city under control constantly. In other words, **city dashboards are a message** to the public having a codified structure and an understandable semantics, even without having any apparent use. Taking into account this specific role of city dashboards in the interaction between users and the city, it also becomes obvious their technical limitations to support coordinative, cooperative or collaborative practices neither behind nor aside the platform, both among local authorities or other local stakeholders.

4.3.2 EXCHANGE PLATFORMS

The label "Exchange Platforms" indicates the second macro-level family group of technologies. It includes **platforms and tools aimed to enable, facilitate or support the exchange of inputs and services between city governments and citizens or local organisations.** The corresponding low-level technology families are:

e) Voting and public debate platforms
f) Citizens proposals collectors and city forums
g) Open Data Portals
h) E-gov Services

These four families are mapped in the two quadrants of the contextual factor cube corresponding to the following combination of factors: Vertical Intangible Specific and Vertical Intangible Unspecific [see Fig. 4.12 and 4.13].

- *Vertical Intangible Specific.* The platforms devoted to letting **citizens debating and voting or proposing new interventions and initiatives** are usually oriented to catalyse the attention on specific areas of interest and issues, both as extraordinary events requiring the temporary mobilisation of a certain population in decision-making processes of public interest or as part of ordinary activities of public engagement. The central focus of these platforms is on intangible aspects of city life, such as the provision of services or the democratisation of local development processes.

Fig. 4.12 Mapping of voting and debate platforms and citizens proposal collectors in the contextual factor cube

- *Vertical Intangible Unspecific.* This family of web-based technologies includes **Open Data Portals** and **e-gov tools** at the local level. These technologies express competencies and responsibilities of local authorities (e.g. municipalities) or public agencies operating at the local level (e.g. city unit of a regional health agency) toward citizens. Their focus is on government transparency, as well as improving the quality, accessibility and efficiency of public services, therefore mostly on the intangible aspects of city life. The areas of interest are unspecific, in the sense of linked only to the territory included within the administrative boundaries and not to specific places in the city to which the tools refer.

Fig. 4.13 Mapping of open data portals and e-gov services in the contextual factor cube

4.3.2.a. Family 5: public debate and voting platforms

DecideMadrid (https://decide.madrid.es) and **Civocracy** (https://www.civocracy.org) follow two common schemas of public debate and voting platforms. In the first case, these two core functions are combined, while in the second case the attention is on the public discussion and quantification of the “constructive contributions” to the debate without necessarily setting a formal vote among pre-defined options.

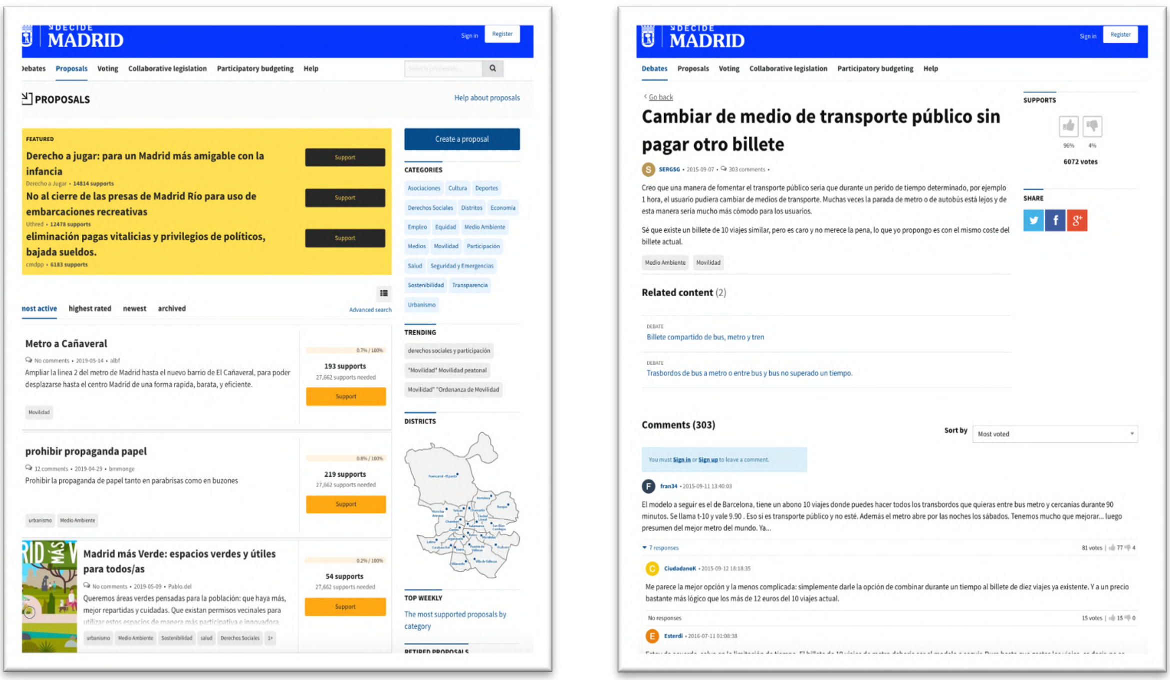

Fig. 4.14 Screenshots of DecideMadrid, an example of platform for public debate and voting. (Source: https://decide.madrid.es/)

Users. In this family of technologies, there is a clear distinction between the Public Administration providing a space of discussion and the citizens called to participate. In this virtual environment, the **administration responsible for the platform set the conditions for action**, such as establishing a “relevance threshold” for citizens proposals and inputs. Also, **the administration can act on the platform independently from the established rules and constraints.** Thus, unbalanced capacities and competencies between public administrations and individuals are also reproduced in different capabilities of the platform respect to the two users’ groups. For instance, while citizens proposals require thousands of supporters to be voted, administration proposals usually have no threshold for voting.

To this regard, it is important to notice that almost no citizen proposals can reach the established threshold in platforms supporting these relationship patterns, or not even getting closer to that. Indeed, there are **no mechanisms to support the aggregation of similar proposals or the effective navigation among the existent ones to avoid repetition and potentially creating coalitions of interests among users.** In DecideMadrid, citizens proposal rarely passes the 1% of the required number of supporters to have a proposal taken into account by the Public Administration, even though topics and requests of most of them are quite similar and could be easily composed. Same patterns can be observed in many other debate and voting platforms, enormously limiting the potential support to dialogue and open discussion on sensitive topics.

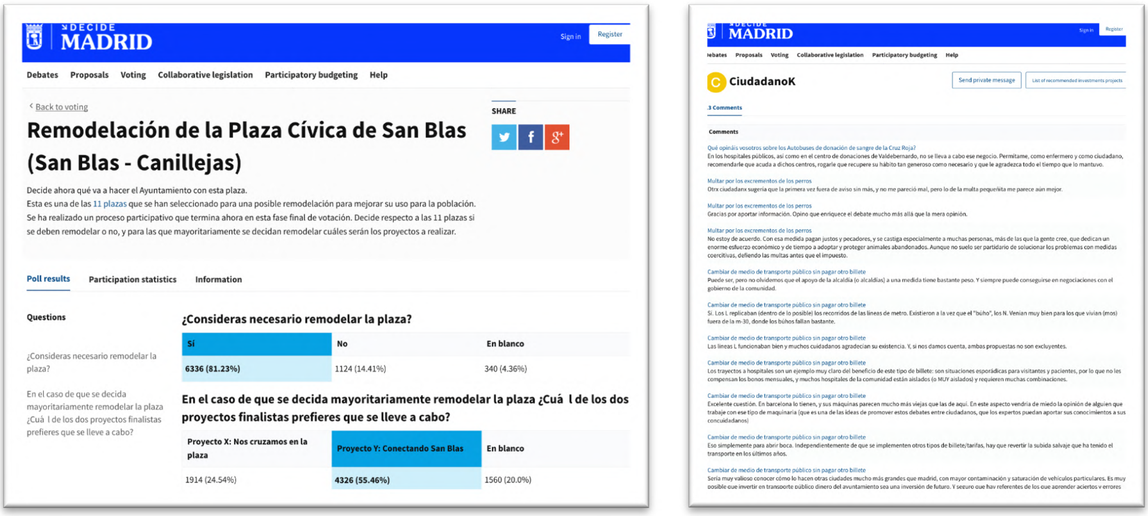

Fig. 4.15 Screenshots of DecideMadrid, example of voting report page and user profile. (Source: https://decide.madrid.es/

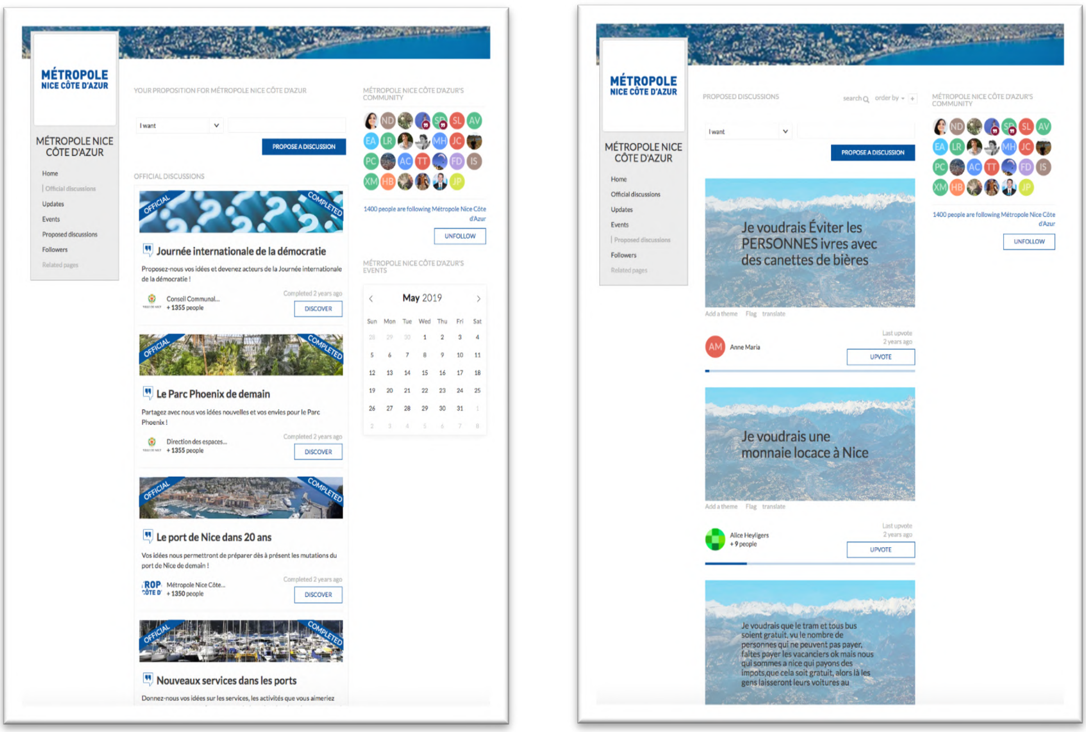

Fig. 4.16 Screenshot of Civocracy, example of a public debate platform. On the left, the "official discussions". On the right, the discussions proposed by citizens. Source: https://www.civocracy.org/nicecotedazur/discussions/official

In platforms like Civocracy, even without a threshold, the number of contributions to debates proposed by individuals, as well as public discussions proposed by local authorities is quite limited, even on topics related to decisions and projects potentially really affecting city life such as new infrastructures. The difference between **official and unofficial debates** is highlighted by outlining the interfaces for their presentation in more or less formal ways [see Fig. 4.16]. Moreover, **the different status and responsibilities of authorities and citizens are reflected in the way the platform engages users**. In the first case, public officers are asked to detail the key elements of a debate or proposal, and in the second case, citizens are invited to express what "I want", "I want to help", "I want to solve" or "We should". On the other hand, citizens can access and use the system also as anonymous or under weak identification protocols (no mandatory real name or identification through ID card number or equivalent). Thus, citizens are considered vaguely responsible or accountable for the shared contributions, while the public administration remains the only subject accountable for their proposals and the legitimate use of the platform in a public arena. Only in specific circumstances, such as participatory budgeting for neighbourhood interventions, the registration on voting platforms can require a proof of residency to restrict the right of voting to the interested population.

City. The physical components of the city, such as public spaces or mobility infrastructures, are usually the principal objects of debate and discussion, often in relation to plans and projects targeting specific areas. However, this type of platform is oriented to represent the **city as the corpus of citizens**, a collectivity spatially aggregated characterised by its intangible perceptions, values, needs, expectations, opinions. In this sense, the **city is primarily represented as a political entity**. As regarding the temporal aspects of the city life, these **platforms are oriented to capture an instant** in the present (the vote or the taken decision), instead than tracing over time the local processes associated with the results of public debates and votes.

Technology. Voting and debate platforms are usually associated with **extra-ordinary actions** requiring timely inputs, discussions and decisions carried out on a short time, while the **tools can be accessible in continuity**. Their main use is to mediate the communication between administration and citizens. Secondarily, they are meant to facilitate the communication among citizens involved in a debate. However, these platforms do not usually provide support to the aggregations of interests among users for enabling their active cooperation and collaboration toward a specific action to be publicly voted[8].

As also highlighted for city dashboards, it is important to be aware of a potential use of voting platforms by the public administration that is not necessarily operational. A public debate platform can work indeed as a complex media to communicate the openness and attention to democratic processes by a public administration, independently from its actual use, adoption, penetration. At the same time, the mechanisms put in place by the platform are required to minimise the risks coming from this democratisation. The conscious or unconscious perception of this misalignment between use and capabilities of these technologies can affect the behaviours of the platform users and their offline relationships with public authorities favouring antisocial and destructive attitudes, distrust in public authorities for lack of transparency, unrealistic expectations of individually orienting city-scale decisions.

4.3.2.b. Family 6: Civic initiatives collectors and city forums

Neighborland (https://neighborland.com) and **Talk London** (https://www.london.gov.uk/talk-london/) [Fig. 4.17-4.18] are two examples of engagement platforms intentionally aimed at stimulating collaboration

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[8] The voting platform "Liquid Feedback" is a notable exception to this schema, because the system is explicitly oriented to support the collaborative construction of proposals, as well as the cooperation in determining informed decisions of voters. This platform will be discussed in detail in Chapter 8, as part of the case study of WeGovNow.

among citizens and better cooperation between local government and citizens. Neighborland is a platform devoted to collect and develop initiatives of public interest, and Talk London is a listening point for citizens opinions. In both cases, the engagement of users is not oriented to vote for something or taking specific decisions. The pursued goal is supporting dialogue among public agencies, grassroots organisations, private institutions for promoting changes in the management of public resources, improving community services, or sustaining social innovation processes. These platforms also work as archives of these initiatives to document local efforts in participation processes.

Users. Similarly to other families of technologies reviewed so far, platforms collecting civic initiatives and establishing public forums are provided by local authorities. Differently from debate and voting platforms, these **online environments are conceived as operational space and meeting places, frequently associated with offline actions such as local initiatives or events**.

This configuration softens and balances the asymmetry between host and guests on the platform. This asymmetry is due to the fact that the authorities responsible for the platform are in the position of deciding to maintain this public space opened. Moreover, they can facilitate certain uses or agendas, and privilege certain tools available for the system manager only such as surveys or broadcast messages. This asymmetry pushes for using the platform capabilities to reinforce the engagement on administration-led initiatives, for instance by offering rewards for the online participation or selectively choosing controversial topics to keep alive users' attention as can be observed in the Talk London platform. Indeed, the level of engagement in terms of the number of users involved in constructing an initiative or in discussing a topic is usually quite limited.

Another important difference in respect to voting and debate platforms concerns the involvement of local partners, mainly organisations and other public agencies. They usually receive visibility and public acknowledgement in relation to specific ideas, projects or discussions on the platform through dedicated sections and mentions. Extending the groups of public authorities and agencies or local organisations directly accessible in a shared space (beyond the platform providers) amplifies the benefits of its use both for providers and users of that shared space. The subjects implicitly ignored by this family of platforms are local enterprises.

City. Platforms for collecting civic proposals and dialoguing about everyday issues and future directions at the local level are based on the assumption of the **city as a dynamic space**. These platforms communicate to users the idea of the **city as a transformable entity**, reactive to local needs and opportunities. This type of platforms tends to focus on actions related to city services (e.g. "housing" or "the market of S.Thomas"), lightly representing these functional clusters in connection to the physicality of the urban environment. Indeed, users are assumed as local residents. As local residents, they potentially know already how to contextualise these services in a specific space without requiring the platform to provide the needed information. Similarly, users are assumed as potentially able to make sense of personal opinions, suggestions, proposals on the basis of their direct experience of places and city services. However, the experience of places and city services among different groups of users (that not necessarily live or work in the same area) can vary enormously making more difficult to assume a common ground and not represent it on the platform.

Technology. The actions outlined in this type of platform are promoted or documented online, but not directly mediated or supported through technology. For this reason, this type of platform is usually strongly integrated with social media platforms and other tools projecting the platform contents outside and increasing their outreach. Civic proposal collectors and city forums are platforms intended for continuous use and multiple purposes at the same time across a variety of topics.

Differently from voting and debate platforms, tools such as Neighborland provide support to the aggregation of interests around specific proposals, potentially leading to an active offline and online engagement. For instance, a dedicated page for each proposal is enriched by all the people involved, their contribution, a timeline of the proposal, explored alternatives, and so on. Beyond the cooperation in a single proposal, there is no technical support to the coordination of distinct initiatives or the collaboration among groups working, for instance, in near areas or on the same themes.

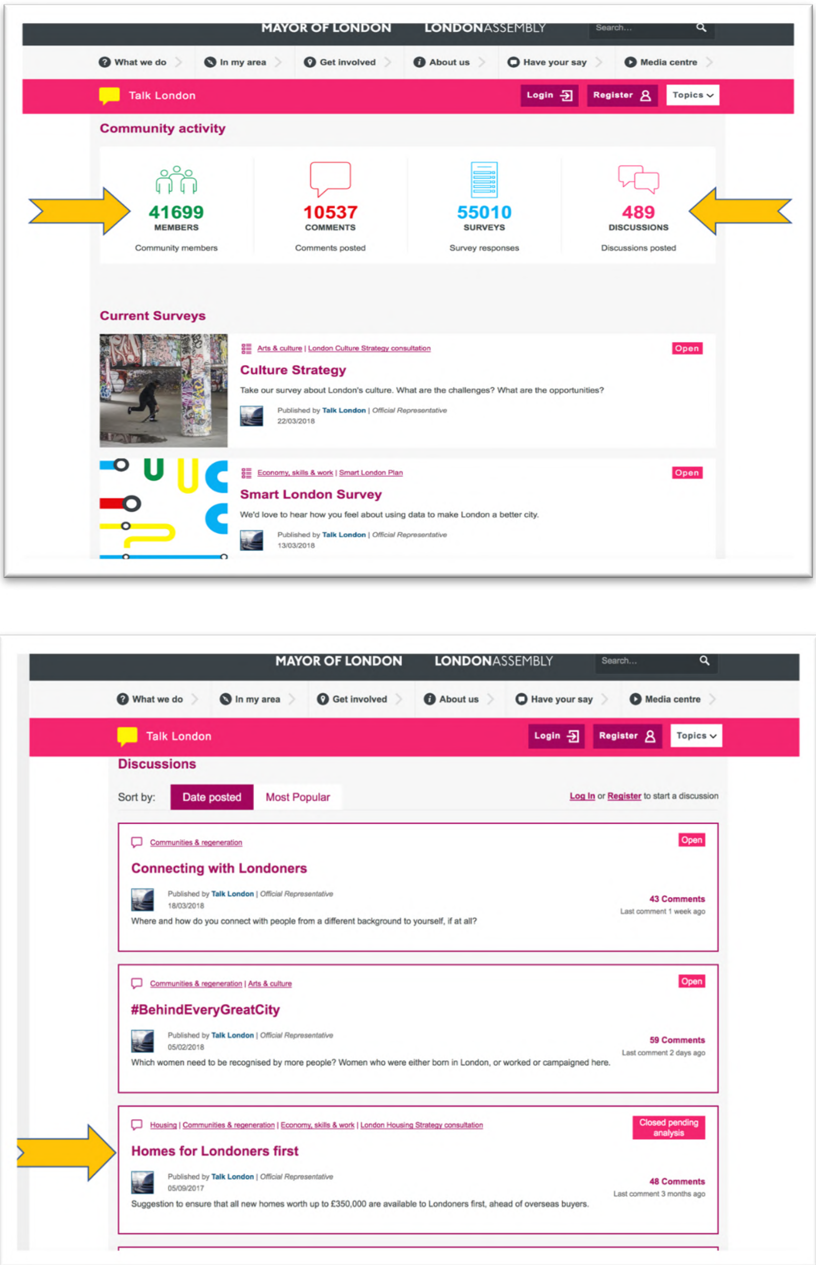

Fig. 4.17 a and b, Example of a public discussion platform at city level. (Source: talklondon.uk)

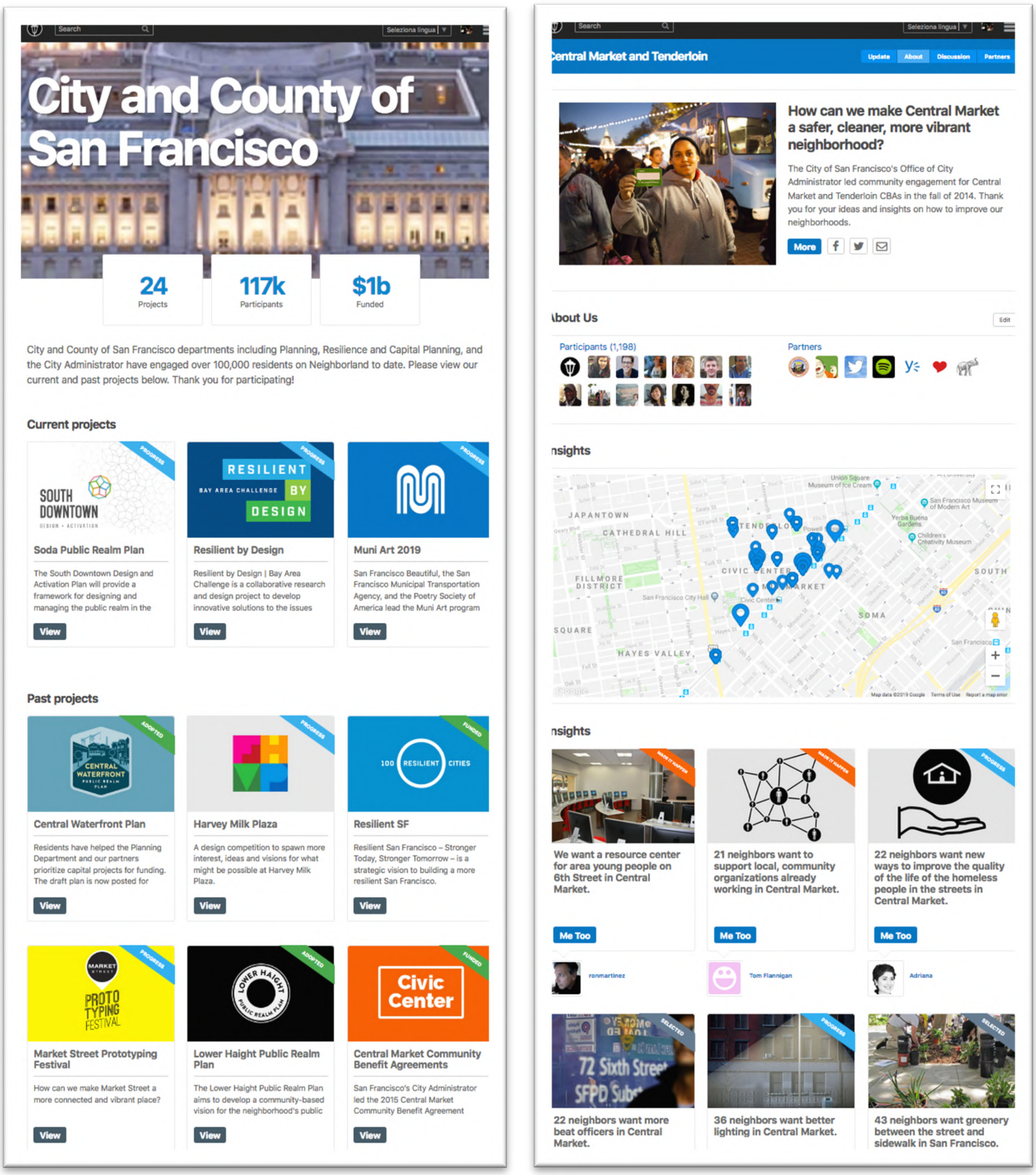

Fig. 4.18 Screenshots from Neighborland, an example of a collector for local projects proposals. (Source: Neighborland.org)

4.3.2.c. Family 7: Open Data Portals

The **Bristol Open Data portal** (https://opendata.bristol.gov.uk) represents a standard example of city data portal providing both access to open data and basic tools for their visualisation. City Open Data portals are usually designed as static data repositories to be updated by public officers and downloaded by everyone. As other data portals, it provides access to data that can be grouped in macro-topics (health, population, environment, mobility, see Fig 4.19 a) or listed to select the properties of the wanted datasets (year, format, keywords, see Fig 4.19 b). According to the new trend of making data more accessible and explorable for the general public, the Bristol Open Data portal also provides analytic tools to visualise data on maps or graphics [see Fig. 4.20 a, b].

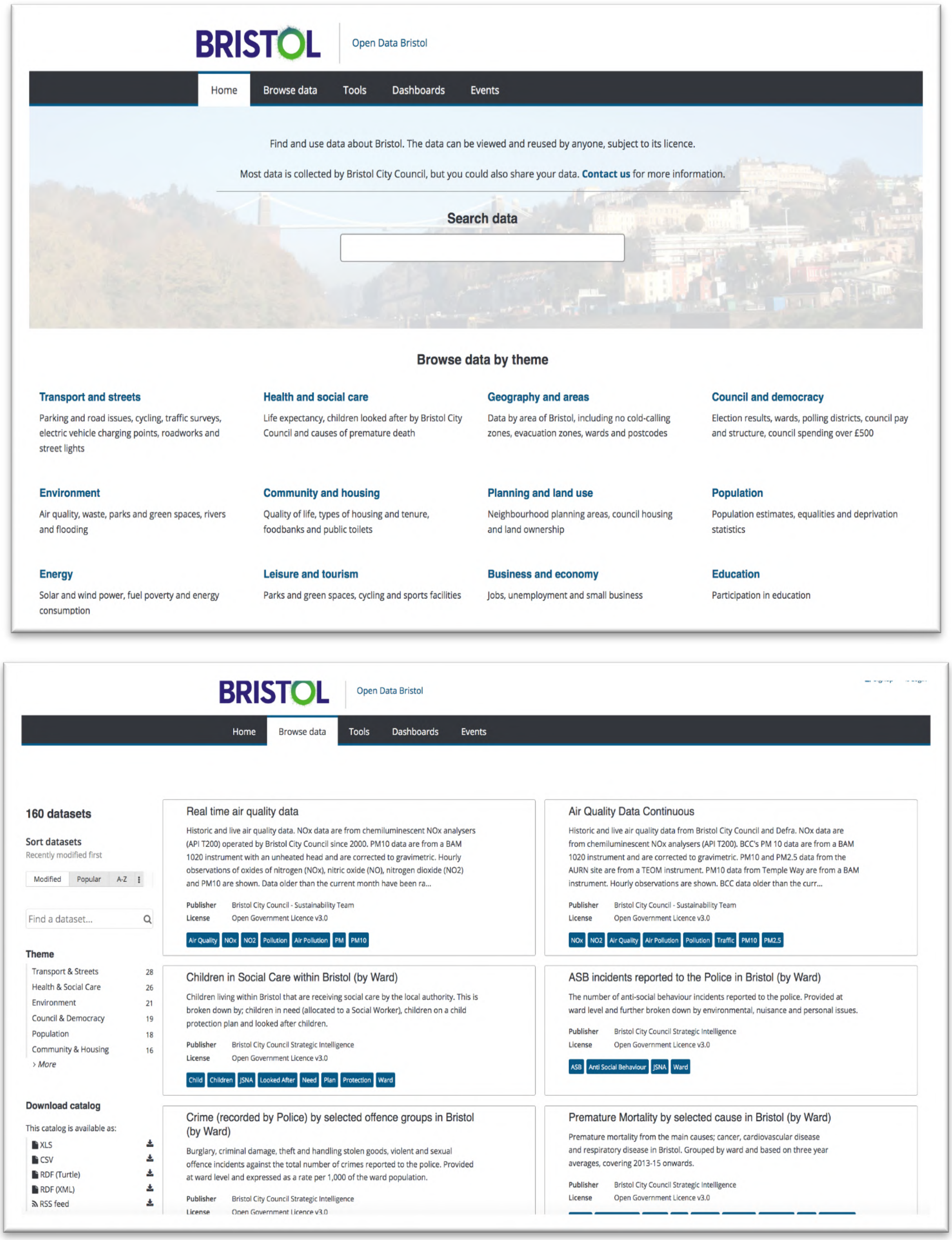

Fig. 4.19 Screenshots of the Bristol Open Data Portal. Browsing datasets by theme, on the left, or by list, on the right. (Source: https://opendata.bristol.gov.uk)

Users. Open Data Portals at the urban level are provided by local authorities (City Council or equivalent). According to the governmental structure of different countries, the datasets provided by local authorities on Open Data portals can be mainly produced by the same authorities (e.g. in Italy) or be dependent on data produced by national agencies (e.g. in the UK). Rarely, more than one agency has visibility on the portal, that is considered an online organisational space. The general public is formally considered as intended users of Open Data Portals, even though the actual users are public officers, community activists and technology companies. Indeed, this family of technologies is characterised by an **extreme distance between the segments of intended users and the actual users** [an extensive discussion of this point is available in Chapter 9]. This distance is established by design in Open Data portals, that are structured on the needs of public agencies and authorities publishing data on the portal, but not on the needs of users supposed to use those data despite limited data literacy and digital skills. Data visualisation tools mitigate and mediate the exclusion of non-technical users, though without balancing the utility and efficacy of data portals for the involved parties.

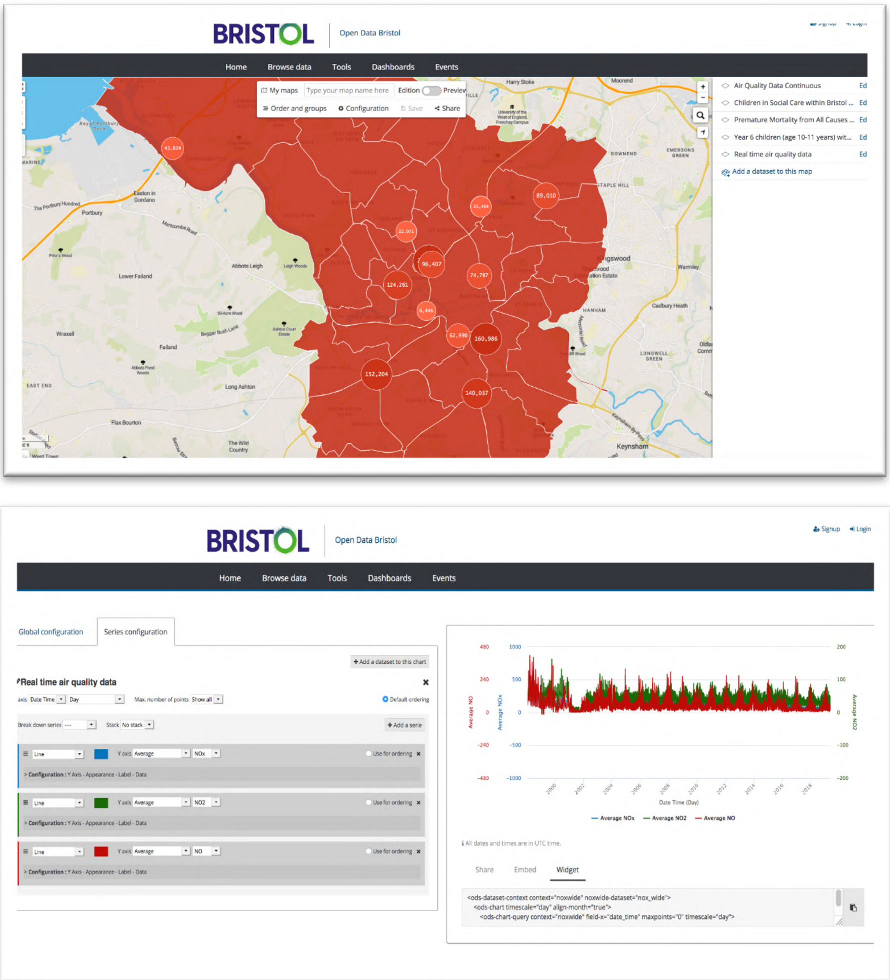

Fig. 4.20 Tools for the visualisation of the available dataset in the Bristol Open Data portal. (Source: https://opendata.bristol.gov.uk)

City. Open Data portals at the urban level usually contain data associated with services provided within the urban area or to indicators describing specific phenomena at the local scale (e.g. demography, education level, employment rates). **The city in its materiality disappear behind data**, and at the same time, it becomes an **entity objectively described and parameterised**. This objective description of the city emerges **from the perspective of the Public Administration**, assumed as unitary and meaningful also for other users 'groups. Spatial and temporal qualities of city activities are possibly incorporated within the portal datasets (that can be updated or visualised on maps), but not drive the interactions of users with data on the portal.

Technology. Open Data portals are not meant to directly support any actions in the city or activate relationships with other users (included data publishers). The **portal mediates data-related transactions** by providing a digital space for the **preliminary exploration of data and their download**, but not for the communication among users. In this case, a wide range of **actions supposed to be enabled by the portal**

(e.g. monitoring the activities of the public administration, planning the provision of public services, taking business or civic decisions) are **independent of the functionalities provided by the portal**. These actions happen online or offline, but outside the portal, and in general, the use of the portal is episodic.

4.3.2.d. Family 8: E-gov services

TorinoFacile (https://servizi.torinofacile.it/) is an example of web portals for accessing to the full set of digitalised services of a municipal administration, including registries (births, marriages, deaths, residency, citizenship), local taxes payments, certifications, appointments in public offices, complaints and claims submission.

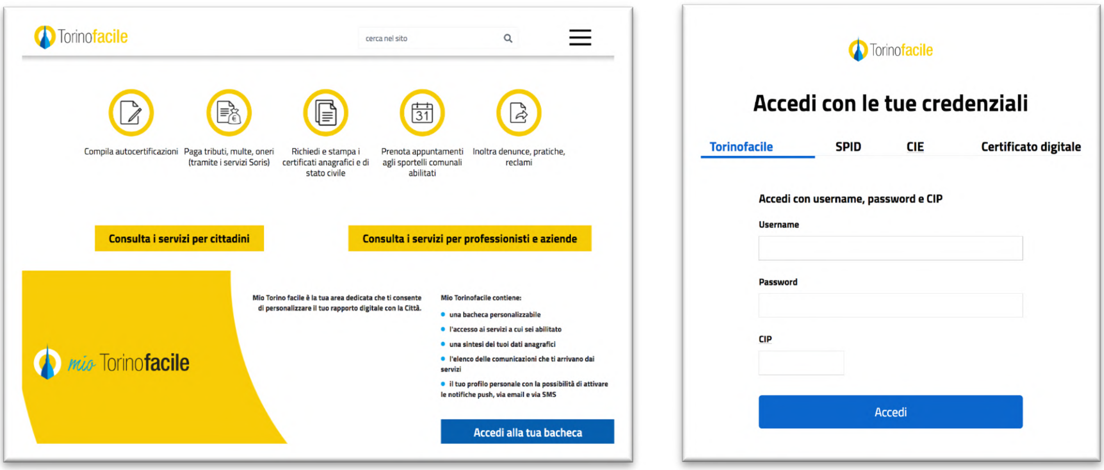

Fig. 4.21 Screenshots of Torino Facile: home page and user login (source: https://servizi.torinofacile.it/)

Users. E-gov services at the city level are explicitly meant to be used by **local residents and citizens, or enterprises relating to the Public administration for bureaucratic purposes** [see Fig. 4.21.a]. Differently from Open Data portals, citizens are not framed as the general public with undefined needs. E-gov portals transpose in a digital environment **consolidated scheme of interaction between PA and individuals**, and also clear needs developed over decades or even centuries (e.g. obtaining certificates, paying local taxes).

While Open Data portals are potentially accessible by anyone and in an anonymous way, e-gov services require a **reliable identification of users** based on details of ID cards, VAT number, National Insurance Number, and official documents [see Fig. 4.21 b]. On the other hand, individuals univocally identified by the system (and cooperating with the system in its operations) interact with the system for automatic procedures or with non-identified public officers, acting on behalf of their organisation. However, both sides, **individuals and organisation, benefit from the use of the system** (e.g. avoiding long-hours queues and reducing face-to-face exchanges in public offices).

City. Similarly to what mentioned for Open Data portals, the representation of the city in this family of technology is dematerialised and filtered under the perspective of the providers of e-gov services. However, differently from an aggregation of datasets simply describing the city, the catalogues of digital services accessible through e-gov portals reflect offline operational frameworks of city activities (PA/citizens practices) and provide a shared space for direct action to public administration and citizens.

The city in itself remains in the background, as an undefined static entity within administrative boundaries. The temporal dimension of the activities associated with public services is suspended or not represented on the platform, except than for pointing to offline offices contacts [see Fig. 4.23].

Technology. The role of technology in this family of applications is mediating the access to public services and making more efficient their supply by local authorities. E-gov portals support routine activities, rarely handling exceptions or extraordinary procedures. E-gov portals support the cooperation without individual users and agents of public organisations on the platform to produce documents having a recognized social value for actions outside the platform. In this sense, e-gov portals become enabling technologies for end-users, even though the terms of the cooperation are decided exclusively by the portal owners. At the same time, mechanisms enabling the internal coordination or collaboration among different departments of the public administration are not visible on the portal, if in place (e.g. visibility of the status of users' requests for the platform administrators).

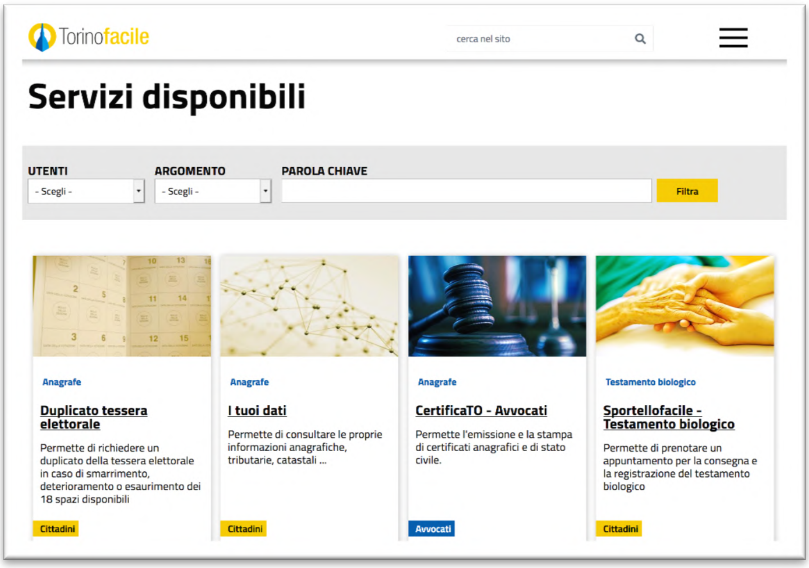

Fig. 4.22 Screenshots of Torino Facile: catalogue of online services (source: https://servizi.torinofacile.it/)

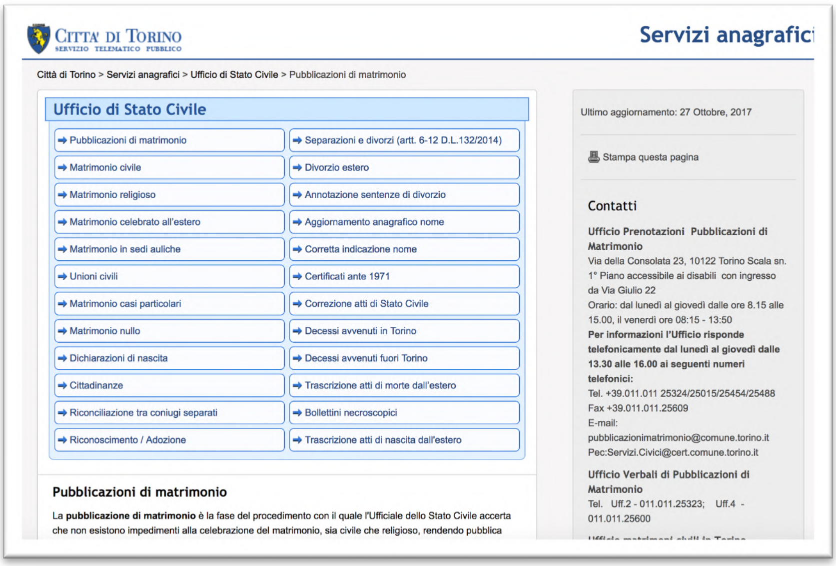

Fig. 4.23 Screenshots of the online registry services of the City of Turin (source: http://www.comune.torino.it/anagrafe/)

4.3.3 SCOUTING PORTALS

The label "Scouting portals" is associated with the third macro-level family group of technologies in the proposed classification schema. These portals are aimed at **supporting users in the exploration of the city context and its available resources.** The corresponding low-level technology families of this group are:

i) Community mapping tools
j) Location-Based social networks
k) Civic crowdfunding
l) Sharing platforms

These four families are mapped in the two quadrants of the contextual factor cube corresponding to the following combination of factors: Horizontal Tangible Specific and Horizontal Tangible Unspecific [see Fig. 4.24 and 4.25].

- **Horizontal Tangible Specific.** Community mapping tools, wikies, community portals, hyperlocal journalism portals have in common a deep connection with the specific place in which a certain group of users contextualised its actions, both ordinary or framed in short-term projects.

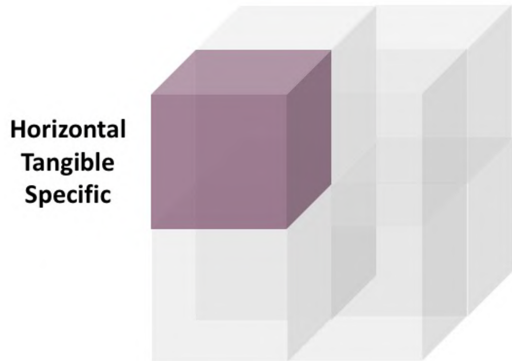

Fig. 4.24 Mapping of the scouting portals in the contextual factor cube

- **Horizontal Tangible Unspecific.** Civic crowdfunding and sharing platforms have in common the standardisation of a limited set of operations, virtually repeatable in every context by every group of people.

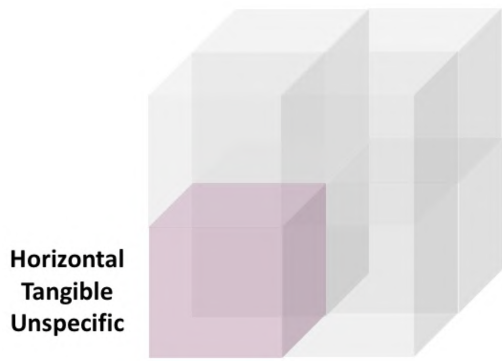

Fig. 4.25 Mapping of civic crowdfunding and sharing platforms in the contextual factor cube

4.3.3.a. Family 9: Community Mapping Tools

Community maps (https://communitymaps.org.uk) is a representative while advanced example of participatory and/or collaborative online mapping tools. It is explicitly intended to support local initiatives, differently from more commercially oriented tools such as Map Creator (https://mapcreator.here.com/). The platform is based on a catalogue of projects aggregated by themes. Each project corresponds to a web page including an interactive map, the category system with its description, and the wall of the users'contributions on the map. Users' contributions can include point of interests, shapes drafted on the map, texts or media [see Fig 4.26].

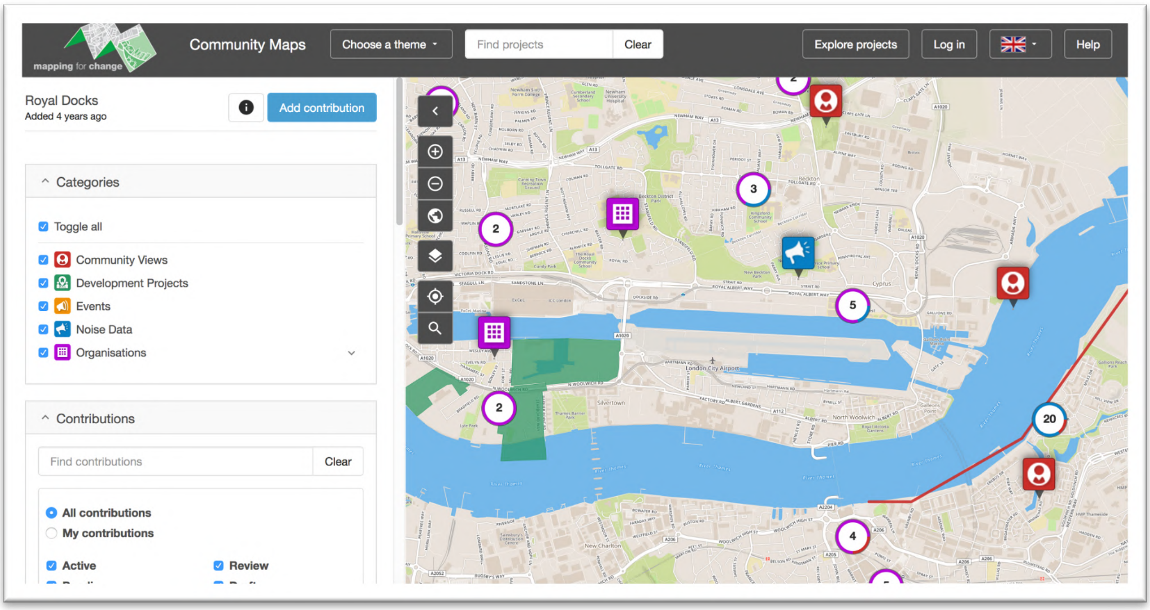

Fig. 4.26 Screenshot of one of the projects on the platform "Community Maps".
(https://communitymaps.org.uk/welcome)

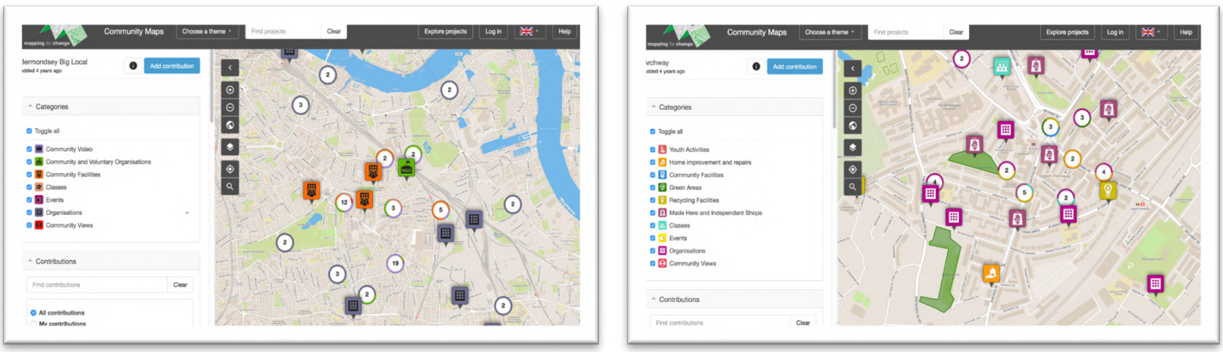

Fig. 4.27 Screenshots of two projects on "Community Maps" (https://communitymaps.org.uk/welcome)

Users. The platform, provided by third parties, is available for every kind of organisation (local authorities, non-profit sector, university, citizens groups) that can set its own project and set the rules for internal and external contributors. The rules that each group can set concern the definition of the category system for the map entities (labels, icons, see Fig.4.27) and the protocol for contributing to the project (e.g. pending publication based on prior approval, project opened to external contributors or restricted to a specific group).

In this sense, this tool is a democratic space that can serve a plurality of actors and purposes and be activated by any group.

As regarding the map's contributors, the structure of relationships among users is basically horizontal, even though project promoters are called to establish topic and categories for their initiative, and they can decide whether their space on the platform is opened or not to external users. Indeed, control mechanisms over other users' actions on the platform are extremely limited. The extra-agency of the promoters is pushed over esthetic choices and labels, but not over contents, their visibility, aggregation, accessibility (differently from debating platforms, for instance). Shared information is indeed supposed to benefit both promoters and contributors, but also the general public exploring the project.

City. Even though the core of community mapping tools is usually a map of tangible local resources available in the neighbourhood or at the urban level (e.g. monuments, schools, groceries, bicycle lanes), the city remains a static entity on the background of users' interactions with the platform. Indeed, the temporal dimension is not considered in the map-making. The community map is potentially developed during the timeframe of a specific initiative (or opened for an indefinite period), but the value of contents is not directly connected to that time (e.g. mapping bicycle lines during a neighbourhood workshop is a kind of information represented as time-independent).

As regarding the spatial aspects, an interesting point is that the same shared space of the city is rendered as a group's space, deceptively separated from the rest of the city on the background because closed within a specific project page. In other words, even several projects carried out in the same area remain invisible to each other, as well as other developed on similar themes on close areas, or at different scales, or in a different timeframe. Mapping tools, Community Maps included, do not provide an instrument to integrate or aggregate contents across different projects (because of design and business model constraints). As a result, each community map provides a subjective and specific representation of the city within a collectivity.

Technology. Community maps, like many other similar tools, is not integrated with other web-based technologies (e.g. social media, civic crowdfunding, external community portals) where the mapping projects could be connected to other online and offline actions (e.g. donating, organising a local event). The platform itself is closed respect to what happens outside, even if related to the same initiative corresponding to a project.

The tools provided to promoters and users are flexible to accommodate a variety of preferences and possible customisation (colours, icons, media, images), but not versatile. In this sense, the range of needs and actions, as well as the ways to support them remain limited. The map-making is primarily oriented to self-learning and community reflection purposes, but not oriented toward more operational or practical endeavours.

The visualisation of the users' contributions on the map allows users to avoid duplication of contents and comment on existing contents, besides enabling the cooperative production of the map by a collectivity. However, there are no specific functionalities to support the coordination of contributors in making the map or using the map for offline actions, because of the lack of temporal features and communication options beyond comments. Collaborative mechanisms for the collective development of contents on the map are not in place. In other words, the same points of interests and shapes do not admit multiple concurrent contributors.

4.3.3.b. Family 10: Location-Based Social Network

Nextdoor (https://nextdoor.com) is the most popular location-based social network, self-defined as a private social network for neighbourhood communities. Many other tools followed the same principles and adopted the same features of NextDoor in different countries, generating independent or affiliated tools (e.g. TocTocDoor). The platform is centred on a wall showing local newsfeed composed by multimedia users' posts (text, images, videos). The wall also works as a marketplace for advertisements of local companies, job offers and requests, and houses sales notice [Fig. 4.28 a and b]. Users can also directly contact other users through private messages or share public alerts, that will reach other neighbourhood through SMS, beside the platform. An additional map-based interface provides an overview of the adoption rate of the platform at the neighbourhood level [Fig. 4.29], but it is not connected with the newsfeed or other functionalities.

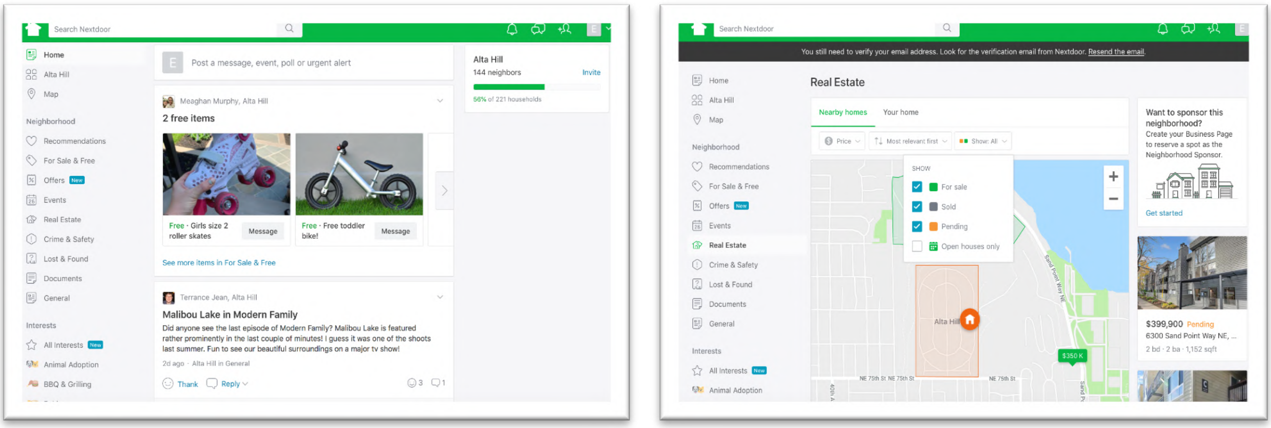

Fig. 4.28. a and b - Screenshots of Nextdoor (https://nextdoor.com)

Fig. 4.29 Screenshots of Nextdoor, map-based visualisation (https://nextdoor.com)

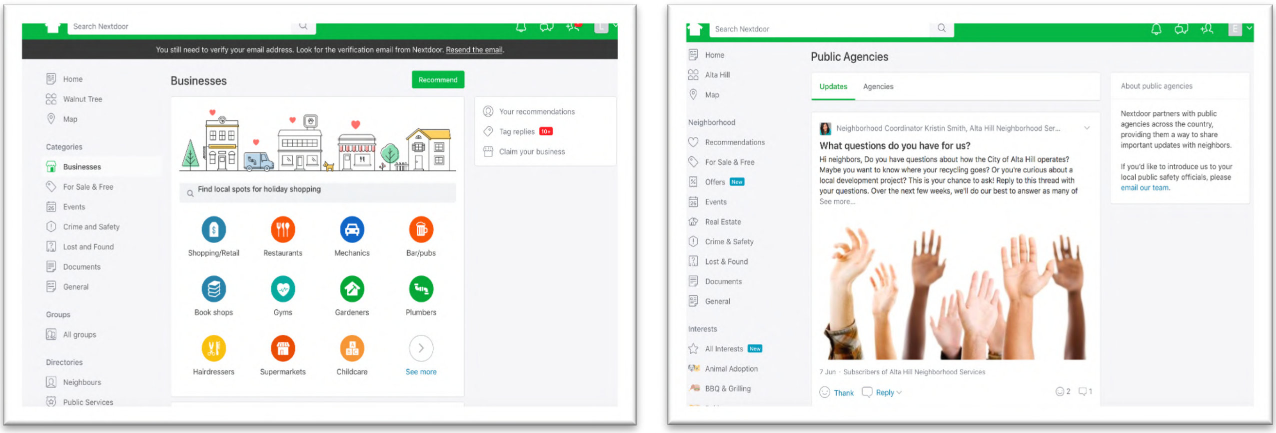

Fig. 4.30 a e b. Screenshots of Nextdoor, category system and public agencies account (https://nextdoor.com)

Users. Nextdoor and equivalent platforms have a strict procedure for the **authentication of users** because the main advantage promoted by the platform is providing a dedicated online space for verified residents only (in contrast with global social networks). Thus, the online subscription is completed upon the reception of a physical card with an authentication code at the address provided on the website, implicitly certifying the real existence of users. While in e-gov tools the certainty of users' identity is a requirement for accessing to public services, in platforms such as Nextdoor is a system to establish boundaries among residents in different areas, as the assumption for distinguishing communities. This choice resulted in being critical as regarding dysfunctional behaviours such as racial discrimination, increasing of fear and suspect for strangers and newcomers, and other related issues.

The platform is provided by an ICT company acting as third parties respect to users and local organisations. Once a new neighbourhood is activated with its first subscriber, users are engaged in inviting their direct contacts to join the platform and contribute to the creation of an online community. In this setting, users related to each other horizontally. There are no explicit or implicit roles established by specific functionalities, and the rules for the community reflect the commonsense practices of shared physical space.

Local businesses can be listed in a catalogue, recommended, tagged in users' posts or even claimed if their activity is mainly local, as well as their services (e.g. real estate agencies). Still, they remain attached to the account of a specific verified person active on the platform [Fig.4.30 a].

Public agencies can activate their own dedicated page on the platform to reply at the residents' concerns [Fig. 4.30 b]. However, this option represents a critical choice for the public sector because it implies to transform public information in private communication. Indeed, official protocols usually require public access and transparency in the communication of the public administration with its constituency, but the access to contents published in the page of a specific neighbourhood is limited to registered residents. Thus, there is a structural incompatibility between official protocols and platform rules.

City. Nextdoor proposes a representation of the city fragmented and divided in its different neighbourhood, invisible to each other, and assuming the existence of area-based communities.

The definition of a specific area of interest for a group of users is considered in this kind of platforms as essential to bridge online activities (posting, alerting, informing) and potential offline activities based on spatial proximity (e.g. babysitting, housekeeping help). Users have no access to information and news on other districts, or at the city level.

The built environment is represented as the physical container of activities, but interestingly also the development of the online community relies on physical transactions of goods (e.g. houses, objects) and professional services (e.g. maintenance works).

Technology. Nextdoor configures an online space that is separate and not communicating with any other online tool, in order to prioritise and efficiently implement the user's verification protocols and protects information exchanged at the local level. Nevertheless, users can choose to export contents on Twitter and Facebook, but not vice versa.

Even though the partition of users in closed neighbourhoods can make this kind of platform closer to the fourth macro family of segmentation tools (see next section), this aspect is explicit and legible to users accessing the platform specifically for local news and resources. Thus, this explorative aspect is predominant in both the design and use of the platform, in the sense of users' expectations aligned to platform functionalities.

The platform is intended for daily use and everyday needs implying close (while occasional) social contacts. The platform is aimed at supporting a kind of cooperative effort in surveilling the neighbourhood and sustaining local businesses, but the schema of interactions among users do not reflect this purpose or other potential forms of collaboration among neighbours.

4.3.3.c. Family 11: Civic Crowdfunding

SpaceHive (https://www.spacehive.com/) is civic crowdfunding platform aimed at supporting local communities and organisations to raise funds for small scale local transformations, such as regenerating community gardens, providing new furniture to socially relevant spaces, restoring buildings, and organising temporary initiatives. The platform provided three main visualisations: a wall with the descriptions of the projects currently opened for funding [Fig. 4.31], a wall with organisations and "movements" successful in previous crowdfunding initiatives [Fig. 4.32 a], and a place-based search to narrow the user's area of interest [Fig. 4.32 b]. SpaceHive is also integrated with online payment services.

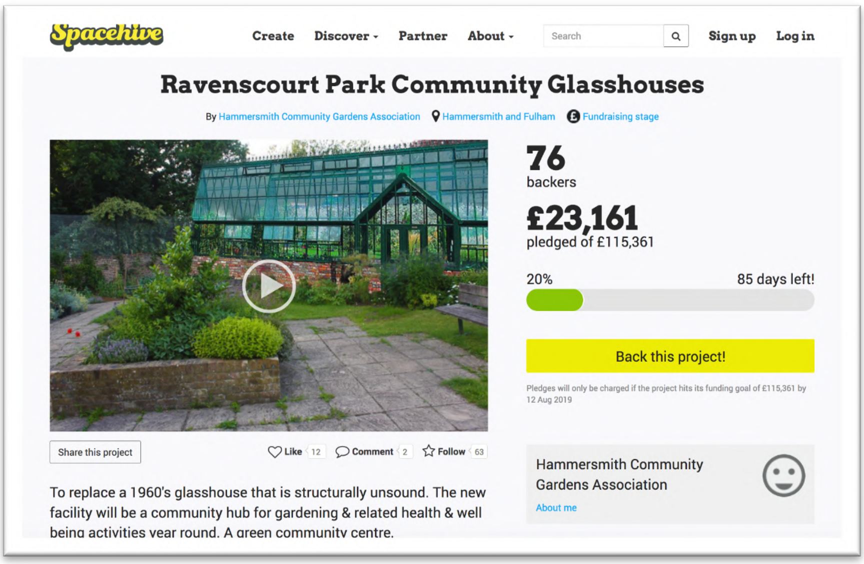

Fig. 4.31 Screenshot of SpaceHive, example of a project (https://www.spacehive.com/)

Users. Analogously to platforms for collecting civic proposals (family 6), a project page in SpaceHive includes information, contact, milestones, public discussions, sharing and rating options. Differently from those platforms, Space Hive is a **platform not depending on its adoption by local authorities**. It is instead **opened to everyone, without restrictions, configuring horizontal relationships between promoters and contributors that remain independent in their online activities**. Spontaneous groups and organisations can promote their projects to get financial support from other users, that can adhere to the ones meeting their needs and interests [Fig. 4.35 a/b]. There are **no internal recommendation mechanisms favoring a movement over another.** Indeed, the **search criteria for organisations and projects are place-based** [Fig. 4.36 b]. Contents can also be filtered on the basis of some macro-categories (e.g. Buildings, Sport, Art & Culture, or the status of the project, in preparation, on-going fundraising, successful delivery).

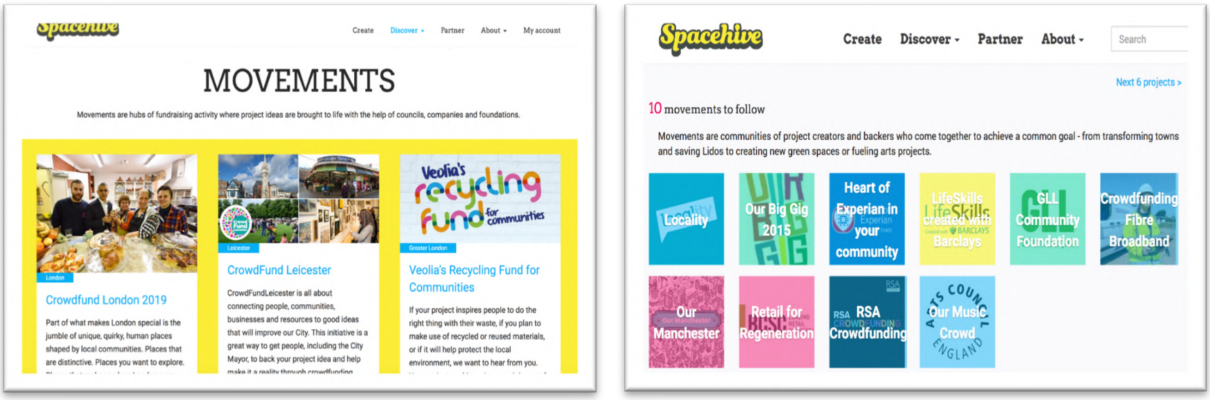

Fig. 4.32 Screenshot of SpaceHive, example of the organisations wall (a) and the suggestions in a specific city (b) (https://www.spacehive.com/)

City. Most of the crowdfunding projects concern physical interventions at the local scale, directly enabled by the joint action of users on the platform by donating. It is worth to notice that the locality works as a filter for projects because the **functionalities of the platform are invariant to the context** [Fig. 4.33].

The potential **transformation of the city is made tangible** in two ways: by sharing material resources through the platform and by linking this online action to the regeneration or refurbishment of specific collective spaces.

The temporal dimension of the promoted transformation remains marginal, even though crowdfunding projects are often time-sensitive with specific deadlines to complete the fundraising. In other words, the platform does not cover the implementation process.

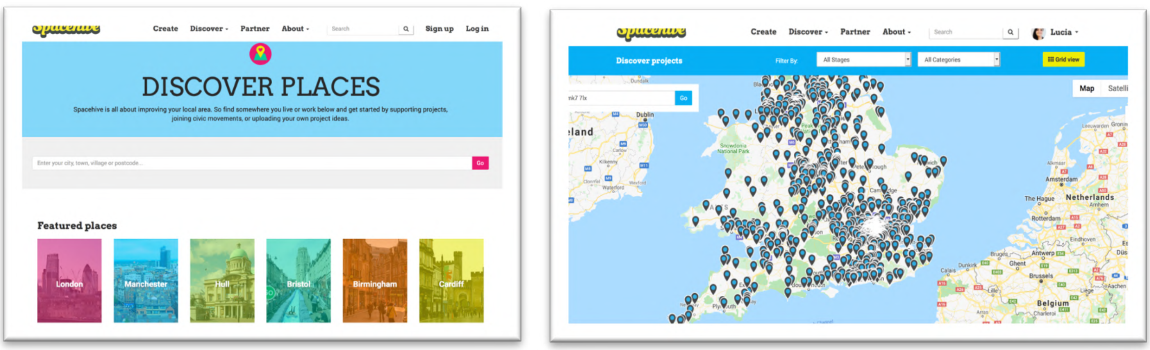

Fig. 4.33 Screenshot of SpaceHive, example of the place-based wall search (a) and map-based search (https://www.spacehive.com/)

Technology. SpaceHive is designed as a tool to support the temporary and episodic cooperation among users as individuals and members of local organisations toward a specific goal. The **common goal is defined through its monetisation, and the cooperation is implemented through asynchronous and spatially independent donations.** In this sense, users have limited knowledge of other users' actions (both promoters and donators) and remain **focused on their interaction on the platform** along the schema browse-select-donate, **not necessarily initiating communications of any kind with other users**.

Space Hive, like other crowdfunding platforms, does not support the coordination, cooperation, collaboration among different proposals to maximise their chances of success avoiding repetition and user basin fragmentation, or combining their efforts to amplify their impact. It configures an open space for competition among proposals instead.

4.3.3.d. Family 12: Sharing Platforms

Airbnb (https://www.airbnb.co.uk) is one of the most emblematic examples of sharing platforms, ideally aimed to optimise the use of underexploited resources (house, cars, goods) by promoting their temporary sharing with other people. However, sharing platforms are now the newly established online trusted marketplace, based on recommendation and rating options for users offering their goods and services. The key features of Airbnb support the exploration of accommodation options and other related touristic services (by area, topic, or user preferences) and then their booking and online payment.

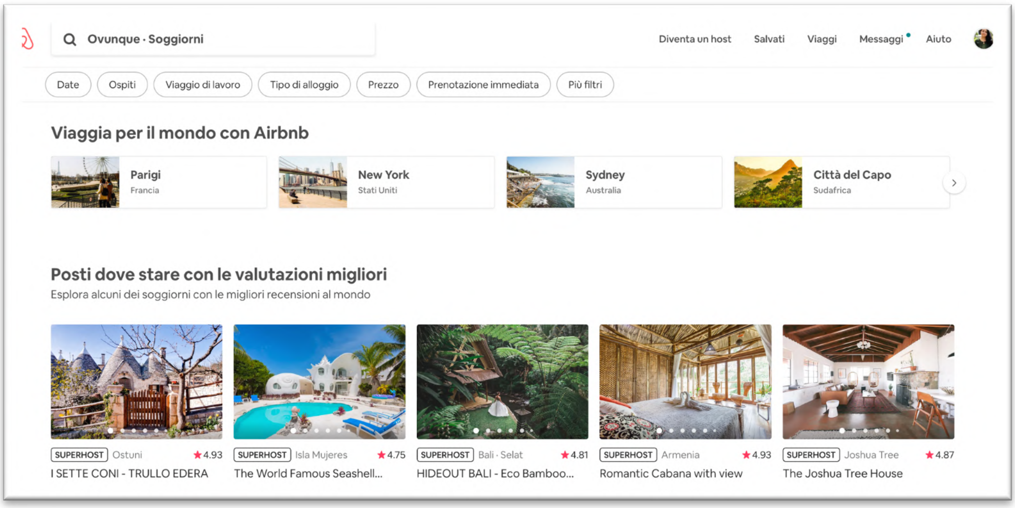

Fig. 4.34. Screenshot of the platform Airbnb, accommodation options (https://www.airbnb.it)

Users. The platform frames users according to **two roles, hosts and guests**, relating each other through an economic transaction (paying for accommodation services). Each user can potentially cover both roles, in different times and places. These roles are used to divide users in **two macro-groups that internally are meant to help peers and externally to build proxies for trust-based relationships.** Indeed, each transaction mediated by the platform can be associated with reviews and recommendations of both hosts and users. In this way, ideally, hosts help other hosts to avoid risky or problematic customers. At the same time, guests help other guests to assess the trustworthiness and quality of the services provided by individual guests based on their previous experience.

This mechanism tries to **balance the informality of relationships** between hosts and guests. However, the double review mechanisms can also generate conflicts due to misalignments and misunderstanding, or it can be circumvented through vague preformatted contents. In other words, the **platform strictly defines the online behaviours of its users** called to comply at every step, even though not necessarily rules meant to implement a good "usership" are followed beyond than as a formality. In this way, the platform itself establishes relational rules for all its users and forces specific approaches to the provided functionalities implicitly and explicitly.

City. The underlying model of cities assumed and promoted by Airbnb is based on the concept of **urban areas as an aggregation of private spaces** (i.e. houses) **managed by independent private actors** (i.e. houses owners, tenants or associated hosts) and **oriented to meet the needs of non-resident customers.** Each city results to be a **pool of resources** activated by exogenous factors (tourists).

This schema made Airbnb to deeply impacting on cities, and it is now forcing for new regulations of the activities enabled by the platform (tourism and accommodation businesses without licenses and outside local taxes systems). Online actions on the platform affect offline interactions among residents (hosting or not), regular business and informal entrepreneurs, platform users (both hosts and guests) and local administrations, local administrations and platform providers. Frictions are due to new technology-enabled offline practices established beyond the framework of social and collective institutions, disconnecting economic opportunities from local development processes.

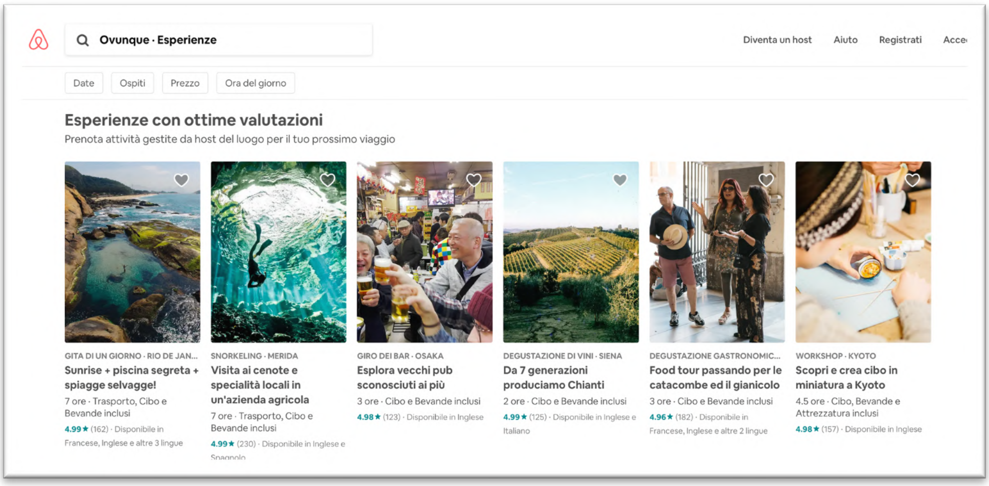

Fig. 4.35. Screenshot of the platform Airbnb, purchase of local experiences (https://www.airbnb.it)

Technology. Airbnb, such as other sharing platforms, is built around the concept of peer-to-peer collaboration and temporary sharing of personal resources for mutual advantages of both parties involved. The kind of resources available for sharing is virtually everything, including *"truly authentic city experiences"* [Fig. 4.35], as recently promoted by Airbnb on its homepage.

As commonly highlighted in press and literature, sharing practices had been flattened to economic transactions. Thus, the technology support to interactions not driven by commercial purposes is limited to instant messaging between hosts and guests for logistic arrangements. Other basic forms of collaborations among guests or hosts (such as seeking for help, making joint plans, identify collaborators) are not made evident on the platform or associated with specific functionalities. Instead, the competition among hosts results from common market-based mechanisms, amplified by comparisons and rating options on the platform.

4.3.4 SEGMENTATION TOOLS

The label "Segmentation tools" is associated with the fourth macro-level family group of technologies. These tools are intended to **help users in navigating among homogeneous groups of peers sharing some characteristics, needs, or priorities**. The corresponding low-level technology families are:

m) Events and group applications
n) Wikies, community portals, hyperlocal citizen journalism platforms
o) Campaigning and advocacy platforms
p) Global social networks

These four families are mapped in the two quadrants of the contextual factor cube corresponding to the following combination of factors: Horizontal Intangible Specific and Horizontal Intangible Unspecific [see Fig. 4.36 and 4.37].

- **Horizontal Intangible Specific.** Web applications associated with temporary events and webpages working as community portals are meant as online space among peers united by a common goal and spatial proximity.

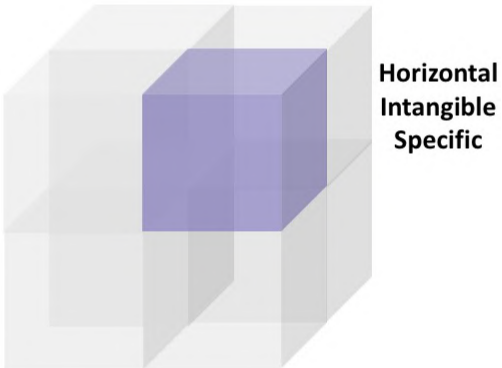

Fig. 4.36 Mapping of event applications and community portals in the contextual factor cube

- **Horizontal Intangible Unspecific.** Advocacy tools and global social networks, while often used to engage people at the local level, remain primarily aimed at aggregating like-minded people around shared topics of interests, independently from their location.

Fig. 4.37 Mapping of advocacy platforms and global social networks in the contextual factor cube

4.3.4.a. Family 13: Events and group web-applications

Web-based services such as **All in the loop** (https://www.allintheloop.com) or **Aloompa** (https://aloompa.com) provide the possibility to assemble and personalise standard architecture and functionalities of common web applications for specific purposes or short term initiatives. Their use is not limited to commercial applications, but quite spread as support to important city events such as festivals, fairs, exhibitions, joint initiatives of cultural institutions. These applications are meant to connect people facilitating networking, engaging the public, and optimising the navigation of the event. Their recurrent functionalities include interactive maps, calendars, downloadable documents, instant messaging options, index of events and people, alerts, polls and surveys. Differently from web-based applications for group management such as **loomio** or **slack** (www.loomio.org, slack.com), events applications are intended to support spatialised interactions of aggregation of people sharing the same experience.

Users. Events applications are made available to the public by the organisations responsible for a specific event, as part of customer assistance services (instead than as an operational tool for the organisation of the event). However, these applications are explicitly meant to connect the events' attendees among them, instead than with the organisers (enable to monitor the online activity on the app). The potential horizontal relationships among users are virtually sustained by the shared experience that they are living during a specific event, their convergence of interests for being there, and the partial overlapping of needs (e.g. orientation, information) and activities to be done (booking, selecting sub-events). As a result, users are considered as part of a temporary community, artificially created and voluntary signed. The benefits coming from the use of this application are indeed envisioned at an individual and community level in terms of making the experience more productive and satisfying, or also less frustrating (but not explicitly supporting coordination and cooperation among users/attendees).

City. As mentioned before, events applications are increasingly built also to support major events in cities, both in dedicated spaces or distributed in different areas. These tools are aimed to facilitate individuals' offline actions (e.g. meetings, seminars, shopping) happening in the same space. While the spatial dimension is extremely important in this setting, the focus in on actions. In all in the loop, as well as in similar frameworks, maps are the visual media structuring the information for users and the way to interact with contents (e.g. every space in the map corresponds to a link to an exhibitor, event, external web pages). The map contains little information in itself, differently from monitoring systems and GIS tools, but it is mostly an intermediary between the direct experience of a space (with stands, rooms, areas) and the kind of information required to act in that space, individually or collectively. In group management applications, the spatial dimension of activities is less relevant, even though the provided functionalities are similar.

As regarding the temporal aspects, the representation of the space for action during the event tends to be static and objective, focused on functional details and activity descriptions. Limited options (e.g. forum corner) are oriented to enable personal or community narratives on the city or the specific area hosting the event, difficult because of the short time engagement with the event, the city and the associated community.

Technology. An interesting aspect of this family of technologies is that not only events or projects are temporary, but often the web-applications associated with them are temporary as well. This means that they are created ad hoc for being in use just during a specific period and then closed or disconnected afterwards. Events applications are also characterised by their nature of meta-technologies. Indeed, they are toolkits to serve purposes and customers preferences by assembling a limited set of functionalities in customised combinations. This schema is transferable to other settings and urban activities, beyond events.

4.3.4.b. Family 14: Wikies, community portals, hyperlocal citizen journalisms

The community portal **"Salida citizens"** (https://salidacitizen.com/) is a long-lived community portal, spontaneously established in 2008 by the residents of the town of Salida (in Colorado, USA, 5000 inhabitants) and still active in 2020. Usually, community portals have a short life because of the effort to develop and maintain a small online community. Indeed, community portals cannot count on a critical mass of active users to get their virtual space continuously animated and attractive for other users, such as global online social networks.

The recurrent structure of community portals is centred on a public wall for news and events relevant at the local level. Users can comment and initiate a discussion or participate in the ongoing ones [Fig. 4.38]. Other features could include the subscription of a special newsletters section, or the contents navigation by themes. The same architecture recurs in wikies and hyperlocal citizen journalism portals, united by the intent of aggregating relevant information for a public operating in a specific area of interest.

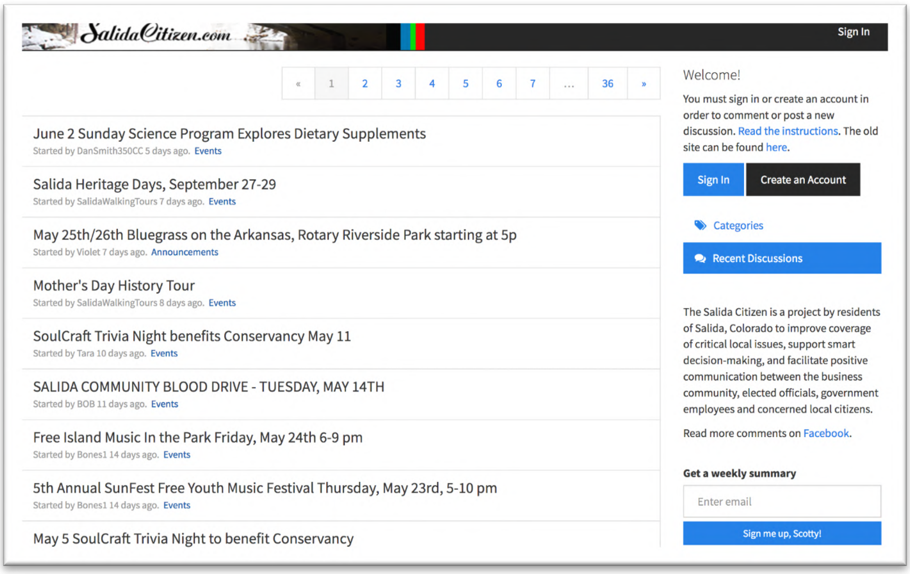

Fig. 4.38 Screenshot of the community portal "Salida Citizens" (https://salidacitizen.com/)

Users. Community portals are presented as online spaces for aggregating the members of a community, letting them self-organising their participation online and offline. However, the ideal horizontal structure of relationship among portal' users coexists with **informal roles and responsibilities** attributed or self-attributed to specific users. In Salida Citizens, for instance, a few users keep sharing and moderating contents on the platform since the beginning, while the portal potentially allows everyone to contribute and join the group.

City. Analogously to platforms aimed at aggregating civic proposals (family 6), the representation of the city as a physical environment is not a concern in community portals. All users are assumed as knowing the place and sharing a common ground on the context of the information advised on the community portal. Nevertheless, community portals explicitly support concrete actions in the city (meetings, citizens' initiatives, events) aimed at improving the quality of social life at the local level, and potentially **transforming the way to perceive the city by its inhabitants.**

Technology. Community portals, such as Salida Citizens, are often associated or connected to a group or a dedicated page on online social networks. Indeed, there is a partial overlapping between the goals of these two families of technologies, but tools are not independently built and managed in the second case.

The actions supposed to unite residents happen outside of the community portal that works uniquely as a digital notice-board. Thus, the portal remains open, flexible and generalistic, even though it does not provide any form of operational support to concrete actions. Its scope is getting residents informed about what is going on where they live, but differently from platforms such as NextDoor, that information is publicly accessible.

4.3.4.c. Family 15: Campaigning and advocacy platforms

Magnify - your voice - (https://www.magnifyyourvoice.com) is a platform supporting both campaigning and advocacy for local and global causes. These causes concern mainly civil rights and political engagement, but also local transformations aimed at improving the quality of life (e.g. affordable housing, community volunteering, taxes equity, emergency response) [Fig. 4.39 a]. The platform is opened to individuals and organisations that want to share a call to action with other users [Fig. 4.39 b]. That call to action usually refers to offline actions for actively collaborating within on-going projects, but can also imply online actions outside the platform, such as sharing project-related contents on social media. The platform facilitates users in sorting projects by spatial proximity, upcoming events, national relevance and last update. The contribution of individual users is summarised in a board visualising the points of each user that actively contributed to the supported projects teams [Fig. 4.40].

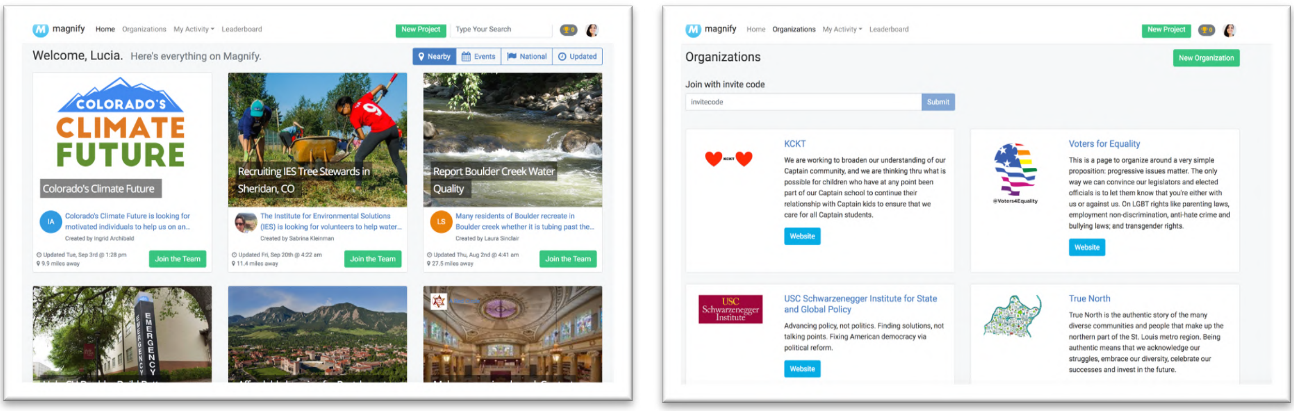

Fig. 4.39 Screenshot of Magnify. Project wall (a) and organisations wall (b)

Users. Magnify your voice, as several other campaigning platforms, clearly attributes an operative role and specific task to users (individual users). While the call for action is unilaterally defined by its promoters, the existence of clear and explicit rules for cooperation make the two-way relationship transparent, by allowing users to pre-assess the outputs and impact of their actions and set according to their expectations in relation to the supported projects and the platform as well (that is provided by third parties, i.e. technology company).

Differently from crowdfunding platforms, the effort requested to people joining a team in pursuing a mission is not limited to monetary transactions, but usually involve an investment of time and personal resources, social capital and special skills. The involvement of users is deeper and, at the same time, more comprehensive as regarding the potentialities of each "member of the team" from a personal and professional perspective. Despite the clear distinction of individual users and organisations, the horizontality of the relationships among the two classes of users is enabled, on one hand, by the free choice and voluntary support offered by individuals to organisations, and on the other hand, by the effective or virtual establishment of a temporary working unit, the "project team", composed by a representative of the organisations promoting an initiative and online/offline volunteers, and thus intrinsically opened.

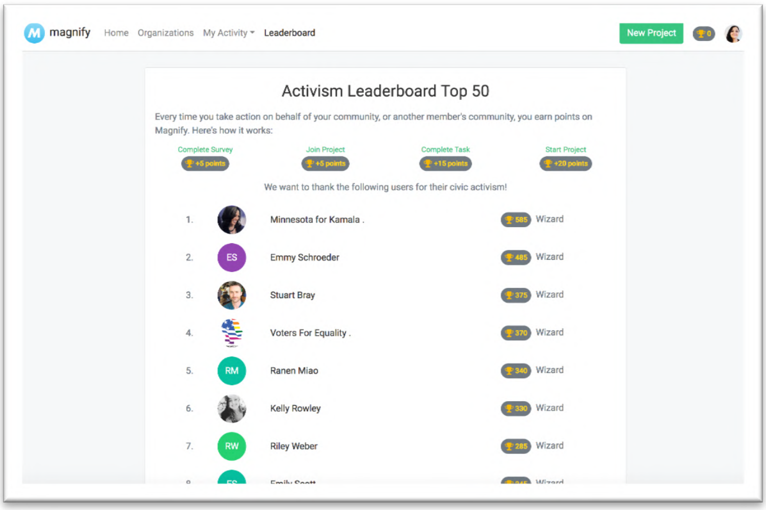

Fig. 4.40 Screenshot of the leaderboard used as user's incentive

City. Advocacy and campaigning platforms usually do not have a specific geographical focus and do not restraints the boundaries of the supported missions. However, acknowledging the principle that issues lived and directly experiences can be more motivating than generic call for actions (e.g. closure of the local school vs reform of education, lake cleaning social initiative vs environmental protection campaigns), these platforms prioritise searching for area-based projects to be supported and local organisations.

The emphasis on the direct involvement and commitment to a mission determines a double framing of places as physical transformable entities and political space where to act for addressing local and global problems. This is independent of a specific focus on urban settings or other environments (e.g. rural villages), that remain under-defined online while clearly connected to a defined place for promoters and volunteers.

Technology. The mechanism for acknowledging the value of the voluntary and deep involvement of users in concrete action toward a mission is linked to symbolic badges associated with points and ranking categories [Fig 4.40]. By measuring the value of the commitment in quantitative terms, this kind of platform replicates logics similar to the quantification of the financial contribution to projects, that is typical of crowdfunding tools. By establishing an arbitrary and platform-specific ranking among volunteers, the platform renders vertical hierarchies that result limitedly meaningful or useful for the campaigns to be supported because established among unrelated people that even do not necessarily participate in the same project. In other words, this type of tools proposes a platform-based incentives system even though the connection between online incentive and offline actions is indirect and not binding.

4.3.4.d Family 16: Global Social Networks

Facebook (https://www.facebook.com/) currently is one of the most popular online social networks at a global level. While not meant to focus on the city scale or neighbourhoods, Facebook Pages and Facebook groups are two of the platform instruments most used at the local scale for aggregating communities and residents [Fig. 4.41]. Facebook pages represent a way to distinguish individual accounts from non-individual ones, such as institutional pages of private and public actors, or also virtual showcases for businesses and projects. Facebook groups are instead a segmentation strategy for the global space of the platform. Within the online environment defined by pages and groups, users keep all the key functionalities of the platform (i.e. posting multimedia contents, comment, endorsing, sharing). At the same time, pages and groups' administrators can partially control the information displayed on their wall and the access to them on the basis of the privacy settings (e.g. public or private pages and groups).

Fig. 4.41 Screenshots of a Facebook page (a) and a Facebook group (b)

Users. Facebook pages are usually the expression of organisations and public administrations officially existing on the platform and using the platform as an additional channel to communicate with customers and citizens. However, communications mediated by Facebook pages are misrepresented by rendering organisation-to-individuals as every other communication one-to-one among individuals. Indeed, the outputs of organisations and individuals remain apparently the same in terms of structure and properties of multimedia contents, interaction mechanisms, and potential of public visibility (actually limited by not legible mechanisms). This soft levelling of the relationships among organisational users and individual users, on one hand, flatten the agency, structure and reach of upper-level social structures, and on the other hand, provides the essential illusion of fairness and open opportunities among users having different capabilities and resources and level of expertise.

City. The georeferentiation of user-generated contents in Facebook could support a bottom-up definition of specific areas, included cities, as a result of the information shared on the platform aggregated and visualised by area. However, the platform favours instead the multiplication of unconnected single perspectives about the places of people's activities, increased in Facebook pages and groups that have limited public visibility outside their list of members or because not necessarily managed as open spaces. The focus is indeed on convergences of interests among users, but not necessarily on their spatial proximity.

Technology. The notification system incorporated in Facebook, as in other global social networks, allows users to constantly be informed about updates of online activities of their interest. But most importantly, the notification system associated with the preferences applied to the settings of Facebook pages and groups is the only option provided by the platform to help the management of one-to-many and many-to-many communications. An adjustable and proactive notification system could potentially encourage the use of the platform for coordination purposes. But the management of the preferences still based on the choices of individual users hinders this possibility. Recommendation mechanisms considering all the interactions of users with the platform and other associated tools contribute to do not prioritise the visibility of contents related to groups' activities.

4.4 DISCUSSION OF THE MAIN ISSUES HIGHLITHED BY THE REVIEW

As mentioned in section 4.1, the review of the different families of web-based applications having a city orientation was aimed at highlighting some patterns and choices determining the use and role of these technologies in city dynamics. More specifically, **the purpose of the analysis was critically reflecting on the link between recurrent design choices in consolidated types of web-based technologies and the assumptions/implications of these choices in terms of users' representation, vision of the city and forms of technology support to local actions.**

Indeed, in urban studies and planning research, little attention is given to the analysis of digital technologies as material objects with specific properties and features defining the affordances of specific tools, as well as potentially determining all the well-known and unwanted side effects. The issues associated with the integration of digital technologies in urban management, the failure of technology-supported public participation processes, the critical examination of the dangerous drifts of smart city models are topics widely discussed at a theoretical level or in empirical works. Still, the reference to specific classes of digital technologies and their peculiar characteristics tends to be vague. The focus is on the effects of the use of technologies, but not on what of their peculiar characteristics contribute to those effects.

On the other hand, it is frequent in informatics research to focus on the analysis and evaluation of specific tools and prototypes, or their comparison with equivalent solutions, by paying particular attention to specific properties and features and modalities of interaction. However, a comprehensive account of the applicative context of technologies, especially from a relational perspective and by taking into account social tensions and political implications related to their use, are still quite rare.

Thus, **I tried to widen the focus of the analysis to include both relational context and profile of technologies designed for urban applications. The classification of the different families of technologies had been guided by the definition of invariants related to the structure of relationships among users, the focus on tangible or intangible aspects of cities, and type of actions supported through technology. The analysis of some significant examples of each class of technology helped in discussing in practical terms:**

- **the capabilities of specific tools representing recurrent properties in a certain class of technologies**
- **the misalignment between apparent desiderata and their actual use**
- **the structural limitations to the creation of pluralistic and versatile online environments**
- **the transferability and potential transformation of current solutions in new configurations.**

This section discusses the main issues of the different classes of web-based technologies analysed before under the light of the double nature of the problem of getting web-based technologies supporting city stakeholders in local development actions (as a design and research problem, see Chapter 1). In particular, I am going to focus on the limitations of existing solutions as regarding their application in multistakeholder settings and multipurpose processes (research side), but also on the inputs for outlining alternative city technologies addressing the *"Recomposing problem"* formulated in Chapter 3 (design side).

4.4.1 USERS

As seen in Chapter 3, the definition of an online environment facilitating the kind of social interactions naturally happening in cities in local development processes requires, first of all, the possibility to shape these interactions in a fluid way, without forcing or artificially creating dependencies, power tensions, decisions-actions chains not finding their correspondence in offline environments. In the proposal of the

City Mirror, this condition has been synthesised by defining this type of online environment as a multi-stakeholder space, where every segment of users can actively pursue its interests, priorities, operational protocols, goals and, at the same time, dynamically negotiating its action space with others.

The main limitations of the analysed classes of technologies to move in this direction concern:

1) the **asymmetry of powers** (access to information and control the outputs and impacts of other users' actions)
2) the tendency to support **oppositional dynamics among users' segments**
3) the enforcement of **static non-negotiable rules of interactions** among different users' segments
4) the **misrepresentation of other users' segments**, that can even include their reciprocal invisibility.

As summarised in Table 4.3, these various kinds of limitations become more or less evident across different classes of technologies, while often coexisting.

Table 4.3 Summary of the review of the state of the art. Part I

Users		
Family	Limitations in city dynamics	Inputs for city techs
Family 1	Asymmetry of control over public information and anonymity	Differentiated level of access to public/reserved information
Family 2	Oppositional relationships between citizens and local authorities	Active/proactive simple and clear engagement mechanisms
Family 3	Users invisible to each other, individually and in groups of peers	Open access to the platform and information, not restricted to residents
Family 4	Invisible users	Users' presence visibility not obvious
Family 5	Different rules for administration and citizens by design	Official/unofficial dialectic
Family 6	User asymmetry balanced in between online-offline activities	Visibility of multiple actors involved in specific initiatives
Family 7	Misalignment intended users/actual users	Technical/non-technical users
Family 8	Consolidated schema of relationships administration/taxpayers	Reliable user identification
Family 9	Map contributors limited by the map promoters framing of the initiatives.	Multiple systems of "rules" for different groups and initiatives
Family 10	User's segregation by area (local businesses and public agencies included)	Strong user verification protocol independent from public administration records.
Family 11	Promoters and contributors independent in their online activities.	Opened to spontaneous groups and organisations, independently from local authorities.
Family 12	Trust-worthy relationships based on the contraposition between users covering different roles.	Explicit different roles for users, coexisting and interchangeable, associated with specific set of dedicated functionalities.
Family 13	Tensions between individual needs and shared needs.	Temporary artificially created communities.
Family 14	Informal roles and responsibilities in the online community.	Aggregation of users with pre-existing connections and relationships.
Family 15	Unilateral call for action, following the rules established by one of the involved parties	Clear and explicit rules for cooperation, making transparent expectations, roles, actions, output, impact
Family 16	Misrepresentation and flattening of social structures	Soft levelling of users' outputs and agency, independently of their level of expertise, structure and reach. Importance of the illusion of fairness and open opportunities.

The asymmetry among users' segments is expected in platforms based on vertical relationships between administration and citizens (e.g. Families 1 and 6), especially when technology simply replaces or reflects consolidated dynamics of interactions such as in the case of tax payments (e.g. Family 8, *E-gov services*). However, this **asymmetry can be spontaneously mitigated** in the cases in which technology is just one of the triggers for offline actions (as in *Citizens proposals collectors and city forums*, Family 6), but can also be **proactively strengthened by design choices aimed at concentrating access and control of information** under one users' segment only (as in *Situational Monitoring Systems*, Family 1).

Oppositional dynamics seem to be particularly evident in classes of technologies leaving to users the burden of individually self-managing natural conflicts among diverging goals and interests. Divergences include competencies and responsibilities of public administrations versus the expectations of residents (e.g. Family 2, Reporting platforms), but also the exploitation of competitive advantages in the offer and access to goods and services (e.g. Families 12 and 13, *sharing platforms* and *events and group applications*). In some cases, platforms even lead users to establish specific **practices to cope with escalating anti-social behaviours associated with latent or open conflicts among parties**, such as the complex mechanisms activated on *sharing platforms* and *global social networks* to mitigate the self-exposition to risks and damages (e.g. neutral reviews, visibility control on shared contents).

The **unilateral definition of static and non-negotiable rules** of interactions with other users and the platform contrasts with more common bilateral implicit or explicit agreements regulating the coexistence of different stakeholders operating in the same city context (and inevitably sharing part of the same resources). This issue can be easily observed both in tools based on vertical and horizontal relational schemas, such as *Voting and public debate platforms* (Family 5, vertical) *and Community mapping tools* (Family 9, horizontal). In these two classes of technology, **a segment of users establish what other users can or cannot achieve through the platform, while not directly controlling the access to information**. The problem is not the asymmetry of information, but the autonomous **definition of the sphere of action for other parties**, that is not necessarily so explicit and clearly legible through the platform, as frequent in debating and voting tools. Again, the impact on social interactions external to the platform is spontaneously mitigated when decisions and actions can be independently organised in an offline dimension (e.g. Family 11 and 15, *Civic crowdfunding* and *Campaigning-advocacy platforms).*

The representation of users and different segment of users called to coexist in the same platform is one of the most significative limitations to create multistakeholder environments, recurring in a number of platforms. Misrepresentation issues can be extreme, such as in the cases in which users remain completely invisible to each other and their actions untraced on the platform (e.g. Family 3 and 4, *Environmental Monitoring Systems* and *City Dashboards).* In other cases, there can be a **misalignment between intended/desired users and actual users**, such as in the case of *Open Data portal*s (Family 7), but also a **fictitious representation of homogeneous clusters of users, such as in the case of area-based communities,** virtually segregated in *local-scale social networks* (Family 10). Lastly, the **misrepresentation of roles, competencies and actions of different segment of users can be the results of design choices flattening framing and outputs of the users' interaction with the platform** (e.g. Family 14, *Wikies, Community portals, Hyperlocal citizen journalism platforms* and Family 16, *Global social networks).*

Despite the above-mentioned issues, the review also highlighted inputs that could be furtherly explored and developed to design multistakeholder online environments in city technologies. In particular, [see also Table 4.3]:

- the importance of strong **users' identifications protocols** (to contrast the side effects of online anonymity), based on administrative or independent protocols, even in the cases in which users' identities are not necessarily publicly shared
- the option of **differentiating the levels of access to information** on the same platform based on locality, roles, competencies, affiliation, goals, dynamically changing and opened to combinations and unforeseeable opportunities
- the definition of **multiple systems of "rules" for different segments of users and types of actions,** based on clear and explicit rules for cooperation, while keeping a certain malleability to official and unofficial dialectics.

4.4.2 CITY

Chapter 3 highlighted how the representation of the City mediated by digital technologies, both smart and web-based technologies, tends to be polarised between supporting top-down or bottom-up actions at the local level, excluding the majority of city activities that are based on structured and more informal actions often combined. In addition, the landscape of digital technologies applied in urban activities renders an image of the city extremely fragmented because of the microtasks that each tool is intended to support independently from the connection of each activity with others performed in the same context. This fragmentation hinders the possibility to technologically connect actions impacting on the city ecosystem at different scales intrinsically intertwined, and irreducible to hyperlocal or global dynamics. In the proposal of the City Mirror, the alternative to this condition has been hypothesised as a type of multi-purpose and multi-scale online environment, providing support to local actions organically developed by taking into account the interconnections among city activities.

The main limitations of the analysed classes of technologies to move in this direction concern:

1) the **static or abstract representation of the city**
2) the representation of the **city filtered on the basis of one perspective** only on the activities supported by technology
3) the **lack of context** to deeply understand or make legible activities and relationships shaping local actions.

As summarised in Table 4.4, **static and abstract representations of the city** tend to prevail in families of technologies where the intrinsic vertical structure of relationships among users' segments determines a **special focus on priorities and operational framework of specific city stakeholders, supposed as permanent.** This outcome can be linked to the lack of platform features to manage temporal properties of contents, especially when represented on map-based interfaces, walls and wizards. For instance, the schema of service provision based on public administration competencies in *e-gov technologies* (Family 8) changes slowly, and this assumption is relatively acceptable. However, **the choice of making actions and interactions static in the online environment while they are temporalised in the city can also produce unintended consequences** (e.g. negative representation of the city and value of citizens engagement) such as in the case of *reporting platforms* (Family 2). Indeed, these platforms often keep the stratification of issues without rendering the effects of actions pursues within a frame of competencies. Similarly, *voting and public debate platforms* (Family 5) support contingent activities in a short timeframe, **without accompanying users to connect the effects of their actions to the related urban transformations.** The City remains an abstract entity also in *Open Data portal*s (Family 7), in which public administration operations or **urban transformations are discretized in a limited number of static data objects, disconnected from the actual flows of actions overtime to which the very same data refer**. In all those cases, the representation of the city rendered by technologies is not considered as a subject for interpretation and negotiation.

Slightly different is the case of several classes of technologies supporting a more dynamic and collective representation of the city, but still filtered under **one predominant perspective**. This perspective can be implicitly defined **by public bodies** (e.g. in *Situational Monitoring Systems*, Family 1, or *City Dashboards*, Family 4) or determined **by the intrinsic limitation of devices** capturing one or more specific aspects of the urban environment (e.g. *Environmental Monitoring Systems,* Family 3), but also b**y the platform providers and their market strategies** (e.g. *Sharing platforms*, Family 12).

In general, the **coexistence of a plurality of concurrent representations of the city is prevented or avoided** also in other classes of technologies. In *community mapping tools* (Family 9), as well as in *local scale social networks* (Family 10) and *global social networks* (Family 16), the **prevailing logic is segmenting**

homogeneous contents expressed by (assumed) homogeneous groups under a specific purpose in a limited area. Mono-purpose tools such as *events and group applications* (Family 13) also relies on temporal factors and explicit contextual goals to implement this segmentation, considering that their use is usually episodic and in the short term. All these cases are united by the fact of providing one view at the time (even if in multiple visualisations, e.g. map, table, wall) or one view extracted from the available contents on the platform and disconnected from other views (e.g. user can see contents related to their project/event/group, but not other contents concerning the same area/timeframe/theme).

The third issue impacting on the capability of existing tools to support multiple purposes at the same time and multiple scales of actions is related to their **limitations in rendering the context of contents**, users, and actions. Indeed, while aimed at creating open and inclusive digital spaces, platforms and tools designed to support groups and communities (e.g. Family 6, *citizens proposals collectors*, and Family 14, *wikies, community portals, hyperlocal citizen journalism platform*) rely on user-generated contents only to enable users autonomously making sense and interpreting contents and related online and offline actions. In these cases, most crucial pieces of information for a correct decoding remain implicit or completely absent on the platform, trusting that there could a be a common ground among the members of a community to fill the gaps. Similarly, in *civic crowdfunding* and *Campaigning-advocacy platforms* (Family 11 and 15), underlying motivations, potential value, and impact of the local transformations to which users are called to participate usually remain implicit.

Table 4.4 Summary of the review of the state of the art. Part II

City		
Family	Limitations in city dynamics	Inputs for city techs
Family 1	Representation filtered under one perspective, remaining implicit	Space as a proxy for institutional arrangements and rendering an on-going process
Family 2	Staticizing image of the city as an aggregation of issues and problems	Disambiguation of positive or negative trends and integration with local protocols
Family 3	Fragmented representations depending on sensors features	Multisource integration and combination
Family 4	Neutral representation	A priori conflicts avoidance
Family 5	An instant in time. Snapshot of processes.	City as the corpus of citizens
Family 6	Assumption of the existence of a common ground on the city	City as a transformable entity
Family 7	Materiality of the city behind data	(Partial) objective description of the city
Family 8	City as an administrative area: in the background, undefined, static.	Catalogue of city services rendering the operational frameworks of the public sector
Family 9	Mapping area separated from the rest of the city. Shared space of the city as group space.	Multiple subjective and specific representations of the city (even though not related or concurrent).
Family 10	Fragmented representation of the urban area, flattened to residential spaces	Transaction and resource exploration based on spatial proximity.
Family 11	Untraced processes of regeneration, rehabilitations.	Place-based search for organisations and projects.
Family 12	City as an aggregation of private spaces and resources.	Operational framing of city experiences, applicable to multiple sectors of activities.
Family 13	Functional focus, limiting subjective or collective narrative over the space and shared experience.	City as space of actions and interaction with other users and third parties (organisers, exhibitors).
Family 14	Decontextualized contents, not completely legible without sharing a common ground with the community.	Combination of online and offline actions to transform the city perception by its inhabitants.
Family 15	Global and local scale are background abstract characterisations for specific and punctual actions.	City as physical and political space to act for addressing local and global problems
Family 16	Multiplication of unconnected single perspectives on the city, developed by distinct groups and entities.	Online space for identifying convergence of interests with existing or emerging groups.

The review also highlighted important inputs that could be furtherly explored and developed to design multipurpose platforms to support multiscale actions. In particular, [see also Table 4.4]:

- the **overlapping between physical spaces and "institutional spaces"** shaped by social norms and organisational/inter-organisational protocols in the context of actions (referring to Families 1, 2, 5, 8, 13)
- the **relevance of subjective perceptions and perspectives** over the understanding of the city in its objectivity, the understanding of other users and groups perspectives, and the prevention/management of conflicts deriving from these different perspectives (considering Families 3, 4, 7, 9, 16)
- the search for an **evident connection between online and offline actions** (as frequently attempted in Families 6, 14, 15)
- the use of **place-based criteria as a filter for contents, users, type of supported actions** (as partially adopted in Families 10, 11, 12).

4.4.3 TECHNOLOGY

Since the beginning of this thesis, in Chapter 1, I specified that my research interest is focused on future web-based technologies aimed at supporting local development actions. These actions are intrinsically related to multiple strands of intertwined activities implemented by different actors, pursuing different goals, but operating in the same context (social, institutional, physical context). Thus, I narrowed my explorative study on technologies that could orchestrate these distinct flows of activities by supporting coordinative, cooperative and collaborative practices among city stakeholders. The context analysis for the definition of the boundaries of this intervention space in Chapter 3 presented several factors hindering the opportunity to have current technologies working in this direction, given the relevant economic, socio-cultural, technological, political, organisational, and legal constraints. On this background, Chapter 3 proposed to address first the knowledge problem underlying this condition, by speculating, conceptualising, designing, and testing technological alternatives built on the awareness of these constraints, and explicitly oriented to support local development actions as in the proposal of the City Mirror.

The review presented in this chapter made an additional step in this direction outlining what is the baseline for the exploration of potential alternatives. By focusing on the specific research object constituted by web-based technologies having city applications, the analysis of the recurrent characteristics of several families of technologies made evident marginal attention to enable users:
a) coordinating their actions in space and time through technologies
b) cooperating in connected operations
c) actively collaborating toward outcomes benefiting all the involved parties[9] [see also table 4.5].

Communication issues have a significant impact on hindering coordination, cooperation and collaboration practices. Extreme cases are represented by *situational monitoring systems* (Family 1), *environmental monitoring systems* (Family 3) and *city dashboards* (Family 4). While in the first case technology enables only **one-way communications** from public authorities to residents without creating the conditions for a mutual

[9] These kinds of objectives are partially pursued by other classes of information technologies,

- not necessarily web-based, such as logistic platforms for supply-chain management and defence applications for military field operations
- or not necessarily oriented to support spatialised activities, such as collaborative tasks management tools or group decision support systems.

However, even these digital environments are opened to a plurality of stakeholders, competing actions and inter-scale dynamics. More often they are accessible to predefined clusters of users called to contributing in a predefined set of actions, setting hardly replicable in most of city activities. Thus, I preferred to consider only web-based technologies currently applied in cities.

exchange, in the other two classes of technologies is even **missing the clear identification of senders and recipients** of technology-mediated messages, leaving quite uncertain and underdetermined the potential use of the conveyed information. Other extreme cases are represented by Open Data portals (Family 7) and Civic crowdfunding tools (Family 11) focusing on **enabling data and monetary transactions by minimising the opportunities for contacts and relational exchanges**.

Strong limitations to support coordination among local actions in existing tools come from design choices oriented toward the **spatial segmentation of users.** Major implications include restraining the contents users can access, the actions they can contribute, but also the general understanding of their context in terms of concurrent, complementary, conflictual action in place and the appropriate use of resources in that cases. *Community mapping tools (*Family 9) and *location-based social networks* (Family 10) exemplify quite well platforms artificially[10] implementing this spatial segmentation by design, making difficult to connect and coordinate distinct actions even when happening at the same time in the same space.

Another issue related to the coordination support is the **lack of mechanisms to facilitate many-to-many communications in messaging systems** such as the ones incorporated in *event and group applications* (Family 13) and *global social networks* (Family 16). Even though the options related to the public visibility of contents, notifications, and alerts could help real-time updates among users, their position, their actions, other aspects pertaining the **management/self-organisation of sub-groups and their tasks implementation remain unaddressed**.

As regarding **technology support to cooperation** in connected operations, classes of technologies such as *reporting platforms* (Family 2) and *debate and voting platforms* (Family 5) seem to implicitly or explicitly **generate competitive dynamics instead than cooperative ones**. For instance, **by promoting potential tensions among different groups of users or making difficult the aggregation of interests** to incentivise or prepare cooperative actions within/outside the platform. In other classes of technologies such as *e-gov services* (Family 8) and *community portals* (Family 14), **online and offline cooperation dynamics among different organisations, sectors, groups remain untraced and unsupported**, but at the same time, no forms of competition are facilitated. In between, it is interesting the case of *sharing platforms* (Family 12) proactively **balancing the cooperation between providers and customers with the competition among providers (and customers)** by setting internal protocols within the platform, minimising the options for contingent and alternative forms of cooperation rooted in the context of users.

Collaboration dynamics among users jointly working toward shared outcomes remain widely unsupported because of the difficulty to help users understanding the contingencies of their actions and under which conditions collaborating with others is possible, or even convenient and easy. Indeed, even classes of technologies such as the platforms aimed at *collecting citizens' proposals* (Family 6) **lack of clear engagement paths outlined on the platform** to actively contribute to specific actions, or tend to completely separate the online/offline incentive systems to collaboration **focusing on mechanisms confined on the platform and scarcely relevant outside,** such as in the case of *campaigning and advocacy platforms* (Family 13).

As regarding the potential design of web-based technologies aimed at orchestrating local actions, the review highlighted several inputs, often marginal in existing technologies, that could be taken into account and furtherly developed to overcome the limitations previously mentioned [see also Table 4.5].

[10] This segmentation does not correspond to the common perception of cities and cross-block, cross-estate, cross-neighborhoods experiences.

Table 4.5 Summary of the review of the state of the art. Part III

Technology		
Family	Limitations in city dynamics	Inputs for city techs
Family 1	One-way communication from local government to residents	Comprehensive view of one stakeholder offered to the public
Family 2	Unofficial evaluation mechanisms of one users' segment over another	Hidden or not visible coordination among peers
Family 3	Indirect support to decisions and operations, but undefined target of the communication	Living archive of local trends
Family 4	No evident application/use	Symbolic value of technology
Family 5	No support to the aggregation of interests and structured dialogue.	Risk management of open processes (by design)
Family 6	Lack of clear engagement paths on the platform	Rendering of processes and evolution of initiatives, projection of contents outside the platform
Family 7	Data-related transactions, not actions	Episodic/continuous use
Family 8	Unstructured/uncertain cooperation intra-inter organisations.	Mediation and support to multiple goals at the same time (accessibility and efficiency)
Family 9	Closed virtual environment	Content visualisation to reduce effort and facilitating the collective map-making by independent users.
Family 10	Shared space of the city and public information closed in a private space.	Prioritisation of everyday needs.
Family 11	Monetisation of the collective effort and marginality of communications.	Temporary and episodic cooperation between individuals and organisations.
Family 12	Platform strictly structuring public interactions among users.	Homogeneous framing of diversified activities and forms of tech support.
Family 13	Limited set of functionalities for individual use instead than for community-level activities.	Technology as a toolkit to assemble customised solutions for temporary contingent uses.
Family 14	Open and generalist portals, but with centralised management.	Digitalisation of physical artefacts, such as the bulletin board, and centralised public archive of community activities.
Family 15	Platform-based incentive system for actions and operation projected outside the platform	Task assignment to actively cooperate or collaborate in a project online and offline.
Family 16	Difficult management of one-to-many, many-to-many communications relying on the notification system only	Platform enabling different uses for different levels of expertise.

The value of rendering a **comprehensive and stratified view of a segment of stakeholders or a community** provided emerged in relation to the general public as well as to other stakeholders (such as in the case of Families 1 and 14, *situational monitoring systems* and *community portals*), taking into account also the **meanings commonly attributed to certain types of technologies independently from their actual use** (as exemplified by *city dashboards*, Family 4).

At the same time, the focus on one dominant perspective over actions and potential collective dynamics in some classes of technologies leads to reflect on **risks and potentialities of making coordination or cooperation practices openly visible and accessible, revealing the logics of competences attribution and tasks implementation**. Tensions on this matter shine through the solutions adopted in *reporting platforms* (Family 2), *debate and voting platforms* (Family 5), but also in *campaigning and advocacy platforms* (Family 15) to minimise potential risks to offline actions associated with the use of the platforms by design.

Interesting strategies to engage users on the examined platforms include:

- the priority given to **everyday needs** (as recurring in *location-based social networks*, Family 10)
- **incremental use patterns** corresponding to variable levels of users' expertise without resulting in outputs significantly different between expert and non-expert (as observable in *global social networks*, Family 16)
- pursuing a **fair share of the benefits** coming from the use of the platform between owners and users (as in *e-gov services*, Family 8)

- providing a **homogenous framing of technology-mediated actions for different types of actions implemented by distinct users' groups** (as implicit in *sharing platforms*, Family 12).

Useful lessons learned from the review also concern the schemas followed for:

- the **management or mismanagement of forms of interactions oriented to collective dynamics that are only temporary or episodic** (see e.g. *civic crowdfunding tools*, Family 11; *events applications*, Family 13; *campaigning platforms*, Family 15; but also *Open Data portals*, Family 7, as problematic examples)
- envisioning **forms of continuous support to situations developing over undefined periods of time**, even though the use of the platform can be still limited to specific moments and conditions (as in *environmental monitoring systems*, Family 3; *citizens' proposals collectors*, Family 6; *community mapping tools*, Family 9).

4.5 DEFINING THE DESIGN CHALLENGES OF THE CITY MIRROR PROPOSAL

None of the examined classes of technologies is intentionally designed to support local development processes. They are designed to support one or more implicit or explicit goals of a segment of users relating to other segments of users to achieve these goals. As stated in section 4.3., most of existing web-based technologies applied in cities cover part of the goals identified as:

- Helping in the **management of urban actions**
- **Monitoring and controlling** urban indicators
- Gathering **inputs for local decisions**
- Providing an additional channel to **access to local services**
- Supporting the discovery and **exploration of local resources**
- Facilitating the **matchmaking among local needs and resources**
- Enabling informal **management of groups and collectivities** at a local level
- Aggregating people and interests to **build local communities**

As discussed in Chapter 3, local development actions can certainly benefit of the various forms of support provided by most of the existing technologies. However, it is necessary to extend their scope and overcome some of the intrinsic limitations due to focusing on one main stakeholder, one type of action, one scale of action.

Several examples of these local development processes still unsupported by appropriate technologies emerged during the activities for the case studies presented in the next chapters. They include, for instance:

- supporting synergies among the public, private and non-profit care providers to facilitate families dealing with disabilities, chronic diseases, health-issue related vulnerabilities
- optimising the use of resources in local regeneration projects to maintain the continuity of social activation activities through the collaboration between public agencies, donors and numerous non-profit organisations
- tailoring the forms of support to local enterprises on the basis on the business ecology and available service providers at the city or neighbourhood scale
- facilitate the co-management of empty spaces, private or public, for recreational and commercial purposes
- preventing risks and consequences of strong public opposition to misunderstood urban transformations implemented by private and public bodies.

Building upon the elements highlighted in the discussion [section 4.4], I am going to formalise the second step in the development of the design theory that is the main objective of the thesis. This second step corresponds to the definition of formal and functional key principles for a web platform meant to instantiate the vision of the City Mirror proposal elaborated in Chapter 3.

The design proposal presented in Chapter 3 [Section 3.5] defined the purpose and the scope of such system in relation to the three forms of disconnection between forms of technology support and city dynamics highlighted by the analysis of the background problem. In the following sub-sections, **I am going to list the key design challenges for the definition of an artefact concretely recomposing these three forms of disconnection.**

4.5.1 DESIGNING A MULTI-STAKEHOLDER PLATFORM

The main challenges to be addressed for the holistic representation of users in city technologies and the design of web-based solutions to support both structured and fluid social interactions include:

- Designing not for a specific target of users, but for **multiple variable targets at the same time**, having conflictual needs

- Designing solutions without imposing static identities to users, but **letting users defining their identities and roles in relation to the dynamics they are involved in**

- Designing for **fluid hierarchies** among users and social structures, also taking into account the existence of more **rigid hierarchies** within specific social structures or needed in specific classes of local activities (and the required compliance with them)

- Designing considering a **plurality of values-systems and systems of social norms and rules** (including the one based on the needed/wanted asymmetry of information), both externally defined respect to the platform and potentially reframed within the platform while keeping consistency with offline dynamics, and adopting **preventive, adaptative or reactive mechanisms for the management of conflicts.**

4.5.2 DESIGNING A MULTI-PURPOSE PLATFORM

The main challenges to define the scope of web-based technologies aimed at supporting the multiplicity of purposes to be considered in interconnected local activities include:

- Designing for the consistent management of the **representation of multiple coexisting domains** of activities covering themes and processes, without providing a top-down definition of themes and scope of processes

- Designing **modular solutions adaptable to support the various needs emerging from distinct practices** in distinct domains of activities, or in open and cross-domains of city processes, evolving over time

- Designing for **rendering the interconnections and intertwinement among actions** and processes happening in offline settings

- Designing to **keep the level of complexity of these various flows still accessible and manageable** by users, **in relation to their contingent goals and actions**

- Designing for a **distributed and autonomous management of the activities** and processes mediated or supported by the platform, divided among distinct segments of users framed within different institutional frameworks.

4.5.3 DESIGNING A MULTI-SCALE PLATFORM

The main challenges of modulating web-based solutions (tendentially globally-oriented) to link online actions and offline actions at the various local scales, and in particular within the city, include:

- Designing to render the **spatial and temporal context of the information and inputs** on the platform to reproduce the **common ground guiding social interactions in the city**

- Designing the type of support generally provided by web-based solutions (**data exploration, data production, data collection, decision support, planning, documenting, communication) in interscalar urban scenario/solutions**

- Designing for the **multiplicity of scales coexisting in the implementation of single actions**, for instance among the phases of planning and their instantiations, both as online representation and offline actions.

- Designing to adapt the **various level of relevance of spatial and temporal phenomena at different scales** in relation to the definition of the goals defined by users and the impact over their actions.

4.6 COMPLETING THE SET OF LOW-LEVEL RESEARCH QUESTIONS ABOUT THE DESIGN PROCESS OF A CITY MIRROR

Since the beginning of this thesis, I argued that approaching the design of a web platform potentially supporting city stakeholders in orchestrating their actions is not at all different from making feasible and acceptable an urban project in an uncertain or conflictual setting. It is also similar to elaborating an urban plan that takes into account all the legitimate concerns of local stakeholders in order to maximise the chances that the plan in itself could actually contribute in enhancing local resources and generating positive outcomes. Nevertheless, as also highlighted in this chapter, the **design of web platforms for cities** is still primarily driven by business logics, and not public interests' purposes as it is frequently assumed in making public plans. Therefore, they do not necessarily are required to **mediate conflicts among different classes of users, or preventing and mitigating the side effects of the use of technology in specific activities, or being aware and modulate the impact of certain applications at different scales.** Moreover, one of the aspects hindering a closer operational analogy between making a city plan and making a city platform is that we do not have examples or guidelines or consolidated practices about the construction of city platforms as we do have about elaborating city plans and projects.

Against this background, and relying on the specific formulation of the design proposal of the City Mirror, the second high-level research question

RQB_How to structure the design process of web-based technologies for orchestrating the plurality of interests, goals, activities and settings of local development processes?

can be rephrased in:

RQB*_How to design a platform intended to be multi-stakeholder, multi-purpose and multi-scale by taking into account the plurality of interests, goals, types of activities and settings of local development processes?

This question can then be broken down into three sub-research questions focused on the practical aspects concerning the design challenges to be overcome for developing a City Mirror. While the low-level research questions reported in section 3.6 concern the contents and applications of a platform modelled as a City Mirror, the following questions concern how to combine a comprehensive representation of users, city activities and roles of web technologies with the need of conveying these elements in concrete inputs within a design process.

The three macro-phases outlining a design process always includes:

- a **pre-design phase** focused on the analysis of the context and potential directions to explore
- a **design phase** in which a system is actually ideated, generated and the options defined through prototypes
- a post-design or **evaluation phase** in which the system is assessed.

These three phases are frequently iteratively repeated, connected and overlapped [Sanders 2014]. Each of the following three low-level research questions is associated with one of these three macro-phases and with the constraints of designing a multi-stakeholder, multi-purpose, and multi-scale platform.

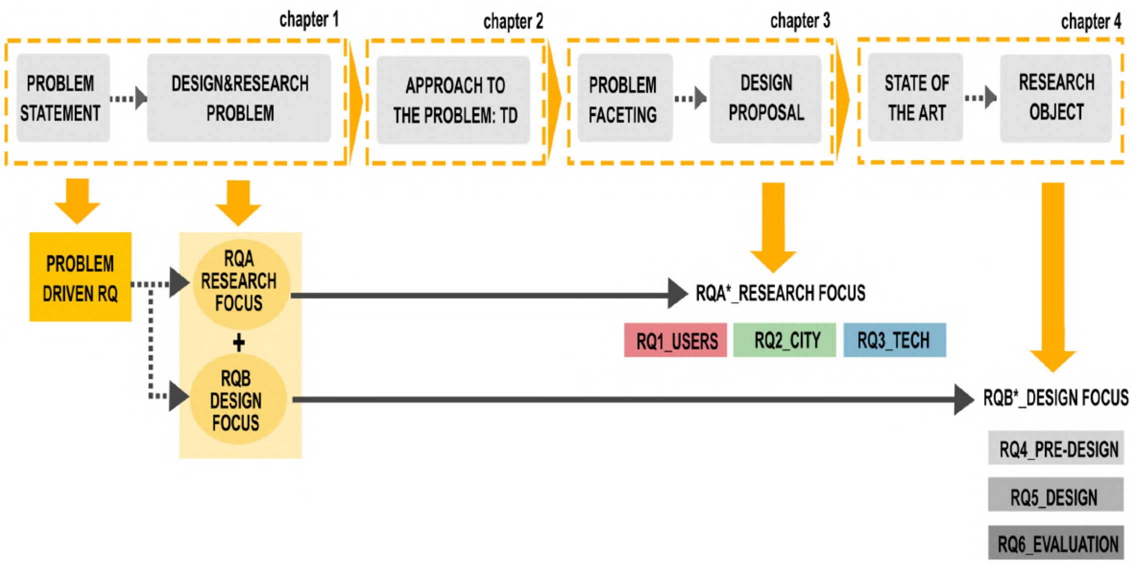

Fig. 4.43 Schema connecting the overall research question to the low-level research questions

RQ4_What types of social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?

The early identification of these factors, preferably in the pre-design phase, is functional to identify the potential directions for navigating the unknown design space of city platforms and defining the strategy for intervening in this space. The awareness of these factors helps to consider: the characteristics of users in their social context; the logics of city activities in a particular setting; and the barriers to the introduction of a multi-stakeholder, multi-purpose and multi-scale technology in that social and operational context. Addressing the research question RQ4 implies to establish a connection between technology capabilities and the social acceptability and political soundness of technology's capabilities in local development actions.

RQ5_What types of approaches could be applied in the design process for balancing the functional and non-functional requirements associated with the different perspectives and goals of city stakeholders?

Understanding pros and cons of different approaches in the design phase for balancing, not only the requests associated to different needs that the system is supposed to meet, but also the perspectives of users as individual and part of upper-level social structures is crucial for defining a shared space of action among diverse city stakeholders. Indeed, the functional requirements for a multi-purpose, multi-stakeholder, and multi-scale web platform to support local actions need to also match with the non-functional requirements coming from the competing goals and values associated with the different purposes that they intend to pursue in the public arena. And lastly, these requirements should also be flexible enough to react and response at the changing and unpredictable use patterns defined by local activities at different scales, that inevitably dynamically refactor goals and needs. Addressing the research question RQ5 involve to critically reflect on the opportunities and specific problems of engaging potential users in the design process of technologies intended to be opened to all actors and actions and not establishing given static hierarchies.

RQ6_What criteria should be considered for evaluating the correspondence between the platform functionalities and the expectations of the city stakeholders to be supported in their actions?

The elaboration of these criteria relies on the possibility to create a bridge between system designers and city stakeholders to assess the consistency between the operational framework of the intended users and the forms of support provided by the specific platform under development. Establishing the correspondence between users' needs and provided services is a well-known principle in system design. But current evaluation frameworks for technology are focused on the efficiency and effectiveness of technology instead than comprehensively take into account acceptance and adoption factors linked to the social and operational context of the intended users. Thus, attempting to address the research question RQ6 implies readapting and extending these evaluation frameworks to deal with multi-stakeholder, multi-purpose and multi-scale platform in urban settings.

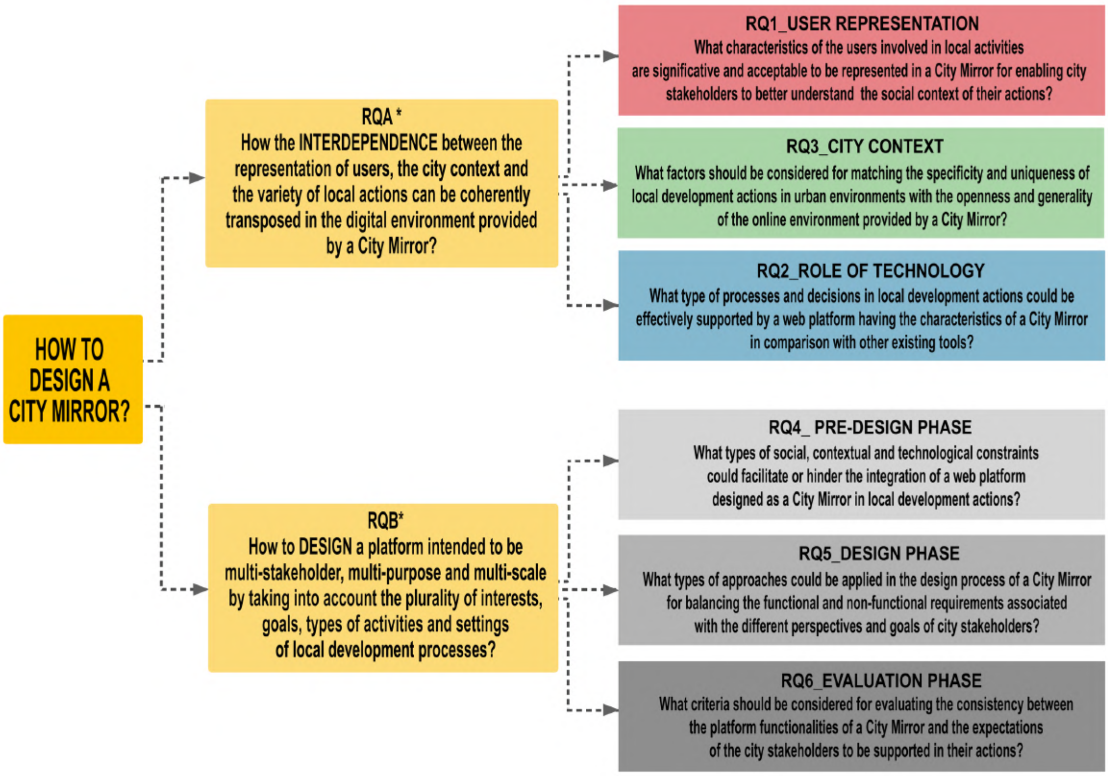

Fig. 4.44 Overview of the high-level and low-level research questions

The relation between these three research questions and the objective of developing a theory of the City Mirror capabilities is given by the fact that this type of theory is intended to inform future choices and designs. Therefore, it should contain a "substantive" part and a "procedural" part [Alexander 1992, Stenberg 2000]. In other words, a part indicating the contents to consider (expressed as concepts and relations among concepts) and another suggesting the principles for managing these contents at a practical level (in terms of knowledge, assessment and decisions)[11]. Addressing the research questions RQ1, RQ2, RQ3 [listed in Chapter 3, section 3.7] will help in defining the components of the substantive part of the final theory, while addressing the research questions RQ4, RQ5, RQ6 the procedural part. They will be organically combined in Chapter 10.

[11] Procedural theories are prevalent in urban planning and design because of the practical concerns of professionals dealing with the elaboration of urban plans and projects, while substantive theories about the nature of entities to manage in urban settings are rarer [Stenberg 2000]. An evident characteristic of these substantive theories in urban planning and design, such as the one proposed by Stenberg or the more common Central Place theories, Concentric zone models, etc., is that they contain very high level concepts, apparently accessible to non-experts but actually usable by experts only because they requires to be readapted case by case for being effective in supporting urban actions and decisions. Differently, substantive theories are quite common in HCI and CSCW and they are usually also much more detailed and often explicitly intended to serve applicative purposes and there are countless examples for every aspect of the design of technologies.

4.7 CHAPTERS HIGHLIGHTS

This section summarises the key points and contributions of Chapter 4 to the three outcome spaces outlined in Chapter 2, Section 2.7. The contributions of Chapter 4 are briefly described in the table below.

Table 4.6 Mapping of the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 4
SYSTEM KNOWLEDGE	THEORETICAL CONTRIBUTION	[SECTIONS 4.2 – 4.5] This chapter provides a **conceptual framework** to critically analyse the characteristics of the digital environment defined by the existing web platforms commonly applied in urban activities. The conceptual framework is aimed at highlighting the **implications of specific design choices** concerning the relationships among users, the connection between online and offline actions, and type of actions to be performed in an urban environment. In addition, the in-depth critical analysis of current solutions led to develop **the second building block of a design theory of web-based technologies meant to support local development actions and corresponding to the definition of the specific formal and functional design challenges for such systems.**
	METHODOLOGICAL CONTRIBUTION	[SECTION 4.1 - 4.2] Differently from the common approach to survey existing digital tools, the methodology defined in this chapter focused on identifying the **high-level resemblances** among the main families of technologies applied in urban settings and the **invariants** in the definition of a particular interaction space. The same approach and schema can be readapted to other domains of technology applications.
	EMPIRICAL CONTRIBUTION	
TARGET KNOWLEDGE	FOR RESEARCHERS	[SECTION 4.2 - 4.3] The classification schema of web platforms having urban applications constitutes a **common basic vocabulary** for researchers belonging to different academic communities that usually refer to the same type of objects with distinct terms.
	FOR TECHNOLOGY DESIGNERS	[SECTION 4.3] The analysis of the key functionalities of different types of platforms and the use of the conceptual framework previously elaborated can help system designers in connecting the **features of their tools** to social and operational considerations of prospective users.
	FOR URBAN PRACTITIONERS	[SECTION 4.2.-4.3] The classification schema presented in this paper **map the variety of platforms commonly used in urban initiatives and projects in a limited organic set** that can facilitate their choice and use.
	FOR CITY STAKEHOLDERS	
	FOR DECISION MAKERS	[SECTION 4.2] The proposed classification can help decision makers in navigating the labyrinth of city technologies by **connecting the functionalities provided by the platforms** they are interested in **the goals they intend to pursue**.
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNOWLEDGE	USERS	
	CITY	
	TECHNOLOGY	[SECTION 4.4 -4.5] Identification of the **limits and issues of existing technologies** to support local development processes, and analysis of the **design challenges to overcome** these limitations in reference to the creation of a multi-stakeholder, multi-purpose and multi-scale digital environment.

PUBLICATIONS

Part of the contents or concepts presented in this chapter are also included in the following publications and/or presentations.

Lupi, L., Antonini A., (2018). ***The Labyrinth of Smart City Technologies. A goal-centred classification of web-based technologies addressing smart governance practices and social innovation initiatives,*** III Conference on Urban e-planning research 2018, Lisbon (PT). – Conference extended abstract and presentation.

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CHAPTERS 5.

DEVELOPING THE CORE MODELS:
LAYERED MODEL OF USERS, CITY SYSTEMS,
AND FORMS OF TECHNOLOGY SUPPORT IN CITY MIRRORS

OPENING HOURS

CHAPTER 5. OVERVIEW

Chapter 5 presents the three core models developed in relation to the three aspects of the problem of designing a City Mirror:

- the **representation of users of city technologies** taking into account the multiplicity of social structures in which individuals operate in the city
- the **nature of actions and interactions in the city** across its physical, functional and social systems
- the **forms of technology support** given to city stakeholders in collective actions.

The three models had been built upon a **critical reinterpretation, repurposing and hybridisation of concepts, theories and frameworks developed or used in the literature of the disciplines selected as roots for the study. The major theoretical work consisted precisely in identifying scattered fragments of knowledge concerning the three aspects mentioned above and interweaving them into three organic conceptual models of users, city systems, and technology roles aimed at defining the starting point for analysing and designing City Mirrors and advancing the related design theory.**

Chapter 5 is organised into six sections as follows.

- Section 5.1 explains **rationale and approach** to the review of the literature used in the core models.
- Section 5.2 presents the **core model of users of city technologies framed as part of multiple social structures**. The model is anchored to the examination of theories and concepts covering properties and characterisation of the different levels of social structures (individual, groups, organisations, communities, networks) under social, functional, and procedural perspectives. These concepts are transferred in the definition of a comprehensive user model representing the plurality of roles and milieu of actions of individual users in the city acting within collective formations.
- Section 5.3 presents the **core model regarding the articulation of social interactions across the city systems and its "infra-systems"**, respectively corresponding to the physical, functional, social systems of the city, and the resources, relationships and values shaping local actions across the three systems. The model is rooted in an action-oriented perspective (typical of planning orientation over the city) with a particular focus on the relationship between norms and actions within the definition of collective experiences.
- Section 5.4 presents the **core model structuring the interplay between forms of technological support to coordinative, cooperative and collaborative practices, and the macro-classes of actions constituted by programmes, projects and services**. The model examines the approaches to the analysis of these practices in the city settings and their link with the design of information technologies, in particular web-based technologies.
- Section 5.5 and 5.6. state the relationships between core models and research questions, and summarises the **chapter contributions**, accordingly to the outcome spaces of transdisciplinary research.

Connection with previous chapters. **This chapter is focused on outlining the basis for answering the first set of questions outlined in Chapter 3 while developing a design theory City Mirrors.** At a more general level, this chapter implements the ***"Integration through conceptual clarification and theoretical framing"*** of distinct domain-specific forms of knowledge that is one of the strategies put in place for structuring this work within the framework of the Transdisciplinarity (see Chapter 2).

Connection with the following chapters. The three core models provide a **conceptual infrastructure and analytical lenses to organise the heterogeneous, stratified, and complex fieldwork outputs related to the case studies** presented in Chapters 7, 8, and 9. On the basis of the evidence, experiences and reflections from the case studies, Chapter 10 attempts to integrate the three core models into a unified framework.

CHAPTER 5. DETAILED TABLE OF CONTENTS

5.1 DEVELOPMENT OF THE CORE MODELS

5.1.1 ROLE OF THE CORE MODELS IN THE DESIGN THEORY

Chapter 5 presents the three core models developed by reinterpreting and interweaving concepts and theories from a multi-disciplinary literature review. This review was oriented to identify and connect the scattered fragments of knowledge relevant to deal with the problem of designing a City Mirror in the following three key aspects [see also Chapter 3].

- Representing **users** by taking into account the **complexity of the real social contexts** in which individuals operate in the city (going beyond the focus on individuals interacting with local governments or platforms owners).

- Representing **city activities** as embedded in the mix of social, economic, physical structures that shape the **collective experience of the city** (going beyond the partial and fragmented technology-mediated representation of city life to create a multistakeholder, multipurpose and multiscale digital environment).

- Defining the **role of technology as a bridge in between city and society** and oriented to support city stakeholders in their actions (going beyond the marginal use of technologies for operational purposes).

The outputs of this process are three conceptual models of:

- the **users** as expression of the multiplicity of social structures shaping city life to fill the intermediate space between individuals and upper-level social entities

- the **city** as ecology of systems shaped by rules and actions defined in a shared environment to fill the intermediate space between top-down and episodic bottom-up initiatives

- the **forms of technological support** to enable the orchestration of local actions at multiple scales, taking into account social structures and meta-structure of city activities.

These three conceptual models are defined here as **"core models"**. This expression identifies in this work an **organic set of concepts describing the aspects under analysis (users, city and technologies) in their constitutive elements and properties**. The core models had been used as high-granularity reference frameworks for analysing fields observations and phenomena in the research and design explorations linked to the prototyping of City Mirrors within the case studies reported in the following chapters[1].

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[1] The potential application of the core models goes beyond the specific case studies. The formulation of these core models does not include prescriptions or procedural indications for their application. Their utility relies on being general and flexible enough to deal with a wide range of situations, contexts, and issues that can be linked to the analysis of the interdependence between people, city and technologies.

In relation to the objective of elaborating a design theory of City Mirrors, the development of the three core models constitutes a central part of the theory. Indeed, accordingly to the "anatomy" of a design theory proposed by Gregor & Jones [2007], the *"kernel"* of a design theory is the corpus of external theories and practices providing the "justificatory knowledge" about the reality that is relevant for the design of a class of objects that the design theory itself wants to inform.

In some cases, it is certainly possible that an external theory on specific phenomena is already appropriate to support the development of a subsequent design theory. But this is not the case as regarding city dynamics, and thus the design of a digital platform reflecting these city dynamics. Indeed, we do not have yet a theory holistically and operationally providing the kind of knowledge useful to understand what characterises users operating in the city context, how the actions in the city are interconnected and what exactly implies focusing on technology-supported collective actions. However, we do have pre-existing knowledge that is directly and indirectly relevant to illustrate and explain these points. The central issue is that this knowledge is not formulated in forms directly applicable to analyse user in the city, city dynamics and technology support to them. Therefore, **I have undertaken the tasks of scanning, sorting, reviewing, analysing, critically assessing respect to my purpose the relevant theories and concepts exposed in the literature of the disciplines selected as roots for the study, but also including in some cases theories and concepts used in these domains while coming from other disciplines (especially as regarding urban disciplines).**

Summarising, the three core models constitute the third building block of the design theory, after the definition of the scope and purpose of City Mirrors in Chapter 3, and the formulation of the principles of forms and function in Chapter 4.

5.1.2 ROLE OF THE CORE MODELS RESPECT TO THE RESEARCH QUESTIONS AND THE TD RESEARCH FRAMEWORK

This chapter constitutes also the initial step to address the first set of research questions concerning the interdependence between users' representation, city visions and technology roles [see Chapter 3, section 3.6]. Indeed, in the process of building the core models, I tried to understand:

1) **What do we already know** that can help in investigating the interdependence between user, city and technologies oriented to inform the design of City Mirrors?
2) **How can we readapt this knowledge, already produced for other purposes**, to the goal of going toward technologies able to reflect city dynamics?

The real-world problem stated at the beginning of the thesis had been progressively converted into a knowledge problem defined as the *"recomposing problem"*. It consists in the problem of generating a focused knowledge to recompose the current misalignment between the representation of social context and city activities provided by existing technologies and their actual dynamics into the real-world [see Chapter 3]. This focused knowledge could help in overcoming the challenges of extending the potential applications of web-based technologies in the city by creating a digital environment that reflects the coexistence of multiple stakeholders, driven by multiple purposes and operating at different scales as characteristic of actions in urban environments [see Chapter 4]. As made explicit also in Chapter 2, this knowledge cannot be generated within the boundaries of a single discipline. It requires instead an approach aimed at **bridging consolidated knowledge across multiple disciplines and recombining that knowledge into new forms, with a new vocabulary and within a new framework.**

Building on that, the three core models provide a synthesis of heterogeneous concepts, stratified visions, and specific aspects concerning the nature of urban social structures, city dynamics and their representation in technologies generated independently within urban and informatics disciplines, and other domains that usually feed these disciplines (e.g. from cognitive science to political sciences). This synthesis is precisely organised in the form of simple conceptual tools with applicative purposes, framed into a coherent structure, and **mapping familiar concepts on both sides in a sort of meta-schema**.

At a more general level, this chapter implements the *"Integration through conceptual clarification and theoretical framing"* of distinct domain-specific forms of knowledge. This is one of the strategies put in place for structuring this work within a transdisciplinary research framework [see Chapter 2, section 2.3].

The development of the core models is positioned into the **TIDS protocol** [see Chapter 2, section 2.4] after the faceting of the problem as the step in which **each facet of the problem is modelled at a theoretical level to inform the subsequent empirical and applied research activities** [Fig. 5.1].

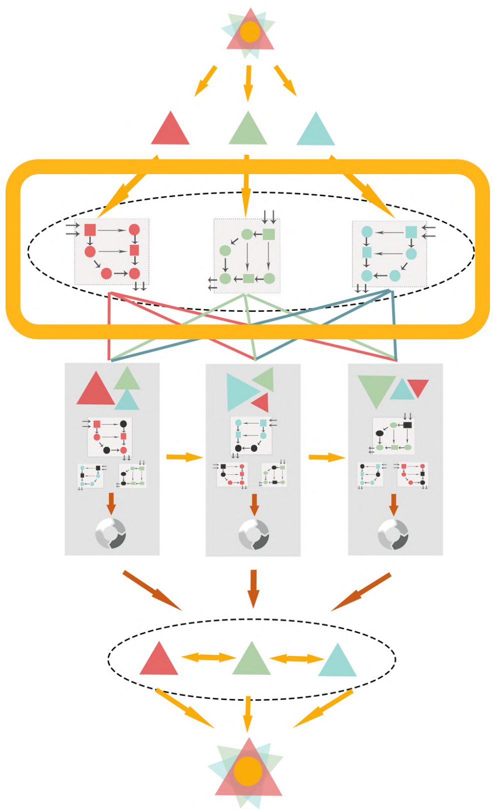

Fig. 5.1 Mapping of the development of the core models in the TIDS protocol

Following, I am going to explain rationale, approach and nature of the core models.

5.1.3 RATIONALE

5.1.3.a Repurposing knowledge

The **primary reason** motivating the elaboration of the three core models is linked to the fact that the concepts that they incorporate have been extensively developed and analysed in the literature of both urban and informatics disciplines, but:

- not with the **purpose of making directly applicable the findings and theorisation in one domain to an audience belonging to the other domain** (e.g. planning theorists writing for computer scientists, or viceversa)

- and not with the **intention of connecting the developed concepts to a specific class of technology**[2] (as regarding urban research) **or to the nature of city dynamics** (as regarding informatics research).

It is useful to mention concrete examples to clarify this point. Studies on social dynamics in cities explored in-depth the characteristics of different social structures such as groups, communities or social networks in specific contexts [e.g. Davies 1993, Gmelch & Kuppinger 2018, Wellmann 2018]. Recently, new attention is also given to the impact of digital technologies on these social structures [e.g. Ragnedda 2017]. However, the goal of these studies is analysing and describing these structures, not transferring the examined properties in an information model to organise the data that we can collect on these social structures in urban contexts. On the other side, important studies on organisations and online communities deeply impacted so far on the design and research of digital technologies (especially web-based) since the first foundational works in the '90s [e.g. Eason 1989, Preece 2000]. Nevertheless, the contextual constraints due to a specific geographical and socio-political context in which an organisation is positioned, or the complex relationship between online and offline communities when people coexist in both dimensions are still underexplored under a design-oriented perspective. Therefore, it can be useful to start mapping the concepts from these two parallel universes to characterise what is really specific of users of digital technologies in the city context.

Similarly, there is an impressively growing academic literature analysing cities as complex systems [e.g. Bertuglia & Vaio 2019] and also taking into account how technologies can help in controlling and managing some specific aspects of this complexity [e.g. Batty 2007]. However, the role of technology in this picture seems to be just instrumental (and for experts only). Most of all, this literature is very vague when we came to issues such as governance models (or even self-governance and self-organisation models of urban social structures) or the social interactions within the different systems of the city and with the city in itself. On the other side, the challenges of embracing the multiplicity of relationships, activities and experiences in shared digital and real environments are nowadays a priority and a paramount for the design of future digital technologies [Bødker 2015]. Nevertheless, the city context is not yet conceptualised as "the container" of these complex social interactions.

Considering the richness of this background, as well as its bipartition, the **three base models are configured as a first very basic nucleus of transdisciplinary concepts aimed at clarifying, matching, and integrating the related concepts and theories developed in distinct fields.**

[2] The connection between concepts elaborated in urban disciplines and a specific type of technologies can be seen in GIS literature, as regarding components, properties and characteristics of the physical environment of cities. However, this type of connection usually has instrumental and not generative forms. It is oriented to use existing technologies (GIS), possibly better, but not to orient the design of alternative tools.

5.1.3.b Connecting knowledge

The **second reason** motivating the development of the core models is trying to **connect theory and practice concerning the handling of the socio-institutional complexity in urban environments to transfer their inputs into the design of city technologies** meant to support different stakeholders with distict goals operating in a shared enviroment [see the concept of "political soundness" in Chapter 3].

Dealing with the social and functional complexity of cities is one of the most characterising elements of urban planning and urban design activities, both in research and practice (at least under the perspective on these disciplines that I decided to embrace). As also mentioned in Chapter 2 [see section 2.3], this relationship with complexity assumes different forms in theory and **practice. While the analysis and conceptualisations of planning theorists are traced in the literature, the experiences of practitioners are marginally analysed and rarely communicated in written forms in a way that can be transferable to other people, contexts, domains**. How urban planners and designers practically face the intricated magma of local institutions, interests, practices, and contextual constraints to design a plan or an urban project that mediate, navigate, and move forward of all that can appear almost esoteric from the outside.

So far, only a few researchers have been engaged to analyse and conceptualise these aspects of urban planners' practices [Hoch 2009, Palermo 2014]. There are only rare examples of self-reflection and comprehensive sharing of direct experiences [e.g. Innes & Booher 2010, De Leo & Forester 2018]. Despite this under-representation in academic literature, certain approaches, ways of reasoning about cities, even thinking automatisms are in general acquired by most of the planners through training since the education in architecture and planning schools, and then very commonly practised as habitus in various types of professional experiences. An important part of these practices leads to *"creating logical representations closely tied to practical cognitive judgments shaped by context and culture"* [Hoch 2009] or, in other words, mental models assuming the form of *"practical schemes focused on outcomes that improve how people cope with complexity"* [Hock 2009].

Like many others with a similar background, I have acquired this mindset by education and practice [see Chapter 6, section 6.7.1]. I thus recognise the relevance of these mechanisms to deal with cities complexity in practical activities and in the generation of knowledge from practice, as guidelines but also as theoretical constructs.

Again, a concrete example can help to clarify this point. It is common knowledge among planners engaged in city planning, community development, or public participation that every person or group should be considered in its multiple dimensions and relationships in the context. Facilitators of these processes know that people in front of them are not just "citizens" (as voters or taxpayers or individuals subjected to the same law system within a specific territory). They are families that invested lifetime-saving in their houses and are worried to lose them; shopkeepers that have no alternatives but caring about the future of their businesses and protecting them from potential disruptions; volunteers that want to see a change in their community and consolidate their organisations at the local level at the same time. All these dimensions can typically coexist in the same person called to understand and participate in urban transformations. Even though this is an essential principle to effectively working with local communities and groups, it is not the object of an organic theorisation in its foundations and operational implications. Nevertheless, the lessons learned and practical orientations to handle these situations are commonly passed from one professional to another in different settings and then instantiated case by case.

In my opinion, this kind of knowledge is extremely important to conceptualise the multi-dimensionality of individuals in the city context and the interactions among city systems, in ordinary urban practices but also for the design of city technologies. I had the opportunity to challenge the adaptability of a practice-based knowledge in the domain of urban planning to the domain of digital technologies, both in previous experiences and in the case studies reported in Chapters 7, 8, 9. This personal background, at a professional level and in research, enlightened the **potential of making communicable and more easily transferable concepts embedded in urban practice through abstraction and synthesis**[3].

On this basis, **the three core models absorbed critical reflections and insights coming from my direct experience, experiences of colleagues met in the past years, and other professional experiences came to my knowledge**. To this regard, I recall that working within a Transdisciplinary research framework implies to legitimise and value also a practice-based knowledge, both for its reintegration in theory development and for orienting specific actions to address the problem under study [see Chapter 2, sections 2.1].

5.1.3.c Supporting Design & Research

The **third reason** leading to the development of the three core models is linked to the lack of preexisting theories able to support the design process of City Mirrors. It is useful to refer to the three tactics connecting theory and practice in a design process indicated by Redström [2017]:

[3] A recurrent question during the PhD school evaluation meetings attended in the last three years was: *"how is it possible that you started your field activities before the formulation of the core models and that your field activities are coherent or had been informed by them?"*.
The answer to this inevitable and recurrent question is reported here for future occurrences and the benefit of readers with similar doubts. That question is based on two implicit assumptions:
1) a linear (ideal) research process in which at a certain time there is the formulation of the research questions, and only after that time, research activities start driven just by these research questions;
2) before the exact moment research activities start, the researcher is supposed to do not know anything on the research topic or to pretend so.
The constant answer to the before-mentioned recurrent question repeatedly clarified that both assumptions are inapplicable to a research process in which research and design activities are strongly intertwined. In this setting, the investigation process covers the process in itself and the people involved, the understanding of the context, the experimentation with the tangible and intangible "materials" and the constraints to deal with. [see also Gaver & Höök 2017a,b]. The answer to eventual research questions covers only very partially the outputs of this kind of research activities. Moreover, the association of design and research activities also implies that the activities had been informed by the previous knowledge of the designer called to perform also research activities.
In my specific case, the first assumption is inconsistent with the kind and frame of the pursued research. The research goal I wanted to pursue through this work was clear before the starting of the PhD. The definition of my research goal determined my choice of being engaged in formal research training during a PhD programme for acquiring new skills and knowledge to operate in that direction, not the other way around (i.e. first deciding to do a PhD and then deciding what to research about). The goal was understanding how to design web-based technologies to get people in cities coordinate or collaborate in their activities [see section 6.7.1, Chapter 6]. Then, as entirely normal in every PhD path, the specific research questions addressed by my research evolved in their formulation over time, even though the primary aim of the work remained unchanged. These circumstances assured an internal coherence to all my field activities from 2015 to 2018.
As regarding the second assumption, it is worthy of mentioning that I have formal education, design training and professional experience in urban disciplines. On the other side, I matured a long experience (supported by continuous training) in relation to the design and application of web-based technologies in urban environments and multi-actor projects [for more details, please see Section 6.7.1 in Chapter 6]. Thus, in structuring the field activities of my first case study before completing the development of the core models, I have been driven and supported by a solid knowledge on the interconnections among city systems in local actions, practical understanding of urban social structures and their management in a design process, years of personal reflections on failures and challenges of introducing web technologies in complex social and urban settings. In other words, previous knowledge and practice pointed out the relevance and precision of the key concepts reported in the core models to inform design research activities. Undertaking a PhD on these topics provided the opportunity to furtherly enrich these concepts at a theoretical level and make them communicable. Indeed, the analysis and contextualisation of these concepts in the literature of the selected disciplinary roots for the study had been fully developed during my PhD. The knowledge generated in the development process of the core models had the merit of speeding up and making more systematic the subsequent analysis and reflections from the field on the three case studies presented in chapters 7,8,9. Another important note for readers not necessarily used to design practices in research activities concerns the fact that the "making" and the "reflection" times can overlap, but can also be developed in completely different moments [see also Schön 2017]. The distance between the "time of action" and the "time of reflection" often helps in selecting what is most significant from a specific experience and seen more clearly the relationship between the context and the undertaken process, or even be aware of new information not available during the design phases that can enlighten new aspects of the addressed problem. To this regard, the most inspiring example I know is the PhD dissertation of Pelle Ehn in which he extensively reflects and theorises on his ten years of experience within the two projects of "DEMOS" and "UTOPIA" [see Ehn 1988].

- *"Parallels"*, a theory from humanities or social sciences is borrowed to inform the design of an artefacts, while remaining separate from the practice.
- *"Sequencing"*, a theory is external to the domain of design, but its concepts and interpretations allow to open new spaces or orientation for design research in specific settings
- *"Intermediaries"*, a theory is generated through design research by mediating the tension between the specificity of a certain type of artefacts and the aspiration to abstract and generalise the insights coming from the design process in a set of articulated concepts supporting future making, communication, learning.

As highlighted in section 5.1.1, the *"parallels"* tactic is unpracticable because of the lack of comprehensive theories connecting the three critical dimensions of users' representation, city systems and forms of technology support in local actions. The production of a theory accordingly to the *"intermediaries"* tactics is indeed the overall objective of this work [see Chapter 1, section 1.3]. Although, **prototyping city mirrors and then building an "intermediate theory" on city mirrors require a theoretical infrastructure for orienting, since the beginning, the design and research explorations**[4] on city dynamics and digital artefacts intended to be multi-stakeholder, multi-purpose, multi-scale. The **development of the three core models thus reflects the tactic of "sequencing"**. The difference is that the core models are the results of a hybridisation of concepts from multiple theories and their organic restructuration in new forms, instead than coming from one only theory. Their scope is supporting the design activities and the analysis of fields observations by being instrumental in enabling the "intermediaries" tactic.

5.1.4 APPROACH

I refer to the Cooper's taxonomy of literature review to describe the approach used for analysing the theories and concepts existing in the literature of the disciplinary roots of the study [Cooper 1988]. The Cooper's taxonomy indicates to explicit focus, goal, perspective, coverage, organisations and audience of the literature review, as shown in Table 5.1.

Table. 5.1 Characteristics of the literature review in this chapter according to the Cooper's taxonomy

Focus	Theories, isolated concepts, aggregation of concepts, concepts abstracted from practice.
Goal	▪ Building a linguistic bridge between urban and informatics disciplines through the reuse and extension of their respective vocabulary. ▪ Mapping of concepts with different denominations and resolution of linguistic conflicts or mismatches. ▪ Identification of central issues, properties, characterisation of the reviewed concepts.
Perspective	Not neutral presentation of the state of the art, but a critical analysis of related works under the light of the thesis scope.

[4] The problem under study indeed is defined as a *"deep design problem"* requiring design and research explorations at the same time. See Chapter 1, Section 1.3.

Coverage	Representative and/or pivotal. Not systematic or intended to be exhaustive. Coverage limited applying 1) temporal criteria and a 2) topic-centred horizontal approach for their analysis. 1) Considering the rapid evolution of the research fields touched by the study as regarding their principles and their applicative fields, the literature review covers primarily papers published in journals and conference proceedings and books in the last ten-twenty years. Foundational and previous works are included when relevant also in the contemporary and future scenarios. 2) Considering the multi-disicplinary nature of the literature review, the selection of sources narrowed as much as possible on the concepts, widening their correlations within complementary fields, instead that exploring and enlarging the theme within a single research area.
Organisation	▪ At macro-level, conceptual organisation in three groups of topics corresponding to users, city and technologies. ▪ At micro-level, discussion of concepts organised by components of the core models, proceeding accordingly to the following logics: - User: proximity to the user's personal sphere, from the level closer to the user to the most distant - City: from the systems to the infrasystems - Technology: from coordination to cooperation and collaboration.
Audience	General scholars, not necessarily specialised in the domains of the reported literature. Attention to present the selected concepts in a way that is also understandable for a non-academic audience (e.g. practical examples).

5.1.5 NATURE OF THE OUTPUTS

The core models have a **theoretical nature, but they are not theories**. They should be considered instead as **conceptual devices to support research and design activities** by providing the "justificatory knowledge" for orienting the research and shaping the design interventions [see also above 5.1.1.]

Indeed, the core models provide a schema to rapidly outline the relationships between specific aspects of everyday practices and observations made during empirical activities. The schema is based on well-known facts and (almost) common-sense knowledge connected to the inputs and the deeper understanding of these facts and knowledge built in the academic environment. For instance, it is nowadays common knowledge that society is composed of individuals, but also of organisations, communities, and so on. However, properties and peculiar characteristics of these social structures are instead less widely known by a non-specialistic audience, and not necessarily broadly known to a specialistic audience (e.g. experts on communities not necessarily are experts on organisations). The core models tried to balance depth and broadness to organise and present clusters of intertwined concepts, keeping in mind that they are instrumental, or rather lenses for action-oriented analysis, without having descriptive or explanatory purposes.

5.2 TOWARD A MULTI-LAYER REPRESENTATION OF USERS AND SOCIAL STRUCTURES IN URBAN CONTEXTS

In this section, I am going to present the **core model of the users of city technologies framed as part of multiple social structures**, determining the limits and their potential actions at an individual level, as well as the boundaries of collective actions in the case of aggregations of individuals. To clarify this last point, I also introduce the corresponding **concept of collective user as the abstract projection of aggregations of individuals whose actions are configured by homogeneous sets of norms in urban settings.**

5.2.1 STARTING POINTS FOR THE DEVELOPMENT OF THE MODEL

5.2.1.a Preliminary theoretical inputs for the model

The dialectic between individuals and the social structures in which they are completely embodied is the backbone of the ***"antro-ecological model"*** influencing most of the theories developed in the planning domain, as well as the actions in planning practice [Friedmann 2008]. Even though this general model[5] pays limited attention to the interactions of individuals with the physical environment of cities[6], it is extremely powerful in understanding social environments and supporting normative decisions (that are the main ones in planning). Indeed, as specified on many occasions before, **our collective existence in cities is primarily shaped by social relationships. They are determinant at an economic, cultural, and political level, more than the biology or psychology of individuals.** Nevertheless, there is not a unified theory in urban disciplines rendering the components and properties of this antro-ecological model, because this vision is primarily borrowed from philosophical anthropology and other social and humanistic fields [Friedmann 2008] and reinterpreted or readapted to the contingent purposes of planning and urban studies.

An attempt to formulate a comprehensive model had been made by E. Alexander [1995], summarising his reflections on city dynamics and theorising from his long experience of managing or transforming these dynamics in complex social settings. Alexander proposes to consider **social structures as articulated into three levels** (micro, meso and meta-level) incorporating units going from the family to nations, and directly linked to **social mechanisms shaping actions at the collective level**, such as: solidarity among individuals personally connected; alliances and coalitions among social units in competition with others; market-driven and "quasi-consensual" rules based on laws at a higher level. While this model discretises and allows an easier analysis of the intrinsic properties of different levels of social structures, it makes still difficult to distinguish the specific characteristic of the type of social structure within each level. Unfortunately, this model has not been widely considered as a common reference in urban disciplines. Not because it is not valid or brilliant, but because it assumes capacities and knowledge in its possible readers that are objectively uncommon.

Looking at the social sciences and their inputs for Urban Studies, there are several theories illustrating the principles of the actions of individuals in society and explaining how those actions are influenced by social

[5] More correctly the antro-ecological model should be defined as a vision and not as a model because it does not include the structural specification of the model itself. It provides instead only an orientation in the interpretation of the reality.

[6] This element could seem counter-intuitive referring to urban transformations, as it is usual in urban planning and design. However, any urban transformation is the result or effect of decisions and actions defined at the social level. Thus, the most important element to understand urban transformations is not what is done to change the physical environment, but why a transformation had been done, by whom, for what purpose (s), on what ground, and with what consequences.

structures or the social environment[7]. Two of the most relevant are the **theory of social systems and social actions** elaborated by Parsons (in the ‘30s and then later expanded during his entire life, and then by other scholars) [Parsons 1951, Parsons et al. 2017] and the **theory of social identity** developed by Tailef and Turner since the ‘70s [Tailef et al. 1979, Turner & Reynolds 2010].

Parsons combined the analysis of the structural factors determining individuals’ actions with a functional perspective on the objectives of these actions against the rules shaping a social system and its sub-systems. In other words, Parsons conceives society as organised by four sub-systems having different functions.

These functions are:

- the adaptation to the context
- the definition of collective or general goals
- the integration of various social components and actions
- the maintenance of the system itself through the continuous and progressive acquisition and interiorisation of its norms by individuals.

These functions are covered by different kind of “institutions”[8], ranging from economic, political, cultural and religious ones, but also families. Individuals’ actions within these institutions and in the social system are determined by intrinsic constraints typical of each social system (called *“patterns variables”* by Parsons). Indeed, different social systems can facilitate actions privileging specific sub-groups or actions benefiting the collectivity as a whole. They can also attribute variable level of importance to specific roles or individuals’ characteristics that are natural (e.g. ethnicity) or acquired (e.g. social status). As a result, the actions of individuals are influenced by personality and behaviours profiles, but mostly by social and cultural constraints pushing individuals toward specific choices reflecting the values promoted by a specific social system.

Parsons’ work is based on the dichotomy between individual and society (corresponding to personalistic or collective actions), without going in the detail of the social structures composing the society. Differently, the work of **Tailef and Turner**, rooted more in social psychology than sociology, focuses on **groups and inter-groups relationships in society**, without differentiating though the nature and scale of these groups. While the theory of social identity has many factual points in common with the Parsons’ theory of social systems, the key difference is the **focus on the constitutive elements shaping the mental representation that individual build of the society in which they act**. This mental representation shapes their identity and therefore influence their actions toward people belonging to the same group or to others. Identity is considered indeed as a continuous process of understanding and assessment (“*categorisation*”, “*identification*” and “*social comparison*” in the Tailef and Turner’s definitions) of the differences among groups and the norms regulating the membership to a specific group.

[7]The frameworks elaborated by E.Ostrom concerning social dynamics in collective actions will be discussed in relation to the interaction in the social system of the city, but they do not cover the analysis and definition of different social structures in society. Thus, they are not considered in this section.

[8] Differently from this work, Parsons does not distinguish between “institutions” as “rules” and organisations or other social entities as implementer of the rules in society.

5.2.1.b Critical assessment of the preliminary inputs

Using these two theories as starting points for the development of the first core model imposed some considerations.

- Both theories **do not refer to urban settings and social dynamics in the city**, even though precisely in cities the multiplicity of social and cultural constraints poses the major challenges for individuals' decisions and the coexistence of different groups appears to be more evident in that kind of setting.

- **Parsons' theory** is frequently considered particularly abstract. Even though its use as an analytical lens for reading urban dynamics is still possible, it offers **limited support to the identification of the specific patterns of rules, actions, and decisions**, especially considering social systems internally diversified like cities. On the contrary, Tailef and Turner's theory facilitates the identification of recurring elements and patterns for the construction of social dynamics through the observation of a specific setting with its groups and heuristics. However, their theory offers **limited support to abstract from an individual to a collective perspectiv**e and to make generalisations across different context and observed settings.

- Looking at the potential transfer of these theories to inform the construction of **user models incorporating their inputs, the main issue is the granularity of the concepts composing the two theories**. On one side, the high granularity of concepts such as *"relational and regulative institutions"* to determine the functioning of the social system [Parsons 1951]. On the other side, the low granularity of a multitude of factors such as age, job position, social status, memberships to sport, community, religious, political groups [Tailef and al. 1979].

As a result, connecting each of these concepts to the related sources of information concerning the online and offline actions of users of digital technologies could lead to users' models with marginal operational value or unnecessarily detailed users' models[9].

Indeed, referring to the design of information technologies as in this work, a **user model is the information infrastructure representing the key characteristics of the users that are functional to designing and evaluating the effectiveness of a system to support the users' goals within the scope of the system.** That information infrastructure can be imagined as a grid structuring the information on the users and the information on the actions enabled by a system or expected by the user. To this regard, the **model of users of city technologies oriented to support collective actions** (i.e. actions of a collectivity, actions having a collective relevance, actions requiring collective efforts to be perfomed) compels to take into account:

- the **city context** and how sharing urban spaces impact on the definition and functioning of the social system, and on the coexistence and overlapping of multiple social systems

- the possibility to follow specific traces (or sources of information) to **identify the patterns of action of individuals within the social system and the footprint of different social structures**

- the **complementarity between individual and collective perspectives** at each level of the social structures, or in the various groups to which the user belongs

[9] In technologies heavily oriented to personal recommendations as the key strategy to access and navigate digital contents, the micro-profiling of individuals based on the characteristics and behaviours recurring in their groups is essential. Differently, the micro-profiling is potentially less effective in technologies more focused on collective actions.

- the need of optimising the information about the individual users and the social structures in the city context in relation to the kind of actions to be supported by city technologies (**balancing granularity and effectiveness**).

5.2.1.c Considerations and choices made for the development of the first core model

Building on the vision, model and theories mentioned before, I developed the first core model presented here by:

a) **assuming the multidimensionality of the antro-ecological model of people as part of my vision**, operationally integrated by the analytic framework based on the three axes of *"discourse"*, *"practice"* and *"structure"* (also used in Chapters 1 and 3) corresponding to the identities, roles and norms impacting on individuals' decisions and actions

b) **considering the articulation of social structures in progressive levels**, as in the model proposed by Alexander, to differentiate them on the basis of the closeness of the personal sphere of individuals and the sameness of structures regulated by similar internal rules (see also the ontological axiom of transdisciplinarity in Chapter 2)

c) **prioritising a functional perspective on different social structures**, as in the Parsons' theory, to connect the role of individuals within specific social structures to the function of these structures in relation to the goals of individuals themselves (that is consistent also with the Alexander's model and his emphasis on institutions as rules socially constructed ordering the functioning of social structures and the perpetuation of society as a whole)

d) **focusing on the identity of individuals as a determinant factor for their decisions and actions in collective settings,** referring to the social identity theory, but also highlighting the importance of the **"collective identity" attached to specific social structures independently from the identities of the individuals** of which they are composed (by referring to the concept of the permanence of institutions within social structures)

e) setting the **goal of supporting the construction of an information infrastructure describing individuals and social structures** within a digital system by connecting potentially accessible information sources to online and offline actions.

Two additional elements had been considered for defining the first core model:

1) the use of a **vocabulary** to refer to different social structures that is transversal to multiple domains and clear enough for a general audience, based on the labels usually linked to the most common forms of aggregations of individuals: **groups, organisations, communities and networks**.

2) the need to **organically integrate the "topology" of different social structures**, or rather the distinct mental models abstracting the high-level characteristics of aggregations of individuals, groups, communities, organisations, and networks such as their uniformity, boundaries, internal structure and nature of the internal and external relationships [see Fig. 5.2]. For instance, it is common to distinguish groups or communities through their boundaries assuming their spatial or thematic

juxtaposition, as well as focusing on the structure of organisations (frequently assumed as pyramidal) or on the direct and indirect links of networks. Usually, user models in information systems are based on a topology of users and users'relationships that is flattened or limited to one type of social structures (groups, or organisations, or communities, or networks). While topological criteria are essential for making information describing users and their interactions with or through technology are essential, also the accuracy and appropriateness of the topological representation of these elements is crucial. For that reason, the first core model attempts to integrate the topological properties of different social structures schemes.

Thus, for the purpose of this work, the working definitions of the above-mentioned social structures are reported in the following sections as used and interpreted in the core model, by also highlighting their instantiation forms, properties and relations with other social structures.

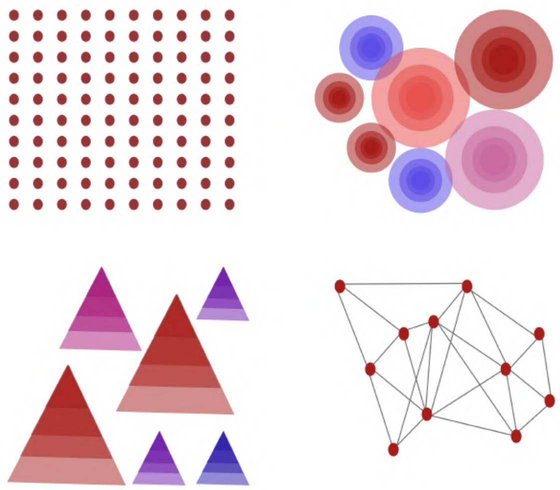

Fig. 5.2 Topological differences between the common mental modelling of different social structures. From left to right: society of individuals; society of groups or communities; society of organisations; society of networks

5.2.2 OUTLINE OF THE MULTI-LAYER USER MODEL

The core model of the users of city-mirrors-like technologies can be represented as showed in Fig. 5.3.

The schema indicates:

- **three fields of action** corresponding to social structures having a personal, professional or territorial connotation
- **four levels of social structures** corresponding to groups, organisations, communities and networks and characterised by specific rules and properties at each level
- **several orbitals** irradiating from the central point corresponding to the user as individual and defining the multiple social roles and identities of the user within the social structure to which the user belongs.

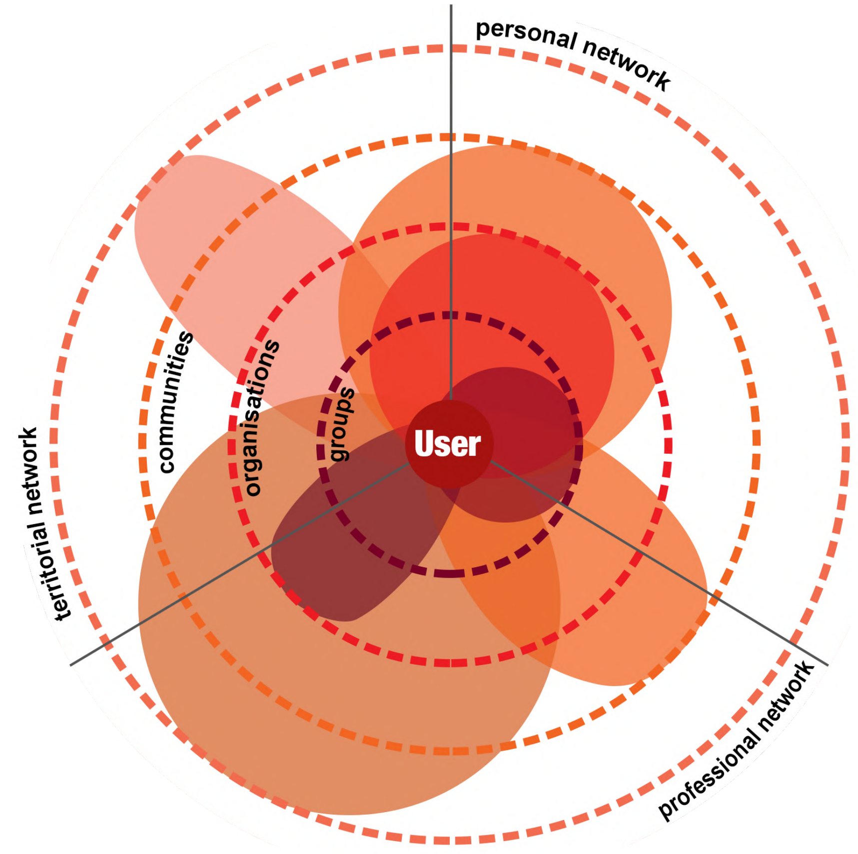

Fig. 5.3 Outline of the first core model

5.2.2.a Fields of Action

The choice of considering **three fields of action for the users of city technologies** is linked to the specific kind of social interactions usually developed within them. Accordingly to the **transdisciplinary axioms** stated and discussed in Chapter 2 (see section 2.5), the key of approaching complex matters such as the multi-dimensionality of users in a holistic way is identifying the discontinuities in the laws regulating distinct aspect of the reality to proceed with the analysis of these laws and their interdependences. Indeed, as commonly experienced, **types, forms of actions, goals, behaviours change and are dynamically readapted to the social norms of the personal, professional and territorial spheres of everyday activities**.

The **personal sphere** is linked to personal relationships like family, friends and relatives, self-help groups, religious communities, and so on. It is also linked to the set of personal preferences of individuals determining their personal connection within thematic clusters (e.g. sports, arts, political views) and **beyond the constraints of professional frameworks and spatial proximity**. The actions conventionally pursued within a personal sphere frequently have the **goals of socialising, collectively addressing some needs, living together or sharing experiences**.

Differently, the **territorial field** of action is linked to the **contingency of the spatial proximity** and the strategies put in place by individuals and collectivities to **cope with contextual constraints, risks, local issues or exploiting potential opportunities**. This is the sphere of the offline exchange of information and immaterial resources among people sharing close spaces, but also the preferential sphere for civic engagement in local organisations, activation of temporary groups' coalitions to react to external threats.

Lastly, the **professional field** of action includes the **various operational frameworks for the exchange of goods, services, competencies** among individuals and structured social entities. While the specific rules for actions are defined at the level of each social structure to which the user belong within each field of action, the separation facilitates the identification of such rules and their analysis in the cases in which they overlap[10]. This distinction helps to clarify what is specific of a field and what is in a *"non-resistant zone"* [see section 2.5].

Another aspect to be considered in city settings as regarding the three fields of actions is the relation between the **orthogonal dimensions of public and private interests on one axis, and public and private utility on the other.** For instance, actions pursued within a territorial sphere of action, that is usually considered as associated with the public domain and a public utility, can be driven by private interests as defending someone's properties against urban transformations. At the same time, actions regularly considered as in the private interest such as the commercial activities (in the professional sphere for the retailers), also have a public utility both for the customers satisfying personal needs but also for the area benefiting of the associated economic development. Of course, actions pursued in the private interest across the three fields can have a utility limited to their agents (e.g. real estate market, job search), as well as some actions can be implemented in the public interest having a public utility (e.g. water supply infrastructures, municipal elections). **The orthogonal dimension related to the public and private interests is essential for taking into account the fundamental political nature of actions and interactions in the city context.**

5.2.2.b Levels of Social Structures

The **social structures levels** in the core model had been represented as four concentric circles, from groups to networks. Their **closeness to the user as individual indicated the strength of the factual constraints on the user's actions determined by the norms, practices and discourses of specific types of social structures.** The dimension of the circles does not refer to the scale of the social structure intended as the number of included individuals, or to the spatial or functional proximity to the user. Following the working definitions of each level in relation to the scope of this research.

- **Groups** are informal social structures composed through the aggregation of individuals united by an overall **goal or a practical purpose** and self-organising their actions.
- **Organisations** are formal social structures aimed at managing **material and immaterial resources** by arranging the activities of individuals through the attribution of specific resources and roles.

[10] Examples of overlapping between the personal, professional, and territorial field of actions. Example 1. A rabbi living in a neighbourhood with his extended family, professionally leading the religious community and representing the instances of that specific neighbourhood in the local council. Example 2. A Syrian refugee working as a florist in the city centre, but also enrolled for a degree in chemistry at the local university and engaged in support activities for her national community in the city district where she works and at the university. Example 3. A trade unionist working as an accountant in a factory and using her skills to fight against the closure of the school attended by her grandchildren.

- **Communities** are informal social structures constituted by individuals sharing **similar characteristics** in one or more aspects of their lives and fields of action. Communities are formalised when needed to facilitate inter-community relationships.
- **Networks** are formal and informal social structures based on a **set of relationships** among individuals, groups, organisations, and communities built around compatible goals, interest toward specific resources, or preferences based on similarities.

The **rules informing the actions of each social structure** in the city can be divided into internal rules, frontier rules, and external rules.

- **Internal rules** include the rules of interaction among peers and across the hierarchies or in relation to other responsibility arrangements in place within a certain social structure. These rules have direct impact over the agency of individuals. In particular, these rules determine the capacity of individuals to act for themselves, on behalf of others, or to determine the actions of other individuals within the same structure.
- **Frontier rules** include the rules of interaction with "the outside". Specifically, how individuals act outside the social structure of reference, at a personal level or on behalf of it, and how the structure itself relates to the outside.
- **External rules** include the rules of interaction among homogeneous social structures, or with other superordinate and subordinate social structures that can be both homogeneous or not. These rules do not have impact only on the agency of the social structures seen as a unit, but also on the agency of individuals as such outside the social structure of reference.

These rules usually cover at least obligations, prohibitions, sanctions, benefits, rights, duties, responsibilities, and roles within a certain social structure (**structural constraints**). More frequently, social structures also implicitly or explicitly formulate and adopt rules concerning the outline of the practices recurring in specific settings and situations (**practice framework**). Other rules can be extended to the attribution of meanings and values to specific entities such as objects, spaces, roles, determining specific one or more representations of the functioning of the social structure itself (**discursive background**).

Starting from this basic schema of the levels of social structures, the construction of a layered model of the users of city technologies will rely on the empirical and applied research activities to link kind and contents of the rules to the type of actions implemented at the local level according to these rules, and to the type of information associated with those actions.

The definition of the fields of action and social structure levels provide the infrastructure for a general multi-layer user model, while the identification of the specific social structures to which the user belongs is essential for building a user profile for better connecting users' actions with the appropriate forms of technology support. However, the membership to specific social structures is not informative enough for this purpose that requires to also **consider identities, roles, interpretation of constraints, and access to resources by individual users and their aggregations**.

Each level of the social structure is contextualised and analysed in the next sections, making explicit the properties useful to detail the user model (in relation to the internal, frontier, and external rules). Part of these properties are linked to the relevant literature, where made explicit, or furtherly detail the outline of the model presented in this section.

5.2.3 USERS AS INDIVIDUALS AND SOCIAL STRUCTURES AS COLLECTIVE USERS

5.2.3.a Construction and Applications of User Models Centred on Individuals

The single user considered as an individual making individual actions is the central focus of disciplines such as HCI that are devoted to **improving the experience of digital systems from the user's perspective**. Beyond this domain, a significant part of computer science research communities is also committed to optimising the computational mechanisms to make these digital systems more effective, performant or efficient in addressing the needs of technology providers, clients, end-users relying on the **analysis of characteristics and actions of individuals to refine the profiles of users and the effectiveness of recommender systems**. Web-based technologies, in reason of their vast reach and immense commercial returns, attracted the greatest attention of research and industry to improve the construction of comprehensive user models for profiling users in the most detailed ways (and thus optimising systems and investments).

In the last two decades, the **new paradigm of ubiquitous technologies** (having web-based technologies at their core) introduced new challenges in the construction of meaningful user models because of the need to take into account the interactions of users in their context of action, and not only with their devices [Cena et al. 2019]. As a result, the **model of the user and the model of the user's context united by the user's personal journal (sequence of user's activities in the context) became the backbone of new standard for** *"context-aware user-adaptive systems"* [Jamenson 1999, Heckmann 2006], or rather systems meant to support users in different actions at the change of the context.

The two **central issues for constructing reliable and effective user's models** (especially as regarding users in the context) are:

- collecting, storing, updating, deleting the **kinds of information that are essential to make assumptions** about the proper response of the system to the inputs coming from the user (or automatically proposed by the system to users)
- maintaining the **consistency between the general model valid for all the users and the specific profile of individual users**.

The structuring of the information in the user's model is usually based on:

- **cognitive models** supposed to be universal enough to cover the average user
- the **technical resources** (e.g. sensors and IT infrastructures) placed in a certain context and connected to the system
- a set of **heuristic rules to define the semantics** of specific users' actions in a given context and the **dependency patterns among actions and context inputs** [Heckmann 2006].

5.2.3.b Common Dimensions in User Models Centred on Individuals

In the literature on user modelling across research communities related to HCI and Web, there is substantial **consensus on the types, sources and structure of information to reflect the image of individuals interacting with a system, regardless the specific context of the user or the purpose of the system,** or with limited differences among various conceptual and empirical solutions [see e.g. Heckmann 2006, Korth & Plumbaum 2007, Golemati et al. 2007, Martinez-Villaseñor et al. 2012, Ouaftouh et al.2015, Curzon & Rukšėnas 2017, Cena et al. 2019].

According to several authors [Korth & Plumbaum 2007, Golemati et al. 2007, Martinez-Villaseñor et al. 2012, Curzon & Rukšėnas 2017, Cena et al. 2019], the **most common users' dimensions** include:

- **Personal information** such as name, contacts, gender, age, date of birth
- **Devices profile** such as the type of devices used and their settings
- **Transaction profile** with the list of purchases, inquiries, payments, reviews
- **Interaction profile** with the log of the visited pages and frequent options or functionalities used
- **Information profile** including contents produced by the user, or reviews, commented, edited, manipulated in some ways
- **Socio-economic and demographic profile** by self-categorisation, questionnaires or deduction of the system
- **Preferences, opinions, interests** concerning politics, society, and other public opinion hot topics
- **Social relationships, affects and emotions** captured thanks to self-disclosure or deducted by semantic analysis
- **Personality traits, physical and psychological status**
- **Habits and behaviours** inferred through recurrent actions.

Personal data, knowledge, experience, interests, and sometimes psychological states tend to be explicit data in the user model. On the contrary, the evolution and changes in preferences and interests, habits, intentions, goals, and expectations are implicit elements in the majority of cases. They are partially deducted or assumed by the system by considering only the feedback received from minimal actions on the system such as the basic interaction with contents, features and other users or systems [Ouaftouh et al. 2015, Cena et al. 2019]. As a result, the **picture of the user is informatively dense, but disorganised and fragmented.** However, **in all basic applications intended primarily for personal use only, the granularity of the model is consistent with the scope of the system.** The scope of the system can make unnecessary to better integrate the available information that must make sense for the individual user (already aware of them) and, at the same time, being non-redundant for the technology-supported tasks. Differently, **in city technologies (as well in other classes of cooperative and collaborative systems), a narrow focus on individuals combined with the fragmentation of information (at the scale of single users and their aggregations) can hinder the chances of the system to practically make easier or support users in their collective actions.**

Looking at complex social settings such as the city context and at collective actions implemented in these settings, the common dimensions considered in most of the user models require to also consider the dimensions associated with **the identities of users at the individual and collective level.** They become essential to establish a direct connection between these identities and the choices, actions, behaviours, preferences and expectations in different operational contexts [Brewer & Gardner 1996, Hogg & Terry 2000]. **Despite its centrality, the concept of identity is usually neglected in the construction of user's models for information systems.** One of the reasons can be traced back to the obstacle of recognising the relevant information to set the components of the "identity dimension" of the user and appropriately processing this information in a way that could be reactive to the context in which the user operates and the actions to be supported.

5.2.3.c Integrating User's Identities in the User Model through the Concept of "Collective User"

As mentioned in section 5.2.1, the two theories of the **social identity** [Tailef et al. 1979, Turner & Reynolds 2010] and the **individuals' actions in social systems** [Parsons 1951, Parsons et al. 2017] provides numerous inputs that could be **readapted to characterise users' identities in information systems** supporting collective actions. In both theories, the common ground is the importance of the social norms and institutions defined and perpetuated within the social structures in which individuals shape their identities and act. Taking also into account the positioning of this work respect to these two theories [as discussed in section 5.2.1], **the starting point of the process to integrate the identities' dimension into the user's model of city technologies is focusing on the properties of the social structures shaping these identities**.

Individuals have a **plurality of identities** partially shaped by their personal characteristics, believes, history and contingencies. Most importantly, these identities are determined through the **dynamic negotiation between self-representation and social representation associated with the different roles covered by individuals across a variety of social structures**. Indeed, while identities are evolutive constructs along the lifetime of a person, roles usually have static properties (i.e. they are determined by static rules iterated in temporary attributions). Roles are attached to the "position" of the individual within specific social structures, even though not necessarily can be considered as infiltrated or substitutes for individuals' identities[11]. Building on this point, **the layered model of the user considered in relation to a multiplicity of social structures finds its counterpart in the complementary model of primary social structures as "collective users"**. Their combination could lead to integrate the "identity dimension" into the user's model of city technologies because of the dialectic relationship between fluidity and permanence of identities and social norms associated with local social structures.

An example based on a metaphor can help to understand the **concept of "collective user" as a unitary and consistent information infrastructure unit within a social system**. It is common sense that the aspects defining a human being are his/her biology, physiology, psychology, cognition, movement, and embodiment. Or more in detail:

- our body seen as the composition of anatomical parts
- its functioning relying on connective systems
- our behaviours
- our way of thinking or learning and generating knowledge
- the changes in our body and mind due to specific actions
- the way we experience the world and we are connected with to it.

Analogously, **every social structure has its own biology, physiology, psychology, cognition, movement, and embodiment.** They are constituted by:

- the tangible resources of which they are composed
- the systems to connect these resources with or without human intervention
- the protocols governing the repetition of its activities
- the mechanisms to process the information related to resources and protocols implementation
- the internal and external changes due to planned and unplanned operations
- and lastly the relationships with other social structures and the positioning in the context.

[11] The overlapping between identities and roles can happen and be stronger especially in the cases in which peculiar identities determined the best fit of a specific individual with a specific role (e.g. numerous examples in culture, politics, government).

As it happens for different humans too, **some aspects can be more or less prominent for different social structures**. For instance, as indicated in the working definitions provided above, the centrality of resources management is more prominent in the structuring of organisations, while the relationships across social structures are distinctive of networks. In the following sections, I am going to discuss the core properties and the most prominent aspect of these social structures and the analysis of their instantiation in collective actions will be continued in the case studies. Before moving on, a last remark on the relationships between identities and cities relevant for the design of city technologies.

The design of cities (even in its spontaneous, traditional, and unplanned forms) is the determinant and results of local identities. To a certain extent, **urban design is "the" shaping of *"identities by design"***, as condensed in the work of Butina-Watson & Bentley [2007]. These authors had extensively analysed several urban transformations across different countries driven by the research and awareness around the **link between identities of people and identities of places**. This link had been deeply studied at a theorethical and empirical level for decades in disciplines ranging from **social and environmental psychology to urban studies**, insisting in particular on the **representational part of the relation between people and cities**, or rather how these two complex entities reflect each other [Proshansky 1978, Lalli 1992, Hull et al. 1994, Gosponding 2004]. The **alternative perspective of urban design on this matter is centred on the actions envisageable through the dynamic construction of people and places identities**. Indeed, these identities are not something given or engineerable, but a sort of a two-parts ensemble that can be oriented to function in a partially defined way through design and readapted through the appropriation of the design outputs by the people living urban spaces. In other words, **the peculiarity of urban design is the interest in constructing a certain way of thinking the space of actions through collective self-representations that directly and indirectly impact on the nature of the individual and collective actions[12] in complex socio-technological systems as cities**. Information systems are socio-technological system much less complex of cities, and the exploration of the properties of the different social structures in which users operates can precisely help to propose and iteratively reconfigure their technology-mediated collective self-representation.

5.2.4 USERS AS MEMBERS OF A GROUP

In the literature across social and natural sciences (also including urban and informatics disciplines), the definitions of groups are polarised according to two macro-orientations:

1) groups defined as an aggregation of individuals sharing a set of similarities concerning their intrinsic characteristics, or behaviours, or specific external and internal social representations

2) groups seen as goal-oriented aggregations of people, permanently or temporarily united in carrying out joint actions.

In the first case, it is frequent that the term "group" actually covers a wide range of social structures that include teams[13], organisations, communities and networks. Indeed, as seen in section 5.2.1, also the social identity theory developed by Tailef and Turner is built in the dichotomy of individuals and groups, leaving the differentiation of the aggregation of individuals out of its scope. In urban studies, it is common to use

[12] In this sense, urban design approaches have a disruptive potential in comparison with nudging theories, nowadays increasingly popular among planners and technology providers, and based on experimenting new ways of changing people's behaviours in cities by exploiting common cognitive mechanisms related to self-discipline, preferential choices, bias [see Ranchordás 2019].

[13] A group is a set of individuals operating together or independently to achieve a collective goal. A team is a specific type of group composed by interdependent individuals or individuals having complementary profiles and activities.

the label "group" for focusing on a segment of the population that can clearly be isolated from the rest of the population on the basis of ethnic, national, cultural, socio-demographic characteristics [e.g. Hochstenbach 2019]. In that case, the term "groups" is preferred to the one of "communities" to avoid the automatic overlapping between the intrinsic characteristics of the population under study and their spatial manifestation in urban settings (considering that is frequent to imagine communities as geographically enclosed or to study specific kind of groups within certain geographical boundaries [e.g. Barwick 2018, Farkas 2017]). In other cases, for instance in planning and urban design, groups are simply seen as a set of individuals following similar behaviours in urban settings and expressing similar clusters of needs that could be addressed in future interventions [e.g. La Rosa et al. 2018, Zignani et al. 2019]. Similarly, also in the domain of HCI is frequent to recognise the same positioning to target the needs and expectations of a specific segment of technology users identifying them as groups [e.g. Abdelnour-Nocera et al. 2013, Zajicek 2006].

Differently, the working definition of the term "groups" adopted in this work refers to them as informal social structures composed through the aggregation of individuals united by an overall goal or a practical purpose and self-organising their actions. Indeed, in my case, distinguishing between group dynamics and community dynamics (where communities are defined on the basis of shared similarities) is essential to understand how potentially supporting local development actions that can be implemented at the level of groups or communities. Therefore, the two kinds of social structures are analysed separately below and in section 5.2.6.

5.2.4.a Common Characterisations of Groups as Goal-oriented Units

The attention to groups as units operating toward a specific goal is central in disciplines such as CSCW. This field has been traditionally defined precisely by the idea that cooperative work is the one oriented to carry out operations and provide services through the coordinated effort of a set of individuals[14], not necessarily united by ideal shared aim or specific characteristics [Schmidt & Bannon 2013]. However, the focus in CSCW, also in the study of groups' practices, remained on the individuals and on the modalities in which they interact with each other or with the systems supporting their activities, instead than on intra- and inter-groups dynamics [Seering et al. 2018]. Nevertheless, there is a growing awareness about the need to look also at groups dynamics as a whole to move beyond the technical feasibility of supporting some specific group's activities to include also solutions reactive to *"social requirements"* [Ackerman 2000].

Relying on the consolidated knowledge developed in CSCW on the "mechanics" of groups and their technology-mediated interactions in a variety of setting, it is possible to extract the common characterisations of groups and users as members of groups. These elements help to detail the analysis of urban social structures through the outline of the user's model presented in section 5.2.2.

The macro-classification of groups under an operational perspective is given by the temporal and spatial characteristics of their activities. Groups can work in the same place or be distributed and carry out their operations at the same time or according to alternative time arrangements [Johansen 1988] such as in sequence, periodically, in cycles. As a result, the **space-time matrix** identifies four main kinds of groups:

- **Co-located and synchronous**
- **Co-located and asynchronous**
- **Distributed and synchronous**
- **Distributed and asynchronous.**

[14] In this sense, a large part of CSCW focus specifically on teamwork.

The perspective of supporting group's activities through technology expands the range of groups to also hybridised forms on the basis of the **virtual and physical dimension of the coexistence of their members** (e.g. virtually co-located, but physically distributed; or physically co-located, but virtually distributed; partial or alternate arrangements) [Rodden & Blair 1991]. The same dimensions can be considered in the analysis of the activities performed by different kinds of groups in urban settings.

The **group-size** is another distinctive element to examine activities and groups' dynamics. It is frequent to associate the idea of a group with units composed by a few members. But, technically, **goal-oriented aggregations of individuals can range from small groups to crowds**. This is particularly relevant in cities, that historically hosted and sustained the emergence of large groups actively (and often publicly) pursuing specific goals without being rooted in communities, but instead leveraging on the heterogeneity and transversality of their composition. For instance, social movements are one of the instantiations of large goal-oriented groups strictly tied to urban settings [O'Brien 2018, della Porta & Subirats 2019]. Even in the domain of CSCW, especially in the last years, the traditional focus on small groups and teams within business organisations continued in parallel with growing attention toward crowds and large groups [Harris et al. 2019].

The theory of small groups as complex systems [Arrow et al. 2000], also proposed for the analysis and design of technology systems to support groups and CSCW systems [Sutcliffe 2005], distinguishes groups also in relation to:

- the **duration of their joint engagement** (short or long term)
- the **effort focused on one specific action** (e.g. project) or on multiple actions over time
- the **modalities for their formation** as set externally or internally
- the **type of goal** as motivated by work objectives or social needs.

5.2.4.b Characterisation of Groups as Collective Users

Looking at **groups as collective users**, it appears evident how these social structures substantially rely on the **individual resources of its members** that include their knowledge, behaviours, skills, personality, social capital (ref. "biology"). At the same time, the **systems to effectively use these resources and the protocols governing the groups' operations are shaped by the conditions, settings and constraints** outlined above (ref. "physiology" and "psychology"). The **awareness of the on-going action in the group carried out by all its members toward the goal** is often indicated as the essential element to ensure the processing of information related to resources and the implementations of the protocols by the group as a coherent unit [Schmidt 2002, Gross 2013].

To complete the characterisation of groups as collective users operating in the city context, it is also necessary to consider:

a) the **topology of the group**, internally and in relation to these other structures (ref. "cognition").
b) the **dependency relationship** of a specific group from other groups and upper-level social structures in which a group could be included (ref. "embodiment")

I referred to the small groups' theory [Arrow et al. 2000] to make explicit the importance of understanding if the setting up of a group had been the result of decision external to the group or a spontaneous internal process, but this element alone does not enlighten about these two aspects.

Groups spontaneously created can be independent and isolated, and this is the case, for instance, of small voluntary groups promoting their specific projects or activities at the local scale. More frequently, groups set through internal decisions of their member can originate for **duplication, replication, emulation, partition of other groups** (ref. to "movement"). In this case, the **new group can be dependent from the original group** as regarding the nature of the systems and protocols put in place, or also for part of the material and immaterial resources incorporated in the new group.

As regarding **groups externally set up**, they can be defined as **units partially independent** (in terms of internal decisions and operations) from the social structures to which they refer to. In alternative, they can be simply considered as external implementation unit, **dependent for both decisions and operations**. Emergency task forces are a typical example of the first case both in the public and private sector, while R&D groups of industry consortia represent better the second kind of setting.

Considering in particular groups externally set up, dependency relationships are furtherly affected by the positioning of a specific group in the social structure from which it originated, **closer to the top-tier taking decisions or to the lower-tier with limited autonomy, or in between.** Other options can also include groups operating **on the margins of these social structures** (i.e. not on their core operations) or **constellations of groups gravitating across and outside them.**

The **internal/external dependency relationships** and the **topology of groups** are the two aspects directly connected to the agency of individuals as members of a group because strongly determining the rules of interactions of individuals outside the group (ref. to "frontier rules" and "external rules") and the malleability of the internal rules under individual inputs.

5.2.5 USERS AS AGENTS OF ORGANISATIONS

Organisations are the most important and essential social structures in city dynamics, relying on the functioning (and sometime misfunctioning) of other social structures such as groups, communities and networks to increase and extend resources and actions impact. Indeed, **cities are first of all spatial aggregations of material and immaterial resources managed within and across organisations**, whose interdependences shape the city itself as a socio-political entity before than as a typical highly-anthropized physical environment. This vision, as discussed in Chapter 4, is fundamentally in contrast with the one proposed by existing urban technologies. But the adoption of this perspective is also essential for moving toward technologies able to support collective actions in multi-stakeholder dynamics (see Chapter 3, section 3.6, Chapter 4, section 4.5.). On the other hand, as I will try to clarify below, recognising this point (and designing accordingly) implies to overcome a series of critical issues concerning the intrinsic properties of organisations and the emergence of silent and/or hidden dynamics.

An important clarification concerns the distinction between **Institutions** and **Organisations**. Institutions are *"rules of conduct"* to ensure the integration of individual actions based on the stratification of a certain corpus of implicit and explicit knowledge within a set of social structures following those rules and enforcing the compliance to them. Differently, as in the working definition adopted int his work, **Organisations are** *"systematic arrangement of resources"* **based on their own internal rules** (including the attribution of roles and responsibilities to people, but also the access and use of resources), incorporated within the framework of the institutions regulating social interactions in specific settings [North 1991, Moroni 2010, Foss & Klein 2014]. Nevertheless, the term "Institutions" is frequently used in common language to indicate organisations, especially public sector organisations. This word exchange is a sort of metonymy due to the fact that some of the rules of social systems envisage the permanence of specific organisational structures to manage public resources. This permanence leads to muddle rules and object or the application of the rules with the subject in charge of their application, while other kind of organisations have a more volatile nature that could seem disconnected from higher-level rules. This semantic overlapping should not prevent from looking at organisations and institutions separating the two aspects and examining the logic of the interactional rules within and outside organisations. For instance, remembering that even the Parliament of a State is simply an organisation based on legislative institutions and *de facto* managing the immaterial resources constituted by the national and regional laws. Or keeping in mind as well that a manufacturing company is an organisation following the rules of institutions driven by market mechanisms and potentially establishing new institutions in its operational context (e.g. by recruiting mainly at the local scale inducing a restructuring of job placement mechanisms as perceived by the perspective workforce perhaps linked for generations to the same company).

Organisations are considered in the core model presented here as the formal social structures aimed at managing material and immaterial resources by arranging the activities of individuals through the attribution of specific resources and roles.

5.2.5.a Common Characterisations of Organisations as Resources-Focused Units

Organisational studies are the core of Informatics thematic clusters such as social informatics, and more specifically the backbone of disciplines such as Information Systems (often also defined as organisational informatics or business informatics) [see also Chapter 2, section 2.3].

[….literature review and support statements for this part …][15]

5.2.5.b Characterisation of Organisations as Collective Users

Looking at **Organisations as Collective Users**, it appears evident their intrinsic difference respect to groups. While groups are strictly dependent on the individual resources of its members, organisations transcend individuals' qualities, or better, they administer individual qualities by attribution of codified roles and responsibilities. In the second case, the resilience of the structure allows to face also major changes in the composition of the organisation, possibly restructuring its functioning on the basis of the new resources and equilibria.

[….literature review and support statements for this part …] [16]

Characterisation of organisations as collective users:
- **biology: vertical, horizontal, mixed composition** of the resource management units
- **physiology: internal regulations, contracts, code of conducts, protocols** and chains of roles-task-responsibilities among distinct units based on explicit upper-level decisions
- **psychology: polyarchy mechanisms** to differentiate the level of formal/actual agency over internal decisions and actions
- **cognition: intermediaries** actively **filtering** access to information, its interpretation, the limitation for the use of information

[15] Section to be extended and completed with the summary of the properties and the common characterisation of organisations as consolidated in the literature, in a better moment of my life.
[16] Section to be extended and completed with the elements of the profile of organisations as collective users, supported by related literature.

- **movement: acquisition of the resources** to operate; structuring; **merging/ segmentation**; forming inter-organisational temporary **coalitions**; **symmetrical/asymmetrical configurations**
- **embodiment: exclusive/shared ownership** of the resources; **direct/indirect management of the resources** to qualify the organisation in the context [see also Fig. 5.3]

5.2.6 USERS AS PART OF COMMUNITIES

The label "community", analogously to the term "group", is often used as an all-catch term to indicate a diversified range of aggregations of individuals corresponding to almost every kind of informal social structure. The main types of communities identified, academically classified, or investigated include:

- **Communities of purpose**, as a set of individuals committed toward similar objectives and, therefore, involved in similar processes to achieve them
- **Community of circumstance**, as a set of individuals temporarily experiencing the same life circumstances (e.g. sickness, exclusion, reclusion, isolation) or contextual pressures (e.g. emergencies)
- **Community of action**, as a set of individuals that decided to actively contributing in experimenting and promoting changes at individual and collective level through their actions
- **Community of practice**, as a cluster of people sharing same needs, or background, concerns, frame of activities and reciprocally learning and developing the practices associated with their operational context
- **Community of interest**, as a cluster of people sharing same interests, passions, ideas, visions, thinking systems and relating each other to exchange data, information, knowledge about their common topic of interest
- **Community of place**, as a cluster of people living or working within specific geographical boundaries
- **Community by contract**[17], as an aggregation of capital holders (individuals, formalised groups, and organisations, conveying to establish common rules of conduct within specific georgraphical boundaries or in relation to specific practices.

According to the working definitions adopted in this work to indicate groups and communities clearly distinguishing their properties, the first three types of communities listed above are equivalent to groups. Or rather, to aggregations of people temporarily or permanently united in overcoming an issue, achieving a certain objective, directly working together with other members or individually with the indirect support of other group members. Indeed, **communities of purposes** frequently are associated with groups of subjects seeking for higher level coalitions or associations to push third parties to implement specific measures in a specific setting (often business) in their favour [see e.g. Wallace 1999, Heap et al. 2019]. **Communities of circumstance** are temporary groups engaged in overcoming issues, problems and difficult experiences by carrying out joint activities individually benefiting the members of the group [see e.g. Marsh 1999, Weston & Lenette 2016]. **Communities of action**, similarly to communities of purpose, emerge for achieving a goal. But, in this case, the goal tends to be more oriented toward benefits for the collectivity such as local changes or toward more sustainable practices or paradigmatic shift in policies, usually pursued through the active engagement of professionals, activists, and academics[18] [see e.g. Zacklad 2003, Brydon-Miller &

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[17] Contractual communities are also sometime indicated as intentional communities causing some confusion between the concept of communities of purpose (not bounding their members to explicit obligations) and this case in which community members' actions are framed under explicit arrangements.

[18] In this specific case a community of action can be also defined as "community of inquiry" as regarding the affinities among the methods and aims of the research to reframe scope and value of the generation of knowledge, such as in the case of researchers

Coghlan 2014]. **In these three cases, the relevance of the goal to structure collective dynamics is prevalent respect to the similarities or homogeneity of the individuals involved in giving form to these informal social structures.** Thus, the properties characterising these dynamics and these types of communities corresponds to those already presented for describing groups in section 5.2.3, and also to the schema of the interactions among stakeholders proposed in section 5.3.4. Following, **I focus instead on communities of practice, interest and place as informal social structures constituted by individuals sharing similar characteristics in one or more aspects of their lives and fields of action.**

In urban disciplines, but more in general also in real urban settings, communities of interest are formalised when needed to facilitate inter-community relationships or inter-organisational relationships in which the majority of the parties involved is composed by organisations, such as in the case of religious communities interacting with State agencies and local governments. The domains of HCI and CSCW pay extreme attention to the study of both community of interests and communities of practices, both in technologies to be used in working or recreational setting, targeted on customer/consumer users or expert professionals or generic community contributors. Differently, as mentioned before, the domain of Information Systems is more focused on organisations and formal social structures than communities.

5.2.6.a Issues and Characterisations of Communities of Place

As regarding the communities of place, a **fundamental issue is the assumption of the equivalence between community of place and community of practice**, frequent in the definition of location-based and community-based digital tools. This assumption does not consider the difference between:

- **spontaneous spatial communities**, possibly stratified and consolidated over time, and resilient to the substitution of their members
- and **spatial communities artificially created** through external constraints (primarily tax system and access to local services) that cannot be considered as cohesive or resilient, rarely stable.

Indeed, the strategies for handling the **tension between individuals and communities** required by the two typologies of communities of place are completely different. In the case of spontaneous spatial communities, the internal diversity of its member is contained because of the sharing of the same background and active participation in shaping, confirming and repeating the same set of social institutions locally. Thus, while individuals can search to differentiate themselves from their communities building or expanding personal self-representations, the forms of their practices and the nature of the structural constraints to opt for the in/out of the community are often implicit, but unavoidable. In the case of artificial spatial communities, the lack of shared practices requires a sort of balancing at the discursive level to virtually project and shape the existence of a collective subject resembling to a community, partially hiding or narratively reinterpreting the structural constraints underlying a localised aggregation of individuals sharing "non-existential" characteristics.

On this basis, the main issues of technology systems oriented to support spatial communities are:

- the assumption about the existence of these communities as homogeneous clusters of people
- the assumption of the existence solid social ties or the willingness to create them
- ignoring the nature of the pre-conditions and external pressures for activating and furthely expanding these social ties without external pressures.

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adopting action research methods [Garrison et al. 2010]. However, more commonly the concept of community of inquiry is a hybrid between the concepts of community of interest and community of practice.

These three issues are primarily linked to the erroneous transfer of dynamics observable in the case of communities of interest or practice to communities of place, that intrinsically are more heterogenous and/or conflictual.

Another essential element defining all the communities, but especially communities of place the definition of the **boundaries among distinct communities**. As mentioned before in relation to the Parson's theory and to the social identity theory, the identification of an individual as part of a community is based on the classification of the difference among distinct communities […].

[….literature review and support statements for this part …][19]

5.2.6.b Issues and Characterisations of Communities of Practice

The concept of Community of Practice, while relatively recent in social sciences literature and not necessarily explicitely mentioned in informatics literature, still constitutes the main vision of communities when refereeing to the design of information technologies. Indeed, the purpose of information technologies is enabling and facilitating information exchange, similarly to the very purpose of communities of practice. Thus, unsurprisingly a significant effort had been put in domains such as HCI in understanding principles and strategies to develop technolgy products responding to the needs of different types of communities [e.g. see Preece 2000].

As introduced above, a Community of Practice is fundamentally a learning communities of individuals spontaneusly conveying together because united by a common interest or problem for which they seek dialogue, inputs, methodological help, ideas, etc. [Wenger 1999, Li et al 2009].

The main caractheristics of Communities of Practice can be summarised in:

- Centrality of the domain as nucleus for interaction and exchange with peers
- Self-selection of their supporters
- Voluntary participation to help in addressing a problem or contributing to spread a practice
- Collective ownership of the ideas and solutions elaborated in the Community of Practice
- Active learning and commitment to dialogue
- Adaptation to the inclusion of external inputs and members
- Scalability
- Agile internal decision-making processes
- Independence from other formal social structures, in particular, organisations and networks
- Difficulty in reaching the self-sustainability and maturity
- Internal diversification of the supporters' profiles from leaders to silent members

Example. Neighborhoods as idealised communities of practice.
[….literature review and support statements for this part …][20]

[19] Section to be extended and completed with the summary of the properties and the common characterisation of organisations as consolidated in the literature, in a better moment of my life.
[20] Section to be extended and completed with the summary of the properties and the common characterisation of organisations as consolidated in the literature, in a better moment of my life.

5.2.6.c Characterisation of Communities as Collective Users

Looking at **Communities as Collective Users**, the most important aspect is the strength and pressure of boundaries self-defined or externally imposed, both explicitly and implicitly. To this regard, the body of a community is composed not only by the individuals participating to the community life, but also by the material or immaterial container of their actions (ref. "biology").

The internal connection among all the community affiliated relies on **spatial or social selection mechanisms** (as in the case of community of place) or **self-selection mechanisms** (in communities of practice). The selectivity at the entrance in the community and the enforcement of the rules to remain in the community are oriented to manage the sustainable growth of this kind of social structure and ensure its permanence as distinct unit from outside (ref. Physiology). The functioning and maintenance of the community depend on the solidity of the **internal dominance schemas** to make each affiliated actively "working" within the community, purposively directing individual resources to meet social expectations and in this way increasing his/her personal influence over peers (ref. Psychology).

Other characterisation of communities as collective users:

- **cognition: recognisability and differentiation** from outside based on intra-community conformation practices
- **embodiment: permeability/impermeability** to the influence of other community at functional or representational level (eso/ecto-representation of the community)
- **movement: expansion, contraction; opening and closure; fusion** with other homogenous communities; dissolution by *motu proprio* or external interference.

[….literature review and support statements for this part …] [21]

5.2.7 USERS AS NODES OF NETWORKS

In this work, **Networks** are defined formal and informal social structures based on a **set of relationships** among individuals, groups, organisations, and communities built around compatible goals, interest toward specific resources, or preferences based on similarities, and motivated by the **access to collective opportunities**. The focus is in particular on professional and territorial framework, linked both to the implementation of local actions by a set of users interacting in the city and potentially supported by technology. **Professional networks** are determined by functional, transactional or utilitarian interactions within the same sector of activity, between two or more contiguous sectors, or among interdependent sectors (such as the ones related to the production of resources and their distribution). **Territorial networks** are determined by the spatial coexistence and exposition to similar conditions within a limited space that include living the same issues, addressing related problems, using shared resources (e.g. urban infrastructures, city services). Examples of network connections within a territorial network can include:

- Acquaintances with people living nearby (at individual level)
- Volunteers in a citizens group to keep the public garden clean (at a group level)
- Affiliated with the local section of a political party (at organisational level)
- Organisers of the summar events for the neighborhood residents (at community level)

[21] Section to be extended and completed with the elements of the profile of organisations as collective users, supported by related literature.

Networks can be considered as collective users only when the actions patterns associated with specific relational schema clearly emerge from the recurrences of interactions across the three distinct spheres of actions identified before in personal, professional and territorial ones.[22]

5.2.7.a Common Characterisations of Networks as Opportunity-making Units

A comprehensive account of the properties and functioning of social network is provided by Kanushin [2012]. Accordingly to his work, some of the key properties of social networks include:

- the density and distribution of the nodes (intended as individuals or their aggregations) in the network
- the existence of weak and strong ties among nodes reflected in the cohesion of the network and its replication
- the centrality of specific social hubs and their reciprocal distance, as well as the social and physical distance among single nodes
- internal hierarchies and levels in the network, associated with formal and informal roles and functions attributed to specific classes of nodes
- partitions of the network in sub-networks or primary and secondary networks
- differentiation between core and periphery of the network.

As regarding the individual acting as a node in a network, Kanushin indicates a wide range of elements ensuring the functioning of this kind of social structure based on social psychology elements, such as the public recognition of status and rank, the perception of safety, sameness and belonginess and so on. However, as regarding the factual aspects related to the active involvement in the network operations, other authors looking at several different types of social network highlight the importance of the practical opportunities to pursue individual goals or achieve collective results relying on the network connections and activation mechanisms [e.g. Zimmer 1986, Kilduff & Tsai 2003, Anderson 2008, Jost et al. 2018]. From a descriptive perspective, Cross et al. [2003] unite psychological and factual aspects defining the role of individuals in networks, listing a set of "measures" to assess the level of individuals' involvement. Among them: the number and diversity of links with other nodes, the closeness to other intended as the simplicity to reach out other nodes; the centrality in the network and the associated prestige of that position intended as possibility to act as a bridge or gatekeeper against other nodes.

In urban settings, the essential characteristics of social networks is working across community boundaries and in a trans-scalar way [Herrera-Yague et al 2015]. [….]

[….literature review and support statements for this part …][23]

5.2.7.c Characterisation of Networks as Collective Users

[….literature review and support statements for this part …] [24]

[22] Section to be extended and completed with the summary of the properties and characterisation of professional and territorial as consolidated in the literature and make explicit the elements of the profile of territorial networks as collective users.
[23] Section to be extended and completed with the summary of the properties and the common characterisation of organisations as consolidated in the literature, in a better moment of my life.
[24] Section to be extended and completed with the elements of the profile of organisations as collective users, supported by related literature.

5.2.8 SUMMARY

The review of the key concepts associated with the main components of the first core models across different disciplinary domains allowed to detail the preliminary outline of the layered models of the user of city technologies. Following, in Table 5.2. and 5.3., the summary of the main elements highlighted by the review.

Table. 5.2 Characterisations – components – elements to be considered for each layer of the user model

USER AS	CHARACTERISATIONS – COMPONENTS – ELEMENTS TO BE CONSIDERED
INDIVIDUALS	Critical aspect to be considered in the city context: **SOCIAL IDENTITY (or multi-facet identity)** Defined through: ▪ the **aggregation of social structures to which the user belongs**: groups, organisations, communities, networks (number, size, scale, permanence, etc.) ▪ the **internal rules, frontiers rules, external rules** caractherising these social structures and shaping individuals' actions and concerning obligations, prohibitions, sanctions, benefits, rights, duties, responsibilities, and roles ▪ the force, real impact and pervasiveness of these rules over individuals'actions as **structural constraints, practice framework, and discoursive background.** Other elements commonly considered in standard user models ▪ About the user: personal information; socio-economic and demographic profile; personality traits, physical and psychological status; preferences and opinions; self-disclosed emotions and affects; habits and behaviours inferred though recurrent actions ▪ About the combination user/technology: devices profile (type of devices used and their settings); transaction profile (the list of purchases, inquiries, payments, reviews); interaction profile (log of the visited pages and frequent options); information profile (contents produced or manipulated by the user).
MEMBER OF GROUPS	▪ Direct **involvement in the definition of the group's goal** or ex-post adhesion ▪ **Motivation for the engagement** deriving from work objectives or social needs ▪ **Timing and duration of the engagement** respect to the lifecycle of the group ▪ **Online only, mixed, offline engagement** respect to the group's goals ▪ Online, offline, mixed online-offline **coexistence of the group's members** ▪ Engagement limited to **one specific action or multiple actions** over time ▪ **Centrality of the user's engagement over the action** in relation to the characterisation of the action itself (centralised, distributed, synchronous, asynchronous) and the pursued goal
AGENT OF ORGANISATIONS	▪ **Position** in the organisation and in the specific resource management units ▪ **Responsibilities and level of accountability** of individuals ▪ **Role in the definition of organisational rules and mechanisms** ▪ **Formal/Informal roles** in the implementation and disintermediation of organisational practices ▪ Overlapping between **personal and organisational values, goals, mission**
PART OF COMMUNITIES	Community of Place: ▪ **voluntary/unvoluntary choice** of belonging to a specific community of place ▪ **in/out options** for individuals and their social bubble ▪ **homogeneity of practices** and value attributed to them ▪ perception of the **external constraints pressure** to maintain the status quo ▪ tension between **diversity and conformism** Community of Practice: ▪ **expertise in the domain** ▪ **relevance of the practice** or challenges supported by the Community for the individual's advancement in a certain domain ▪ **motive and attitude** in contributing to the community scope ▪ **level of engagement and commitment to maintain the community**
NODE OF NETWORKS	▪ **types of opportunities** accessible through the network ▪ importance of the **public recognition of status and rank** for accessing specific types of opportunities ▪ **connectivity of individuals and closeness to others** sharing similar mindset ▪ **roles and positions within the network** (e.g. bridge, gatekeeper, connector, hub)

Table. 5.3 Characterisations of the collective users corresponding to different types of social structures

KEY ASPECTS	COLLECTIVE USERS			
	GROUPS	ORGANISATIONS	COMMUNITIES	NETWORKS
Definitory concept	GOAL	RESOURCES	BOUNDARIES	OPPORTUNITIES
"biology"	sum of the **individual resources** of its members	**vertical, horizontal, mixed composition** of resource management units	sum of the **aggregation of individuals and their material or immaterial "container"**	structure of the network in terms **density of nodes, extension and levels of the grid**
"physiology"	from **socialised decisions** within the group or **top-down indications** to explicitly connect individuals' resources and group's goals	**internal regulations, contracts, code of conducts, protocols** and chains of roles-task-responsibilities among distinct units (explicit upper-level decisions)	**selection and self-selection mechanisms** to manage community growth and keep its relative self-dependency (implicit decisions)	**exposition of the individuals' features** for attraction of additional nodes (nature and **accessibility of "social hooks", visibility of "hubs"**)
"psychology"	**internal alignment** of the group's members through **mutual awareness of the on-going actions** toward the goal	**polyarchy mechanisms** to differentiate the level of formal/actual agency over internal decisions and actions	**internal dominance schemas** to establish the "function" of each affiliated within the community, and the related social expectations and influence	**explicit conditions and implicit conventions for the activation of the network and propagation of the actions** required to the nodes
"cognition"	**changes in the topology of the group** respect to upper-level social structures (closer to the top-tier taking decisions or to the lower-tier with limited autonomy, or in between) and position-based sorting of information relevance	**intermediaries** actively **filtering** access to information, its interpretation, the limitation for the use of information	**recognisability and differentiation** from outside based on intra-community conformation practices	**social and spatial proximity** of the nodes to the action triggers
"movement"	**setting up** of a new group; **duplication, replication, emulation, partition** of other groups; **dismantling,** stop or dormient state of the group.	**acquisition of the resources** to operate; structuring; **merging/ segmentation**; forming inter-organisational temporary **coalitions**; **symmetrical/asymmetrical configurations**	**expansion, contraction; opening and closure; fusion** with other homogenous communities; dissolution by *motu proprio* or external interference.	macro-changes in the **structures of the links** between nodes (e.g. multiplication/diminishing of the links); **densification/spreading** around the hubs; establishing of **cross-network relationships**
"embodiment"	**level of dependency/ independency** respect to the upper-level social structure in which the group operates (as regarding goal settings, decisions, and operations)	**exclusive/shared ownership** of the resources; **direct/indirect management of the resources** to qualify the organisation in the context	**permeability/ impermeability** to the influence of other community at functional or representational level (eso/ecto-representation of the community)	**call/reaction mechanisms** to prove the status of the network and its nodes, confirming the access to reserved opportunities

5.3 TOWARD AN INTERACTIONAL MODEL OF THE CITY, ITS SYSTEMS AND INFRASYSTEMS

In this section, I am going to present the second **core model regarding the articulation of interactions across the city systems and its "infrasystems"**. This core model is intended to support the definition of an online environment that can reflect some peculiarities of the city environment incorporated in the design **proposal of the City Mirror**: the coexistence of **multiple stakeholders** in the same environment, the **multiple purposes** pursued through a variety of interdependent actions, and the **multiple scales** involved in the implementation of these actions.

5.3.1 EXCLUDING THE OPTIONS OF ONTOLOGY-BASED, PREDICTIVE OR PHENOMENOLOGICAL MODELS OF THE CITY

This second core model is not based on comprehensive ontologies of city systems primarily because it looks at actions and rules instead than urban components. At the same time, this core model differs in its aims from the numerous models of urban environments having descriptive or predictive purposes because oriented to support the definition of an intervention space for the design of technologies to support unpredictable and ill-defined city dynamics. Lastly, it is not a phenomenological model because my primary interest is on collective actions and collective action-oriented accounts of the experience of the city.

Acknowledging that ontology-based and descriptive/predictive models are still the predominant types of models considered when we try to conceptualise some aspects of city dynamics, I would like to discuss some examples helping to clarify my motivations for pursuing a different approach in this work.

The first example concerns a 12-years long European project carried out in the 2000s[25]. The main goal of this project was to build an **ontology of urban systems** potentially valid for European and non-European countries[26]. The starting point, of course, was the road system. Indeed, the road system is supposed to be the easiest one to be modelled because of the perceived limited number of its components, but also because of the perceived less conflictual nature of common understandings of these components in comparison with more complex matters such as the cultural heritage or housing typologies. Unfortunately, in this case, the modelling of the road system by the involved experts ended up in over 1200 categories describing its components. While supported by digital tools designed ad hoc for the project, the system was basically unusable, even for the experts who made it. Most importantly, the set of 1200 categories was still not stable because questioned over time by other experts lately joining the project. Thus, the restructuring of the category system would potentially last for decades, probably increasing their number, but certainly not resulting in something that could easily support day by day decisions in city environments or just even their understanding.

This enlightening anecdote points out the intrinsic difficulties and the unquantifiable resources that would be necessary to the attempt of producing a detailed ontology model of cities, but also its misalignment with the scope of providing actual operational support to experts and non-experts of spatial data. In addition, it is worth to remind that an ontology is always built on the basis of the specific purpose the ontology is going to serve, because that purpose drives the lenses over the components to be organised into a logical structure.

[25] http://www.cost.esf.org/domains_actions/tud/Actions/Urban_Knowledge_Arena

[26] INSPIRE is another pan-European project aimed at creating a common spatial data infrastructure for all European countries. However, the project started with the goal of primarily addressing trans-frontier issues related to shared natural resources, its main focus was not the urban environment. Urban systems, especially the built environment, remained underdefined in this common spatial infrastructure (https://inspire.ec.europa.eu/about-inspire/563)

Thus, **a multi-purpose or generalist ontology (as the one that would be needed in the case of multi-purpose and multi-scale perspectives in City Mirrors) easily risks of being inconsistent and not robust.**

As regarding **predictive models**, several significant examples developed since the 80-90s' focus primarily on land use, transportation and environmental factors, such as the PUMA [Ettema et al. 2007] or the ILUTE model [Salvini & Muller 2005]. These models usually frame urban contexts as setting for multiple agents, human and not human, assumed as autonomous and characterised in their properties and potential actions on the basis of data series of past phenomena and events. These models are always aimed at supporting simulations of scenarios to anticipate future developments of very specific phenomena such as land-use changes due to demographic variations at the local level or the travel behaviours and preferences in a commuting area. Then, they rely on data from the past to outline these future scenarios, and this is cautious only for phenomena characterised by certain stability, as well as by accessible and reliable data. Indeed, the weight of urban morphology or the spatial distribution of urban agglomerations and functions (quite stable inputs) tend to be predominant in the representation of local phenomena. From a planning perspective, it is obvious that urban morphology has a fundamental impact over the distribution of economic activities and socio-cultural singularities, but institutions, norms, and social geometries are not less determinant in the definition of local developments, while not easily traced on data. Therefore, **considering:**

b) **the exploratory perspective of this work that is not focused on the study of a single specific urban phenomenon**
c) **the attention to social dynamics that not necessarily are consistently traced within accessible and reliable datasets**
d) **but also the evolving and rapidly changing nature of local development actions not simply predictable looking at past events and trends,**

predictive models appear to do not be the appropriate kind of model to represent city systems for the purpose of this work.

Lastly, I can also mention **phenomenological models of the city** focused on the representation of the space as represented, lived, perceived in the individual experience of urban environments. Several models had been developed since the '60s, starting with the well-known work of Lynch on the relationship between the form of the city and our mental representation of its structure [Lynch 1960], and continuing with other works focusing on specific groups or categories of urban dwellers and users. These models, not descriptive or predictive or prescriptive in their nature, aspire to be instead a sort of guidelines to improve the design of urban environments incorporating placemaking considerations beyond the technical and economic ones. However, while the nature and purpose of this type of models are compatible with the purpose of this work (even though I look at the design of city technologies and not city spaces), its focus on individual experiences of the city is not. Indeed, as highlighted in many occasions, I am interested in the operational support of local development actions that are intrinsically collective, and thus relying on collective experiences of different groups, organisations, communities, and networks working in the same space, or time, or over the same resources. Thus, **even acknowledging the plurality of perspectives, perceptions, understandings, and experiences of the individuals involved in these actions, my primary interest is on the transversal elements of these experiences contributing to define a common ground at a collective level.**

The approach used to build the core model of the city ecosystem reported here is based on the transdisciplinarity axioms presented in Chapter 2 [section 2.4] helping to deal with a complex reality. This model can be considered as an **interactional model. It is aimed at supporting the analysis of the connections between city systems and infra-systems in local development actions** across the case studies of city-mirrors-in-the making [see Chapters 6, 7, 8, 9] and in the elaboration of the theory of the city mirror capabilities [see Chapter 10]. As I clarified in section 5.1., the core model is a conceptual device with an applicative purpose. Following, I illustrate the outline of the second core model and then its contextualisation in the relevant literature, considering the inputs of the disciplines selected as roots for the study.

5.3.2 OUTLINE OF THE INTERACTIONAL CITY MODEL

The general outline of the second core model had been briefly anticipated in Chapter 2 to expose the connection between the ontological axiom of transdisciplinarity and the interpretation of the city as complex reality adopted in this work [see Chapter 2, section 2.5.1]. Indeed, as indicated in the introduction of this section, the modelling of the city can be approached by numerous different perspectives privileging objective or subjective aspects and inputs in its representation.

This work embraces the perspective of cities as complex multidimensional ecology of systems having primarily a social and normative characterisation, differently from other complexity perspectives focused on biological analogies between natural organisms and the city as an organism itself [see, e.g. Batty 1993, 2019] This peculiar perspective assumes the city as a socially constructed entity, and most importantly, as a transformable and evolutive entity, changing on the basis of the transformation of the institutions regulating city life. In Alexander's words [E. Alexander 2019]: *"institutions are the DNA of society, and cities are the mirror of society"*. Therefore, the evolution of institutions is what determine changes in cities, including physical, functional and social changes.

5.3.2.a Action-oriented perspective over places and model of places as integrated units

Before going back to describe the outline of the second model as an interactional model of the city, it is useful to start from the single units of cities, places, and clarifying the difference between a descriptive or transformative perspective over places. This quick digression could facilitate the understanding of the relationships between urban systems and infrasystems moving to the upper level of the city as a whole.

Extensive literature had been produced to examine the various facets and aspects characterising the nature of places and describing the difference between spaces and places (respectively as objective and subjective representations of structured spatial entities), and between urban and non-urban environments. Avoiding going through this literature because not strictly necessary to the purpose of this section, it is just important to point out that a **planning perspective on places** is radically different from the one developed in social sciences, including geography. This kind of perspective is **strictly oriented to frame on-going and future actions over places or to understand the lived experience of cities, that corresponds anyway to past and present actions in places**. Even though the theoretical inputs concerning the dichotomies space/places or urban/non-urban can be contingently relevant or directly useful to support specific arguments, decisions and orientations also in planning, their saliency is limited when looking at the nature and profile of actions in cities (or any other anthropized environment). Indeed, these actions are hardly based on the elaboration of the geometrical/geographical properties of spaces. These actions also are substantially undifferentiated in a world that can be considered widely urbanised even in rural settings as regarding, for instance, ways of living, social interactions, structure of norms for the transformation of the environment itself [Ricci 2005].

Specifically, an **action-oriented perspective over places** (that is aimed at intervening on the norms and institutions for their transformation) frames **places as units** resulting from the combination among:

- the **temporary spatialised integrated arrangements of the materials components** of an anthropized environment
- their **contingent functions** (or rather, functions hosted at the time of observation)
- their **representational value** for people acting within/in/on them in the past and present time
- the explicit, implicit, prospective options for **alternative reconfigurations** of these three elements in the future.

The scheme below [Fig. 5.4.] helps to visualise the mutual relationship among these four aspects. Spatial arrangements of city environments, local areas, or buildings define a set of physical constraints enabling or hindering the possibility to host specific activities in those spaces. At the same time, the need for implementing specific activities in specific places lead to reconfiguring their material components. Spatial arrangements of physical resources also impact on the stratified meanings associated to them and progressively constructed on the basis of the social norms and social segments linked to that places, using that spaces, or that communicated their values through tangible and visible elements associated with the characterisation of the physical environment. The transformative potential of alternative configurations of places often leverages in shifts of uses and social targets, even before than entailing physical changes. But any action necessarily is articulated across the three dimensions of the materiality, purpose and meaning of places. These three dimensions are, at the same time, independent and highly intertwined. Independent because the possible associations between physical, functional and social aspects of a place are fully opened to multiple ways of arranging their coupling in not deterministic ways, often resulting from contingent choices. Intertwined because, once a configuration is given, the effect of the combination among physical, functional and social aspects of a place strictly bound the boundaries for action and the intrinsic transformative potential of a place.

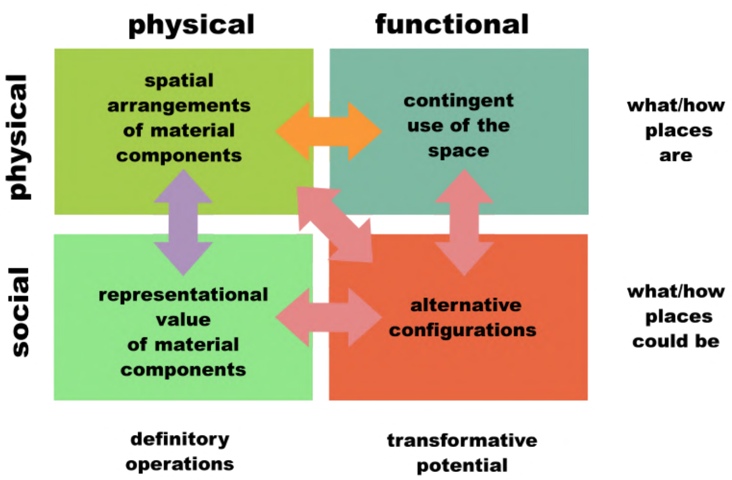

Fig. 5.4 Action-oriented model of places

Schools can provide extreme illustrative examples. While a quite common imaginary pairs primary education services with buildings composed of large rooms to fit in 30 students per class, it is also common in some contexts providing the same services with a similar organisation in a field under a tree. Then, education services hosted in historical buildings sometimes are explicitly or implicitly associated with ideas of prestige, solidity, tradition, severity, but also with the ideas of exclusiveness or exclusion or segregation, accordingly to the perspective of different groups segmented on the basis of the values incorporated in the physicality of a place. On the opposite side, a tree in a field is not usually associated with the idea of progress, opportunities, inclusiveness, work, freedom, but it could be associated to these values if it becomes the physical mark standing for a school in some disadvantaged settings. These different configurations of the physical components of a place trigger a process of social self-definition and segmentation, impacting on the choices of stabilising or transforming a place and the definition of its functions by the social segments having agency over that choices.

5.3.2.b Action-Oriented Model of Urban Systems

Moving to the level of the city as a whole, this action-oriented model of places can be mapped and scaled up to an **action-oriented model of urban systems** in which:

- the aggregation of the temporalised and spatialised arrangements of material components in the space of cities corresponds to their **physical system (context and object of action)**

- the set of activities implemented to develop, maintain, make cities working corresponds to their **functional system (actions)**

- the collection of self-defined and collectively defined segments of society connected to different places and functions in cities compose their **social system (agents).**

These three systems are independent and internally regulated by *"laws"* (as defined by Nicoleuscu 2006 in his TD axioms). These laws are based on distinct set of principles that are not hierarchically ordered, do not overlap, and concern the relationship between object of actions and agents. At the same time, the reality of the city results from the integration of these three systems. In other words, *laws* regulating the logic of the physical system have a different nature than the *laws* pertaining the implementation of the activities and the internal clustering of the social system. The three systems are at the same level, without vertical hierarchies among them. Each system is internally organised in a series of sub-systems regulated by laws following the same logic of the upper-level system. The overlapping among the *laws* regulating distinct systems generates the so-called "non-resistance zones" in which distinct systems appear to coexist and allow the transition and connection among systems [see Chapter 2, section 2.5]. The second core model had been built on the basis of the conceptualisation of the levels of reality and levels of organisation of reality linked to the vision of complex phenomena formalised in transdisciplinary theory.

Translating these principles in manageable concepts, the second core model, intended as an **interactional model of the city** [see Fig. 5.5.], is articulated in:

- **Systems supporting actions in cities,** incorporating the tripartition of the systems of the city, in physical, functional and social systems

- **Infrasystems supporting interaction in cities** and defining the "non-resistance zones" in between couples of systems as resources, relationships and values. The infrasystems also define the boundaries and conditions for the alternative configurations of the city [see the "action-oriented model of places", Fig. 5.4.].

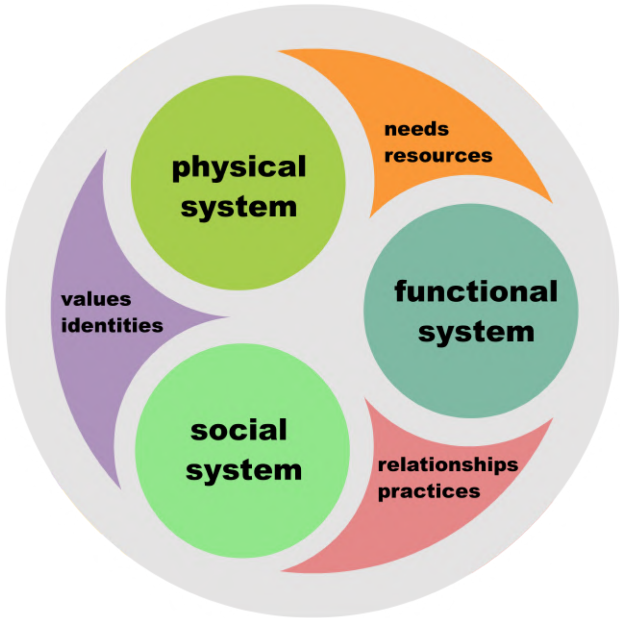

Fig. 5.5 Outline of the second core model

The **physical system** of cities is internally composed by the sub-systems corresponding to the **built environment, infrastructures and natural environment**, and each sub-system includes a hierarchy of components with their specific organisations. Each sub-system and components allow specific actions reconfiguring the pressure, influence and balancing among them. While some researchers attempted to develop an ontology of these components, as mentioned in the previous section, this is not the purpose of this study. In the use of the core model as an analytic device for the empirical and applied research, I will focus instead on the concept of **scales of action over/within the physical environment** [see section 5.3.3] and the **relationship between actions in the physical environment and transformations of the functional and social systems**, in terms of changes in the activities and services provided in cities and new collective processes in cities.

The **functional system** of cities results from the composition of a multitude of independent and interdependent domains of activities carried out in cities. Common views of the functional system of cities focus on its sub-systems defined as **sectors of activities**, such as education, health, utility management, administration, and so on. Another common view of the functional systems of cities under an economic perspective divides its sub-systems into primary, secondary, tertiary, quaternary sectors. Abstracting and readapting this last view to look at the nature of actions implemented into the functional system, the sub-systems relevant for this work correspond to functions aimed at:

- **generating new resources, tangible and intangible**
- **transforming these resources within specific processes**
- **making these resources accessible through the definition of norms and protocols**
- **generating knowledge from/on the available and needed resources at a collective level.**

The **social system** of cities can be seen as the amalgam of the social structures examined in relation to the first core model. As mentioned before, the vision of a city composed, for instance, by individuals (i.e. citizens) or communities (i.e. spatially enclosed communities) drastically changes the perception and representation of the functioning of society, also at the city level. However, in this work, I keep distinct the study of the social structures defining the boundaries for individual and collective actions used to construct the model of users, from the **composition of the social system based on functional and representational clusters of social structures corresponding to the different classes of stakeholders acting within the city by following distinct principles and rules shaping the nature of their goals and actions**. The distinct classes of stakeholders considered in the second core model are:

- **Local Governments** (e.g. municipalities and public administrations at city level)
- **Public Agencies** (e.g. local units of national and regional agencies and authorities, such as public
- health or education service providers)
- **Business sector** (e.g. industry, commerce, and productive enterprises)
- **Capital holders** (e.g. financial institutions, donors and foundations, but also citizens intended as property owners and taxpayers)
- **Knowledge cluster** (e.g. universities, research institutions, think-thanks)
- **Non-Profit organisations** (e.g. charities, volunteering organisations, professional associations).

The interplay between physical, functional and social system originates the Infrasystems of cities. While the analysis of the nature of actions is linked to the rules regulating the organisation of the city system, the analysis of the nature of the interactions within/with the physical environment, driven by functional needs, or among social clusters is linked to the principles of the city infrasystems. The two perspectives complement each other to understand the ecological functioning of the city as a system of systems.

The **infrasystem of resources is in between the physical and functional system of cities**, as the bridge between the existence of material resources in the shared environment and the actual potentialities, constraints and uses of these resources. This infrasystem covers the **connection between object of actions and nature of actions**.

The infrasystem of relationships is in between the functional and social system of cities, as the connector between the use of resources in the shared environment of cities and the rights, modalities, purposes pursued by the stakeholders using them. This second infrasystem concerns the **mechanisms to link the nature of actions and the implementers of actions.**

The **infrasystem of values is in between the physical and social system of cities**, as the infrastructure for the definition of identies, boundaries, decisions and priorities of the different stakeholders coexisting in cities. This third infrasystem enlighten the **reciprocal influence between object and subject of actions**.

5.3.2.c From the Action-Oriented Model of Urban Systems to the Interactional Model of Collective Experiences

The analysis of city dynamics supported by the integrated lenses of the city systems and infrasystems is fundamental to trace the elements of the experience of the city at a collective level as the result of the social interactions happening in cities within places, on the basis of needs and available resources, for specific purposes, relying on a fluid scheme of relationships among stakeholders, and driven by the values that they embrace.

This conceptualisation of the collective experience of cities can be transferred into the definition of technologies mirroring the city by relying also on the **mapping between the principles of the city infrasystems and the dimensions of the individual experience of technology**. These dimensions, as framed by McCarthy and Wright [2007], can be divided into **spatio-temporal, sensual, compositional, and emotional thread.** The spatio-temporal dimension of the experience of technology covers aspects related to the basic modulation of the interactions, for instance, in terms of representation and partition of spaces and timing or rhythms of mediated/unmediated activities. The sensual dimension concerns the *"sensory engagement with a situation"* giving sense and frame to the experience enabled by technology. The compositional dimension pertains the understanding of the *"relationships between the parts and the whole of an experience"* facilitated by technology in different ways and for different settings. Lastly, the emotional dimension refers to the drivers and judgements associated with a specific experience.

The spatio-temporal thread of individual experience is already the focus supported also in existing technologies for cities that, as seen in Chapter 4, propose to users both a spatial representation of the urban environment and, implicitly or explicitly, set the time and steps of the use of tools for online and offline operations. The spatio-temporal thread of experience is also the one unifying the flow of actions across city systems, and as such, it can be modelled and computed to extend the framing of the individual experience of technology to the collective experience of cities. Differently, the threads of the interaction with technologies related to the engagement with/in a situation, the understanding of the composition of experiences and situations, the incorporation of the emotional aspects of an experience in cities have received marginal attention, especially at a collective level. These three dimensions find their abstract correspondence with the infrasystems of resources (linked to needs), relationships (linked to the inner logic of situations and social interactions), and values (linked to the "emotional" drivers). Thus, the investigation of the principles and manifestations of these infrasystems in city settings can help the definition of city technologies focused on collective actions and experiences in the city.

In relation to the second core model, **the space for design and research explorations corresponds primarily to a better understanding of the city infrasystems as spaces for the construction of the collective experience of cities potentially enabled, supported or mediated by technologies** [Fig. 5.6]. **The modelling of the systems of the city supports instead the definition of the information infrastructure in city technologies, concurring to the construction of the city profile, analogously to what is usually done for users' profiles.**

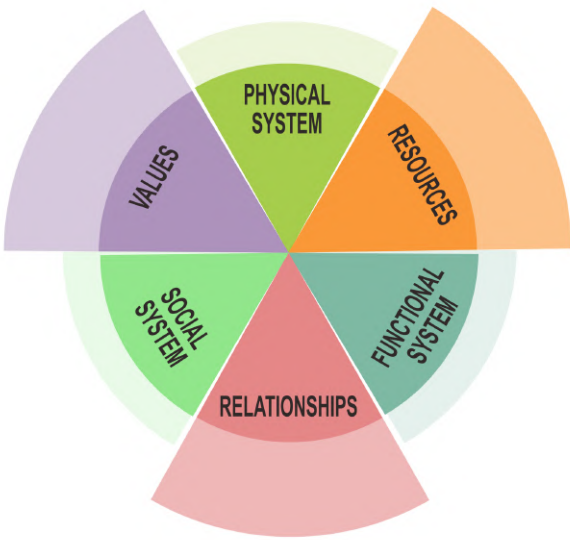

Fig. 5.6 Design focus on infrasystems

5.3.3 INTERACTIONS WITHIN THE PHYSICAL SYSTEM

The physical system of cities is probably the one most studied across every technical, social, humanistic and design disciplines interested to urban environments, included the ones selected as main roots for this study. […[27]…]

Consistently with the main focus of the second core model and the action-oriented perspective over places and city systems, the **interactions within the physical system of cities can be studied by relying on the concepts of scale of action**. All groups, organisations, communities and networks operate in the city by carrying out a wide range of activities to cover needs or interests in areas of different extensions. The geographical cover of an action is commonly indicated as the *"scale of action"*, to express if it is limited to a small area or to a vast territory. The expressions as "at the scale of the city" or "at the scale of the building" are often used in this sense to **merge the physical manifestation of a geographical entity corresponding to the area of interest with the extension of the impact area of a specific action or phenomenon.** The concept of scale is proven to be effective in defining and analysing the people perception of spaces and places, or in other words, to *"construct applied people's geography"* [Howitt 1993]. Howitt highlighted that the geographical scale, usually conceived in terms of size of an area and level of hierarchical subdivision of the territory, should be enriched by considering the aspect of the "relation" intended as the link between a geographical entity and the social, structural, economical, and cultural elements that make sense of this space for people. He refers explicitly to governments, corporations and third sectors organisations constructing different identities, plans and strategies precisely building on the hybridity between the spatial dimension and the social components defining their space of action [Howitt 1998].

In reference to the geographical scale conceived as scale of action, academic literature and institutional documents tends to focus on the **spatial units defined by administrative boundaries such as the country, region, province or county, city areas, and its subdivisions as the city districts**. However, most of **urban initiatives are implemented at lower scales such as the neighbourhood level or sub-areas of it.** They are mostly informal unit that result more difficult to be spatially defined case by case, while sometimes it is possible to have general consensus on their boundaries because of historical reasons, or characteristics of a specific community, or homogeneity of the built environment. Lastly, at the lowest level there are the **scales defined by the urban morphology as in the case of city blocks, open spaces, buildings and indoor spaces.**

The perception of the components of the physical system change accordingly to the potential scale of action of individuals and upper-level social structures. Indeed, the **"knowledgeability" of the context** change drastically by changing the level of actions. For instance, from indoor spaces to the scale of buildings and public spaces, the out knowledge of spaces is constructed by a direct experience of the space and leads to a mental model almost overlapping the reality. From the scale of city blocks, to the one of neighbourhood and districts, out knowledge is based on the progressive and reiterated exploration of the space. The mental model is thus composed by fragmented representations stratified over time, where the urban components are recombined, assembled, and positioned through a set of hierarchical and proximity relationships empirically defined at an individual and collective level. At upper levels, such as the city, regional, and national scale, the impossibility to have a complete exploration by direct experience of the entire area of interest leads to create an abstract knowledge of these geographical levels, corresponding mostly to their geometric or symbolic representations [Montello 1993,

[27] To be completed, integrating a brief overview of the literature and the main perspectives on the physical system matured in the disciplines selected as roots for the study.

MacEachren 2004].

The direct and physical knowledge of the space at a micro-scale, the recomposition of a fragmented knowledge at intermediate scales, and an abstract knowledge at the upper scales are reflected also in the people understanding of actions happening in the space. Individuals can have a direct experience of events, urban transformations, and local services concentrated in a punctual area or in a specific building. On the contrary, the approach to explain complex plans or projects distributed over the city, regional strategies, national trends, is usually based on simplifying and selecting only the essential elements to be communicated and "positioning" them into an abstract space that is assumed as common reference among individuals in collective formations. At the levels of city blocks, neighbourhoods, districts, the challenges for structing the understanding of the context of actions are linked to the crossing between, on one side, actions and physical components that can be directly experiences, and on the other side, actions and a projection of an upper-scale environment with local dynamics.

The scale of city blocks is crucial because at that level the physical and social aspects are integrated as complex primary components defining the perception of urban spaces, and by aggregation the character of the city [Trancick 1986, Batty 1994]. An essential part of the urban knowledge about public and private functions, individual and collective organisations, spatial hierarchies, meanings attributions, ownership and places identities are related to the characteristics of city blocks and public spaces. In relation to that, people implicitly make assumptions and decisions concerning the activities taking place at the building and indoor scales. The type of decisions and actions based on the interpretation of the context at that scale could concerns individuals only, such as renting a house or visiting a local attraction, but could involve also entire communities as in the case of urban regeneration initiatives.

The principles of the correspondence between type of knowledge of the physical system (direct or indirect, comprehensive or fragmented) and scale of action or understanding of the material context for actions is historically rooted and well-known in the field of cognitive map-design. In this field, indeed the choices guiding the representation of the physical system of a territory at a certain scale are correlated to the people's perception of the geographical objects at that scale. Differently from traditional cartography (that is focused on the geometric correlation between geographical objects and their cartographical representation in the form of a ration defining the accuracy of maps as technical tools [Robinson 1986]), cognitive map-design is oriented to the creation of a language of graphical signs corresponding to a set of cartographical scales and to specific geographical levels [MacEachren 2004]. The purpositive driver of cognitive-map design is deeply aligned to the use of representation of the physical components of cities practices in urban planning and design.

Indeed, maps are historically the main visual media to represent the physical system, but also to communicate intention of action or representation of the effects of actions. In this sense, the role of maps as means for accessing to collective and institutional knowledge about cities and territories through the abstract and symbolic representation of spatial objects has been consolidated over centuries [MacEachren 2004, Keates 2014].

In the last decades, the transition from "human-made" maps to computer-produced maps with the development of Geographic Information Systems pushed toward an automatization of the map-making process [Barkowsky et al. 1997]. Consequently, the communication goal moved from using maps to share "relevant knowledge" for discovery, decision, and strategic purposes about the physical system of cities, to use map for producing "correct knowledge" mainly for analytic purposes. Therefore, the design choices guiding the design of map-based representations have been progressively framed by accuracy standards and sectorial protocols, instead than pursuing the goal of making understandable the context of actions to enable people to act.

In addition, most of current web-platforms incorporating the use of maps for representing the physical system of cities, but also directly supporting interaction with it and spatialised actions, tend to make visible most of the geographical units corresponding to the administrative boundaries and to the built environment, but leave the gap in between, without defining neighbourhoods, estates or superblocks, or the building blocks [Antonini et al. 2017]. This determine primarily that the most important scales for actions in the city are completely missing. Then, the well-known mechanisms of associating the user generated-contents to points but not to scales of actions (and rarely to physical entities) tend to flatten the technology-mediated interaction with the physical system to an indefinite level between streets and buildings, often misleading the correct understanding of the context of action.

This background provides the elements for detailing the **study of the physical system of cities** in relation to the **scales of action, and the forms and modalities for the construction of individual and collective knowledge over the city and its components supporting social interactions**. In particular, in the following empirical and research activities oriented to incorporate these principles in the design of city-mirror-like web-based technologies, I am going to consider:

- **Upper-level environments impacting on city dynamics, formally defined, known at an abstract level and only partially experienceable (international, national, regional, territorial)**

- **City physical system, as formally defined, known for stratification and recomposition of knowledge and experiences (metropolitan scale, city scale, district)**

- **Intermediate and lower-level scales, informally defined, directly known and experienced (neighbourhood, city blocks, public spaces, buildings, indoors).**

5.3.4 INTERACTIONS WITH/WITHIN THE FUNCTIONAL SYSTEM

The functional system of cities is the object of interests for numerous disciplines ranging from human geography to economics, and one of the thematic sub-clusters in urban studies. The **functional system** of cities results from the composition of a multitude of independent and interdependent domains of activities carried out in cities. Common views of the functional system of cities focus on its sub-systems defined as **sectors of activities**, such as education, health, utility management, administration, and so on. Another common view of the functional systems of cities under an economic perspective divides its sub-systems into primary, secondary, tertiary, quaternary sectors. Abstracting and readapting this last view to look at the **nature of actions implemented into the functional system**, the sub-systems relevant for this work correspond to functions aimed at:

- **generating new resources, tangible and intangible**
- **transforming these resources within specific processes**
- **making these resources accessible through the definition of norms and protocols**
- **generating knowledge from/on the available and needed resources at a collective level.**

[….support statements from the literature for this part …] [28]

[28] Section to be extended and completed integrating an overview of the literature from Urban Studies about the articulation of the functional system and explaining why it is necessary to adopt instead an action-oriented perspective focused on the actions over city resources.

An action-oriented perspective in the conceptual modelling and analysis of the functional system of cities is a possible solution to overcome the impossible problem of the classification of city activities into homogeneous clusters. However, the classification of these activities at different granularities and scales remains a central challenge, especially because of their interdependence and the frequent overlapping of multiple functions provided at the same time or by the same subjects.

The issues related to the design, acceptance and use of classification schemes (CS) has been deeply analysed in the field of CSCW , specifically because of the importance of enabling users to find the information they need to take their own decisions acting in a cooperative environment. In this sense, a classification schema is intended not as a system for a domain description, but as a coordinative artefact, and its categories constitute boundary objects [Simone 2000] to provide a touchpoint to different type of users operating together, instead than being identifiers of groups of entities sharing objective properties or attributes. The challenge of designing city-oriented web-based technologies intended to support **cross-domain location-based** collective actions in a **multi-stakeholder context** introduces new elements to the problem.

The **distinction between large scale CS and small-scale CS**, respectively addressing a population of users that is large and loosely connected, or limited and closely connected [Simone 2000] is not applicable to the design of the Classification Scheme for the functional system of cities in city platforms. In this case, the population of users is large and closely connected, because it potentially includes all the individuals and organisations operating in a shared physical space, such as a community building, a neighbourhood, an urban district. The classification cannot be based on the knowledge system of a specific domain (e.g. urban planning) or simply imposed top-down by a public authority such as the City Council. In the first case the CS could be not intelligible to the potential users or compliant with the plurality of their operational domains, and in the second case it reflects only one perspective over the urban context, alimenting misunderstanding over the nature and the purpose of contents and compromising the acceptance of the CS in itself, as highlighted in related works on small CS, where the social constraints are identified as critical elements [Hertzum 2004].

The **distinction between content Producers and Consumers**, as well as the distinction between expert and not-expert user (usually linked to their own domain) vanishes in urban contexts if we consider the physical environment as a common ground for the elaboration of the context-based knowledge. Indeed, each individual has a direct knowledge of the space where his/her actions take place, from the scale of indoor spaces to the city as a whole, or an indirect representation mediated by different communication sources, as also mentioned in the previous section. On the other side, if we consider the different operational domains of city stakeholders, the cross-domain communication between expert and not-expert user become critical and to find a common classification schema to create new relations between elements belonging to distinct domains is critical.

Therefore, the classification schema should **combine the characteristics of endogenous CS and exogenous CS** [Simone 2000]. The first case is typical of contexts where all users can be considered expert of their own domain and the CS is based on conventions and negotiation over values embedded in shared contents, but the understanding of information it is possible even without too many contextual details. Exogenous CS are usually created to bridge the gap between contents producers and content users by explaining the context of information and connecting the element with the other domains' specific components.   In addition, the external constraint given to the type of tool to be designed, a web platform for untrained users, implies that the category list must be kept short to be usable.

Another dimension to be considered in the design of the classification schema of urban activities in the city functional system is their processual nature. Urban activities always underlying a process where multiple actors plan and implement their decisions in a complex environment structured by social conventions, norms, protocols, organisational rules. Therefore, the classification of urban activities, or more specifically of documental traces of urban activities reported in a shared platform, is intrinsically complex because of the several perspectives over the same action and the framework of the single unit of action within a more general process. The classification schema is not intended to represent a catalogue of products (documents or physical objects), but the relation of each entity representing a unit of action with its physical context and with the process including the entity in term of actors involved, purpose of the action and purpose of the information mediated by the platform.

Summarising, the issues related to the **classification of urban activities** to support collective actions in multi-stakeholder context are:

- **Multiplication of the social constraints typical of small scale CS in a large scale CS**
- **Overlapping between contents producers and consumers**
- **Endogenous classification embodied in the knowledge of the space of action of actors**
- **Assimilation of urban activities to unit of processes**
- **Plurality of legitimate purposes in using the platform.**

5.3.5 INTERACTIONS WITHIN THE SOCIAL SYSTEM

The social system of cities is often defined in relation to the structures defining the social identity of people acting in the city. In this work, I considered these social structures to characterise the model of users operating in the city and interacting with city technologies, by also taking into account constraints and capacities due the relationships between individual users and groups, organisations, communities and networks considered as collective users.

Another perspective to conceptualise the city social system recurs to the metaphor of multiple helixes working together to trigger and sustain local development processes, in particular when considering the impact of new technologies in local dynamics and their potential for local change. The description of the city social ecosystem significantly evolved in the last years moving from a focus on the dichotomy "government-industry" to the acknowledgement of the role of other society segments. Along this process, as showed in Fig. 5.7., several authors examined the mutual influence in city dynamics of Government, Industry and Academia in the triple-helix model [see e.g. Leydesdorff & Etzkowitz 1996, Leydesdorff, L., & Deakin 2011, Scalia et al. 2018], taking into account the centrality of the knowledge production in the new economy. Then, this model had been opened to also include, for instance, civil society organisations, community groups, or generically "the citizens" or ad-hoc definitions of society segments, such as "social entrepreneurs" [see e.g. Carayannis & Campbell 2010, Leydesdorff 2012, Galvão et al. 2017, Calzada 2020].

While all these models provide a similar framing of the relationships and interactions among different clusters of stakeholders in the city, focusing specifically on the role of the information exchange and technology driver, they address in marginal way the definition of the roles of each cluster in a multi-stakeholder setting and their reciprocal influences. Another aspect kept tacit concern the framing of the social forces impacting over other stakeholder actions as capital holders, that include all the range of capital holders from transnational donors (e.g. EU commission) to the ensemble of tax-payers in a specific district of the city. Lastly, these models, even when they refer generically to the business sector for instance, tend to consider only a minimal portion of the business environment in a city that is often represented by technology companies, not necessarily based at the local level or operating in a local perspective. Similarly, the cluster of "Government" in these models do not consider the intrinsic difference of goals, interests, actions in the city between local governments and public agencies providing services locally, but under the frame of State interests, structures, and priorities.

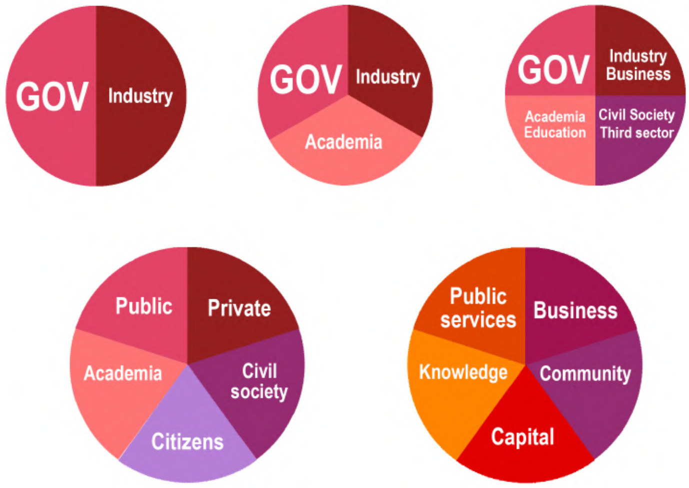

Fig. 5.7 Ideal partition of different classes of stakeholders in city processes in the n-helix models

On this ground, the conceptual articulation of the city stakeholders' clusters in this work divided them in six segments (or helixes) and consider that the reciprocal influences among these clusters are dependent on their proximity, but most of all on their scale of action (that is the reflection of their resources) [see fig. 5.8]. The main aspects to be considered for analysing their reciprocal influences are illustrated in Fig. 5.9.

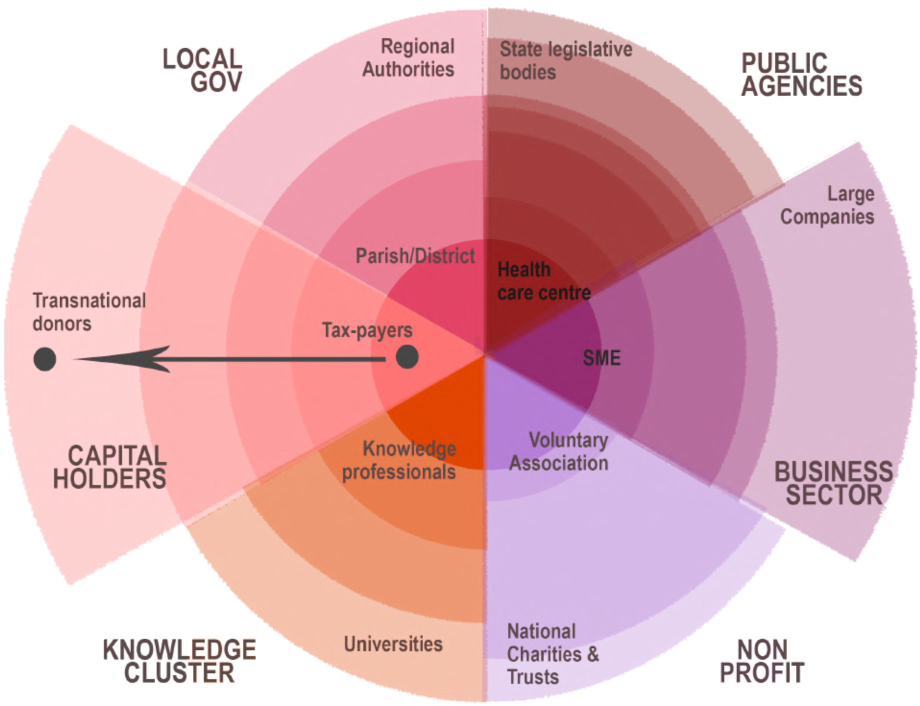

Fig. 5.8 - 6-helix models representing city stakeholders' clusters

The distinct classes of stakeholders considered in the second core model are:

- **Local Governments** (e.g. municipalities and public administrations at city level)
- **Public Agencies** (e.g. local units of national and regional agencies and authorities, such as public
- health or education service providers)
- **Business sector** (e.g. industry, commerce, and productive enterprises)
- **Capital holders** (e.g. financial institutions, donors and foundations, but also citizens intended as property owners and taxpayers)
- **Knowledge cluster** (e.g. universities, research institutions, think-thanks)
- **Non-Profit organisations** (e.g. charities, volunteering organisations, professional associations).

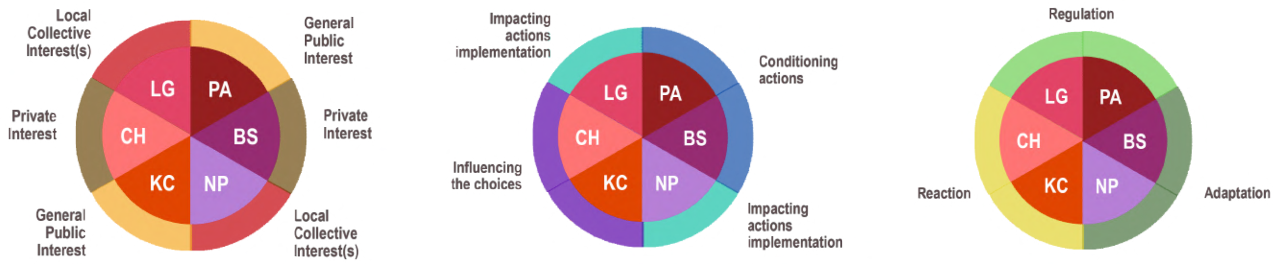

Fig. 5.9 Interaction drivers among city stakeholders' clusters

5.3.6 RESOURCES AND INTERACTIONS IN THE CITY

In the third core model, **the infrasystem of resources is positioned in between the functional and social system of citie**s. As regarding the functional and social interactions associated with the specific tangible and intangible resource in cities […]. [29]

This section will include a short literature overview concerning the two following aspects.

Respect to the ownership of specific stakeholders, city resources can be classified into:

- Private
- Semi-private or "parochial"
- Semi-public or "communitary"
- Public, furtherly divided in resources "under direct public management" or "urban commons".

The type of ownership schema directly affects type and forms of interaction with them in the physical system of the city, and therefore also condition their representation in an online environment.

Respect to the temporality, city resources can be classified into:

- Permanent
- Intermittent
- Temporary
- Ephemeral

[….support statements from the literature for this part …] [30]

[29] Sub-section to be completed, integrating the overview of the literature.
[30] Section to be extended and completed integrating an overview of the literature from Urban Studies about the articulation of the functional system and explaining why it is necessary to adopt instead an action-oriented perspective focused on the actions over city resources.

5.3.7 RELATIONSHIPS AND INTERACTIONS IN THE CITY

In the second core model, **the infrasystem of relationships is positioned in between the functional and social system of cities.** Indeed, cities can be seen primarily as the working environment of a plurality of stakeholders generating value and resources that contribute to local development in every sector of urban activities. Thus, the relationships among different stakeholders and their interactions within the city and with the city are articulated around the exchange of goods, services, knowledge that characterises city life.

It is important to clearly point out that this vision of the city while quite obvious for urban practitioners and researchers, it is instead strangely alien to many involved in exploring the design and application of digital technologies in urban settings (or possibly intentionally removed). As highlighted by other authors in urban informatics [Foth et al. 2011], the figure of the "*Flâneur*" appears indeed to be central in the imaginary built around the use of technologies in city, more than the local shopkeeper, or social worker, or professional or artist or entrepreneur or public officer or any other figure commonly encountered even at the neighborhood scale. At a more general level, this could be connected to the fact that the introduction of technologies in settings such as the city had been widely associated to recreational purposes only, in contraposition with the previous focus of digital technologies on closed working environment [see Rogers 2006]. From a different angle, also the relevance of cultural studies integrated in social informatics reinforced this trend by focusing on the perception of the different modes of appropriation of context and technologies of individuals and culturally homogenous groups [Wulf et al. 2018]. All of this entails a disconnection of the experience of cities and the related purpose and use of technology from the activities usually considered as productive activities, even if aimed at providing recreational services or developing community initiatives.

Excluding to look at the domain of informatics for the above-mentioned reasons and lacking a specific theory in urban studies or planning about the nature, types and structures of relationships among city stakeholders, I primarily considered the inputs coming from social sciences for detailing the properties of this infrasystem in the second core model.

The ***"Relational model theory"***, initially elaborated by Fiske in the domain of anthropology and then extended by Haslam looking also at social psychology [Fiske 1992, Haslam & Fiske 1999, Haslam 2004], it is one of the most popular on this specific topic. This theory isolates four relational models and based respectively on: 1) the sharing of goods, services, and knowledge services among peers *("Communal sharing")*; 2) the respect of orders and ranking in hierarchical systems *("Authority ranking")*, the balancing of rights and actions in equalitarian systems ("Equality matching"); 4) the proportionality in the transactions and exchange among people *("Market pricing")*. The central points of these four relational schemas are the two principles that **social relationships are determined by the presence or absence of hierarchical systems, and the equivalence among the agency of individual or groups can be established a priori or modulated by introducing proxies in the social system.**

To further detailing the infrasystem of relationships among city stakeholders beyond these two basic principles, I considered also the structure and properties of **social hierarchies proposed by Sztompka** across much of his works and directly oriented to enlighten also the logics of local development processes, organisational changes, democratization, globalizations and urbanisations and the experiences of everyday life that are directly linked to the main themes of this work [Sztompka 1991, 1993, 2002, 2008].

Sztompka [2002] articulates the nature of social relationships accordingly to a matrix of types of actions in the social sphere and their properties or characterising elements. The types of actions involving a relationship with others include (going from the less engaging to the denser): individual behaviours, circumscribed actions, social behaviours, social actions, social contacts, social interactions, repeated interactions, regular interactions, regulated interactions, social relations. The properties characterising this flow of actions are:

- the physical movement (intended as actions intervening on the physical distance among actors)
- the **meaning attributed to actions**
- the **directionalities of actions** toward others
- the **expectation for a two-way interaction**
- the **occurrence of interactions** (as unique/rare, or regular)
- their **level of definition** (as accidental, unplanned or repeated)
- their **framing within laws, customs, or traditions**
- their definition as a **full schema of social interactions**.

In relation to the domain of **urban studies** (and planning as well to a certain extent), theories covering the relationships among different stakeholders in the city are basically **general theories of power distribution readapted and contextualised in urban settings.** These theories, drawing upon other scholars and philosopher going from Weber to Foucault and many others, have a **critical stance, but not transformative purposes** [see e.g. Parker 2010, Brenner et al. 2012, Davies 2014, Harding & Blokland 2014][31] As mentioned earlier in Chapter 2, regarding both the role of planning concepts and approaches in this study and more in general the epistemology of the research, I consider power and power-based relationships from a pragmatic perspective. Therefore, **power relationships are studied as a sort of "materials" to be explored through investigation with the aim of understanding their level of malleability in specific applicative scenarios of city technologies and within specific geometries of stakeholders in local development processes.** On this ground, the "properties" of social relationships borrowed from Sztompka precisely help to construct a clear picture of how social hierarchies and power-based relationships are fluidly managed in the city settings, transferred or not in online environments, and potentially transformable.

5.3.8 VALUES AND INTERACTIONS IN THE CITY

In the second core model, **the infrasystem of values is positioned in between the physical and social system of citie**s. Indeed, the formulation, reframing, progressive stratification and adoption of certain predominant values in specific contexts by individuals and higher-level social structures is bounded to:

a) the continuous exposition to the implicit and explicit values incorporated into the design of the physical environment of cities [see section 5.3.1]
b) the social norms established and reproduced within aggregation of individuals sharing same spaces and reources [see also section 5.4.2.a].

The understanding of the values driving single stakeholders and their coalitions in local development actions is fundamental to address their matter of concerns also in the design of city technologies meant to support these actions.

[31] In the domain of HCI, the generative nature of critical theories such as Marxism and Feminism as tools able to inform and orient design processes is progressively experienced, examined and discussed in the approaches proposed by Bardzell and Bardzell [2015]. In the domain of Information Systems, in depth analysis of power dynamics in organisational settings (and sometimes extended to smart cities in relation to e-government research) tend to have direct practical purposes for modelling the reality in which system should be integrated, underlying the boundaries of the intervention space, very similarly to the practice of urban planning.

The main theorethical reference for the analysis of social values in cities and digital spaces is certainly the **"Theory of Human Values" elaborated by Schwartz**, introduced initially in social sciences in the 90's [Schwartz 1992], then furtherly systematized and integrated in 2007 [Schwartz 2008], to become since then a common framework used across a variety of disciplines, and even officially adopted in Europe by organisations and groups studying culture and identies of the various populations across the continent[32] [Davidov et al. 2012].

Schwarz draws upon extensive theorethical studies to summarise the main characteristics of all human values as follows [Schwarz 2007, 2010]:

- Values are believes linked to the **emotional dimension** of people and they are not objective or necessarily rational
- Values refer to the **goals motivating actions** and to the priorities attributed to a desired status resulting from those actions
- Values **transcend from specific actions and situations** to which the concepts of norms and behaviours refers instead
- Values are used as **criteria and guide for actions and decisions**, even when they are not explicitly or consciously considered
- Values have a **hierarchical structure attributing an order of importance** to different values in specific social settings, while norms and behaviours usually do not have an ordered structure
- Values have also a **relative importance case by case** on the basis of the assessment made by individuals and groups regarding the order of priority among conflictual values.

Then, on the basis of years of empirical studies, **Schwartz proposed to cluster human values in ten groups**[33] as follows [Schwartz 1992, 2007, 2010]: Self-direction, Stimulation, Hedonism, Achievement, Power, Security, Conformity, Tradition, Benevolence, Universalism.

Each cluster of value covers their multiple type of instantiations and hybridisations, and it is characterised by a central goal, as for instance pursuing power is driven by the importance attributed to the control and dominance of other people, or self-direction and stimulation are projected toward the creation and exploration of new challenges. As a result, Schwartz organised the ten values into four macro-sectors around two main axes, one contraposing **self-transcendence and self-enhancement** (and covering respectively values 9-10 and 3-4-5), and the other **conservative attitudes or openness to change** (including values 7-8 and 1-2). Along the first axis, conflicts and balancing efforts are between **self-interest and collective interests**, while along the second axis the opposition is between refusing or accepting innovation in customs, practices, ideas. Considering individuals only, values are influenced by multiple factors including the "cohort" (or rather the historical context in which people live), physical age, life stage, gender, and education [Schartz 2007]. As regarding higher level social structures and their values, no details are provided in this theory, and this is one of the points that this work is going to explore through the applied and empirical research in the case studies.

Other theories of human values, partially overlapping with the Schwartz theory or explicitly building on that, propose an alternative definition of the goals underlying each value or focus on a definition of values that made them measurable. For instance, the work of Grouzet et al. [2005] prioritises the **distinctions of goals and values in intrinsic (e.g. sense of belonging to a community) and extrinsic (e.g. financial success) and projected toward the physical or transcendent self** (e.g. safety or spirituality), but the elements on the

[32] See: https://www.europeansocialsurvey.org/

[33] Further elaboration of the theory proposes a different number of values, reaching also 19 clusters. However, I refer here to the version of the theory that is most widely considered.

two axes extensively overlap confusing their potential analysis. **Functionalist approaches**, in particular the one proposed by Gouveja et al [2014], **link values to needs and goals** (respectively divided in personal, central and social goals, and survival or thriving needs) **to rationalise the chain between values and actions**, but leaving behind the fundamental point of the negotiation of values at the social level and the continuous dynamic assessment of the relevance of values made case by case by individuals [Schwartz 2014].

Thus, accordingly to the purposes of my work, I opted for preferring the schema proposed by Schwartz. Other two reasons favored this choice:

- firstly, the Schwartz's theory of human values **avoids dichotomies between positive and negative values**, or right and wrong values;
- secondly, it is explicitly formulated to be applicable regardless of the cultural and social context of analysis because intended to be a sort of **universal framework**.

As regarding the first point, the adoption of such perspective is extremely important to address one of the numerous issues affecting current digital solutions for cities, especially the one oriented to support community activities and participatory practices. Indeed, especially in these circumstances, can be observed a strong attempt to obscuring, denying, and therefore delegitimising the motivations for contributing to collective actions that do not necessarily conform with externally provided moral imperatives (of course with deceptive results, see also Chapter 4 for some examples). As mentioned also in the Schwartz's theory and easily experienced in our everyday life, even "good choices" can be motivated by the worst reasons, as well as the opposite, with a wide range of complex combination in between.

As regarding the second point, the affinity between this theory and my orientation regarding the study of city dynamics is based on the fact that recurrent patterns of rules, decisions, and actions can be identified and appreciated across very different contexts, despite the infinite variability of circumstances and contingencies (see also 5.3.1).

From the perspective of disciplines such as city planning, excluding manichean visions of the values influencing decisions and actions over the city, and embracing the symbiotic nature of a general schema and particular instantiations of rules and values, are positions widely accepted (even if they remain the main object of continuous practical and theorethical reflections in the domain of planning theory). Planning is intrinsically about decisions over the values to be pursued through specific actions enabled or supported in the city context through normative instruments that define what is considered desirable, what individual and collective behaviours are allowed, what is the purpose of the city itself [Berson 1971]. And, as seen before, values are precisely defined by Schwartz as many others as the conception of what is desirable.

Planning, as a collective activity involving planners, local governments and other city stakeholders, is thus strictly tied to the kind of personal and institutional values of all these subjects and their dynamic negotiation in a pluralistic space [Pløger 2004, McAuliffe & Rogers 2019, Yamamoto 2017, 2020]. Despite the awareness of the centrality of values and their implications over the formulation of programmes, plans, and projects for cities, this knowledge is simply suspended or effaced when we move to the definition of digital instruments. At a practical level, this issue is due to the fact that the professionals and academics dealing with the political and ethical aspects of planning are disconnected in methods, interests and visions from the ones working on digital instruments for planning, unfortunately focused on their technical aspects. The centrality of human values in the design of digital tools for planning (while not yet for city processes more in general) is stated only in isolated works not generated within planning research [e.g. Borning et al 2004].

On the other side, in the domains of informatics related to system design, the interest toward the role of human values in the approach to the design and use of technology emerged only recently, while a general theory about scope and methods of "Value-sensitive design" had been formulated since the 90's-2000's [Friedmann 1996, Friedmann et al. 2002, Friedmann et al. 2008]. Interestingly, in these earlier formulations no specific reference to consolidated theories of human values or other frameworks external to the domains of HCI or CSCW are mentioned, leveraging instead only on the lessons learned from the studies in computer ethics. Nevertheless, over the years, the "Value-sensitive design" had been considered as a holistic approach for design and empirical investigations, alternative or integrating more restrictive accounts of the scope of system design, even without becoming a mainstream approach. But, at the same time, the attention toward human values grew in comparison with the one to this specific approach in particular [Borning & Muller 2012].

Incorporating human values in the definition of the requirements of new system and technologies became a way to let the voice of perspective users emerging and potentially addressing needs that would have been remained hidden otherwise, as well as the voice of researchers and designers and their drivers [Borning & Muller 2012]. At a practical level, some experiences reported in the literature (in this case drawing on the Schwartz's theory of values) also show that values can help to achieve continuity and consistency in the design choices and solutions of new systems despite the variability and number of the subjects temporarily or permanently involved in their development [Ferrario et al. 2016]. In addition, the pervasiveness of technologies in our lives and in our cities is raising the need to reconsider human values as central in the definition of a technology-enhanced living environment for people in line with the higher aims of building sustainable and fair digital societies [Sellen et al. 2009, Pereira et al. 2018, Winter et al. 2018]. However, one of the central open questions recurring, in particular in HCI, is about what values should be considered and how they should be instantiated in digital products and services [Sellen et al. 2009, Borning & Muller 2012]. To this regard, common approaches and practices in this domain, still focused on individuals only (while episodically advocating for ill-defined stakeholder-centred approaches), hinder the possibility of approaching the relational definition of values in city context to inform "socially-compliant" technologies.

Against this background, the complementarity between planning and system design perspectives could be rewardingly exploited if embraced in the investigation and implementation of city technologies considering, on one side, the ineluctability of dealing with multi-level conflictual values coexisting in each actions and decision, and on the other side the optimism to be able of finding the way to define solutions appropriate for this kind of setting. Indeed, relying on the axiom of complexity, that is one of the pillars of transdisciplinary research (See Chapter 2, 2.5.3), dynamics that seem contradictory at one level of reality or perception of reality should be considered at higher level to be clearly understood. The key points of the Schwarz's Theory provide basic support and orientation to navigate across these levels detailing the core model of the ecosystem of cities as regarding the infrasystem of values.

5.3.9 SUMMARY

The review of the key concepts associated with the main components of the second core model across different disciplinary domains allowed to detail the preliminary outline of the interactional model of the city as a system of systems to be transposed into city technologies. Following, in Table 5.4., the summary of the main elements highlighted by the review.

Table. 5.4 Characteristics of the literature review in this chapter according to the Cooper's taxonomy

CITY SYSTEMS	CHARACTERISATIONS – COMPONENTS – ELEMENTS TO BE CONSIDERED
PHYSICAL SYSTEM	interactions with the built environment at different scales: ▪ Upper-level environments impacting on city dynamics, formally defined, known at an abstract level and only partially experienceable (international, national, regional, territorial) ▪ City physical system, as formally defined, known for stratification and recomposition of knowledge and experiences (metropolitan scale, city scale, district) ▪ Intermediate and lower-level scales, informally defined, directly known and experienced (neighbourhood, city blocks, public spaces, buildings, indoors).
FUNCTIONAL SYSTEM	nature of actions implemented into the functional system: ▪ generating new resources, tangible and intangible ▪ transforming these resources within specific processes ▪ making these resources accessible through the definition of norms and protocols ▪ generating knowledge from/on the available and needed resources at a collective level. main issues related to the interactions with/within the functional system: ▪ interdependency of functions ▪ overlapping of functions ▪ classification of the urban activities to refer to
SOCIAL SYSTEM	classes of stakeholders in local actions: ▪ Local Governments ▪ Public Agencies ▪ Business sector ▪ Capital holders ▪ Knowledge cluster ▪ Non-Profit organisations Characterisation of the interactions within the social system ▪ Scales of action, size and resources of specific stakeholders within their cluster ▪ Internal and external definition of the roles, mission and practices of each stakeholder cluster ▪ Nature of the pursued interests (general public interest, local collective interest, private interests) ▪ Nature of reciprocal influences (over the choices, over the actions, in the implementation of actions) ▪ Distinctive social "behaviours" (regulation, adaptation, reaction)
RESOURCES	nature of city resources respect to the ownership and determining the kind of actions and interactions they admit: ▪ Private, Semi-private or "parochial" , Semi-public or "communitary" , Public, furtherly divided in resources "under direct public management" or "urban commons". Temporality of city resources: ▪ Permanent, Intermittent, Temporary, Ephemeral
RELATIONSHIPS	properties characterising social relationships in the city ecosystem: ▪ formal/informal arrangements ▪ direct/indirect impact of the relationship over actions and reciprocal interactions ▪ closeness and occurrence of interactions (from rare to regular) ▪ Level of definition (accidental, planned, unplanned) ▪ directionality of influence and power dynamics ▪ framing of the relationships within laws, customs or traditions ▪ meaning attributed to actions and relationships
VALUES	Values axes: ▪ Openness/Conservation; Self-interests/Collective Interest; self-transcendence/self-enhancement Values-driven interactions based on: ▪ Extrinsic/Intrinsic values; priority attribution, relevance in decisions and actions

5.4 TOWARD AN OPERATIONAL MODELS OF THE FORMS OF TECHNOLOGY SUPPORT IN LOCAL ACTIONS

In previous sections, I specified that my work on city technologies focused on users seen as embodied in multiple social structures at the same time associated with the first core model. Then, moving to the second core model, I explained the theorethical foundations for considering every space and every action in the city as part of collective actions where individual actions are inextricably interdependent because of the interdependence between city systems and infrasystems. In this section, I address the forms of technological support to local development actions that could be provided by web-based technologies having a city orientation (seen as a medium between Subject – users- and Object – the City). In particular, I am going to focus on the forms of technology to support coordinative, cooperative and collaborative practices at the local level.

While in the first and second model, the theoretical effort had been oriented in the direction of discretising social structures and systems/infrasystems in the city, in the third model the effort is in balancing the tension between specificity of the infinite variety of actions in the city and full characterization through a limited set of properties directly connected to the actions themselves. Indeed, pursuing the aim of shaping multipurpose platforms supporting local actions implies to reason on the principles of these actions without focusing on specific flows of actions, that are uncountable.

5.4.1 ASSUMPTIONS ABOUT COLLECTIVE ACTIONS IN THE DEVELOPMENT OF THE MODEL

Considering that the design of information technologies, especially urban and city technologies, is deeply dependent on the underlying "ideology[34]" guiding their design [see De Wall 2014], it is worth to clarify the most common assumptions about the reasons for people acting together and their implications when looking at coordinative, cooperative and collaborative practices.

The two extreme positions about this matter are based on the ideas that **people are intrinsically selfish and do not act together unless forced**, or that **people naturally act together because of altruistic impulses** characterising the human nature. As highlighted by Ostrom [2004], the first position implies that some external entity imposes specific arrangements to create a sustainable situation in which individuals seeking their short-term benefits for themselves alone do not compromise the chances for others to do the same or to achieve long-term benefits for the collectivity. The second position, theorised in the field of evolutionary psychology [Burnham & Johnson 2005, Henrich & Henrich 2007], insists instead on the fact that altruistic tendencies constitute an evolutionary asset favouring group success and, thus, genetically or culturally transmitted in small and large groups.

In the design of technologies for cities, these two positions lead respectively toward digital environments framing the *"city as a market"* or envisioning a *"utopian city"*, according to the definitions provided by De Wall [2014]. In the first case, technology is limited to mediate transactional interactions among users or to enable controlled access to urban resources preventing spill-over effects. In the second case, inevitably, technology is called to recreate the conditions of closed communities with unambiguous shared rules and high social control. However, in both cases, the specificity of social interactions in urban contexts are

[34] Ideology intended as mental model and set of believes about the world, society, city, relations among people.

downplayed, ignoring that the essence of the city as the place of strangers, a public arena of composite interests, the public domain for integrating differences in generative forms [Hajer 2001]. To this regard, De Wall [2014] indicates a third possible future type of technologies framing the *"city as a republican space"* and open to deal with the complexity of urban interactions in the sense of multiplicity, dynamism and pluralism.

The definition of a digital space having these characteristics requires though to build on other assumptions than humans acting together because forced or for altruistic tendencies. In anthropology, the so-called *"Interdependency Hypothesis"* [Tomasello et al. 2012] explains that human cooperation[35] is based on forms of mutualistic collaboration based on conventions, norms, and institutions. These constructs are culturally shaped and socially stratified to regulate the interdependencies between individuals and groups, and among different groups, organisations and communities, especially in large-scale social systems where personals relationships become weaker.

Formulated on decades of empirical observations (to distinguish between human and non-human behaviours) combined with solid theorisation, Tomasello's studies build on the *model of the "Stag Hunt"* [Skyrm 2004], instead than on the *"Prisoner's Dilemma"* outlining a choice only between personal benefits and group benefits [Axelrod 1980]. In the Stag Hunt model, widely used also in game theory, there are three conditions for human cooperation:

1) individuals are required to collaborate to access certain benefits
2) the benefits of collaboration are greater than the ones of individuals' actions
3) the possibility of individuals' actions is voluntarily excluded.

In this kind of situation, according to Tomasello, obtaining shared benefits is linked to the ability of **coordinating the members of a group**, helping others to **adhere to the group's commitment**, and containing or **avoiding free rider's behaviours**.

The coordination relies on the agreement that everyone has the intention of acting together and the contingent goal (i.e. the objective of the action) is clear among all parties because of a common ground concerning the understanding of the context of action or the path to achieve the established goal. The assumption is that all the relevant knowledge in a certain situation is publicly shared among the involved parties [Tomasello 2009, 2010]. In addition, the evidence shows that *"formed a joint goal, humans are committed to it"* (differently from animals) and mutual help is due in the interest of everyone [Tommasello et al. 2012]. However, anti-collaborative behaviours such as the "free rider" can happen, especially when the number of individuals involved in an action is higher than the number of individuals strictly necessary to implement it. In other words, redundant actors or partially engaged ones can increase the risks of free riding.[36] As social groups become larger, there is the need to coordinate actions with strangers, effectively control anti-collaborative behaviours, and support self-organised forms of collaboration. In these settings, social norms culturally elaborated and vertically transmitted orient (and sometimes force) human behaviours to ensure the *"smooth functioning of the group"*. These social norms establish expected behaviours, judgment parameters, reciprocity rules, standards, consequences of non-conformity, as well as the differences between a group and all the others in terms of constitutive identities [Tomasello et al. 2012].

[35] Cooperation, as well as collaboration, are used in the Tomasello's work to generically refer to different forms of joint action or joint intentionality.
[36] In the case studies reported in following chapters, this principle helped in understanding the critical issues in multi-stakeholder actions, where some actors were "less involved" than others or even disengaged but benefiting of the sharing of resources [see Chapter 8 in particular].

In my opinion, **assuming the perspective of structural interdependencies in society as the foundation for collective actions is the starting point to define city technologies reflecting the complexity of urban interactions**. Indeed, as seen in Chapter 4, most of the existing web-based technologies serving urban activities or civic purposes tend to rely on strong oppositions among groups or the illusion of homogeneity of intents, failing to provide a shared space to manage this complexity. At the same time, the *"Interdependency Hypothesis"* pushes for reflecting on the attributes of a system to support collective actions allowing individuals assessing benefits and risks of being involved, forming and communicating shared intentions, helping the implementation of the pursued actions and managing the related issues without conflicts.

Tomasello's studies have no reason to functionally and formally distinguishing between coordination, cooperation, collaboration. However, the key elements recurring in his work (such as the concepts of **benefits, risks, resources, interdependence, commitment, the definition of goals and objectives**) are exactly the ones commonly used to distinguish the characteristics of the 3Cs dynamics and also used in this work, as I am going to detail in section 5.4.3.

5.4.2 OUTLINE OF THE MODEL

The specificity of **web-based technologies is being a medium for handling information (texts and visual media) on bidimensional interfaces accessible through a web browser on mobile, laptop and desktop devices** [see also Chapter 1, section 1.4.1]. In local development actions, the access to information on web-based technologies happens in multiple flows of actions that are implemented both online and/or offline because **local development actions are oriented to extend and reconfigure the way city stakeholders express their capabilities into the urban environment**.

5.4.2.a Distinguishing Local Actions by the 3Cs Collective Dynamics

Technology support for local development actions must take into account these distinct flows of actions implemented by different stakeholders, but also their interdependence due to the sharing of spaces, resources, and institutions. In Chapter 1, I referred to the process aimed at composing, combining and harmonising these actions with the term ***"Orchestration"*** [see Chapter 1, section 1.4.4].

This term is intended to cover three distinct dynamics recurring in collective actions: **coordination, cooperation, and collaboration.** There is no generalised consensus within and across different disciplines on the properties characterising each of these dynamics [see also next section 5.4.2]. Thus, **I decided to distinguish them by looking at the convergence/divergence of goals and objectives among the stakeholders implementing local actions**, as well as at their level of sharing of benefits, resources and risks.

In this work, I have formulated the following definitions:

- **Coordination** as the mechanism aimed at spatially and/or temporally combining independent activities carried out by different stakeholders[37] for distinct goals and objectives. The stakeholders do not share resources or risks, but they can gain benefits from the coordination.

[37] In chapter 1, section 1.4.4., I used the term "agents" instead of "stakeholders" to provide a general definition of subject implementing an action. However, as specified there and throughout the dissertation, individuals are considered as part of collective social structures interacting in the city context according to norm linked to the associated type of interests, mission, competencies

- **Cooperation** as the mechanism aimed at functionally composing a set of activities independently carry out by different stakeholders to achieve a shared objective, but not necessarily the same goal. The stakeholders do not necessarily share resources, but they share risks and benefits because the common achievement relies on the commitment of each agent involved.

- **Collaboration** is the mechanism aimed at harmonising a set of interdependent activities carried out by stakeholders having shared objectives and aligned/compatible goals. The involved stakeholders usually share resources, risks, and benefits and their actions can be harmonised at an operational level or by amplifying their expected impact and outcomes.

Even though **coordination, cooperation, and collaboration** are three labels indicating dynamics that can coexist or be developed sequentially, their **distinction can facilitate the identification of patterns in local actions and the related forms of support expected from technology, or compatible with the nature of actions.** Indeed, it is obvious that technologies exposing some of the stakeholders to increased risks respect to offline-managed actions have fewer chances to be adopted [see e.g. Chapter 4, reporting platforms]. Similarly, significant issues can also come from digital settings creating an unbalanced distribution of benefits or the illusion of shared resources not corresponding to the offline dimension of city dynamics [see e.g. Chapter 4, debating platforms]. Thus, the **first layer of the third core model is constituted by the three dynamics of coordination, cooperation, and collaboration**, as illustrated in Fig. 5.8.

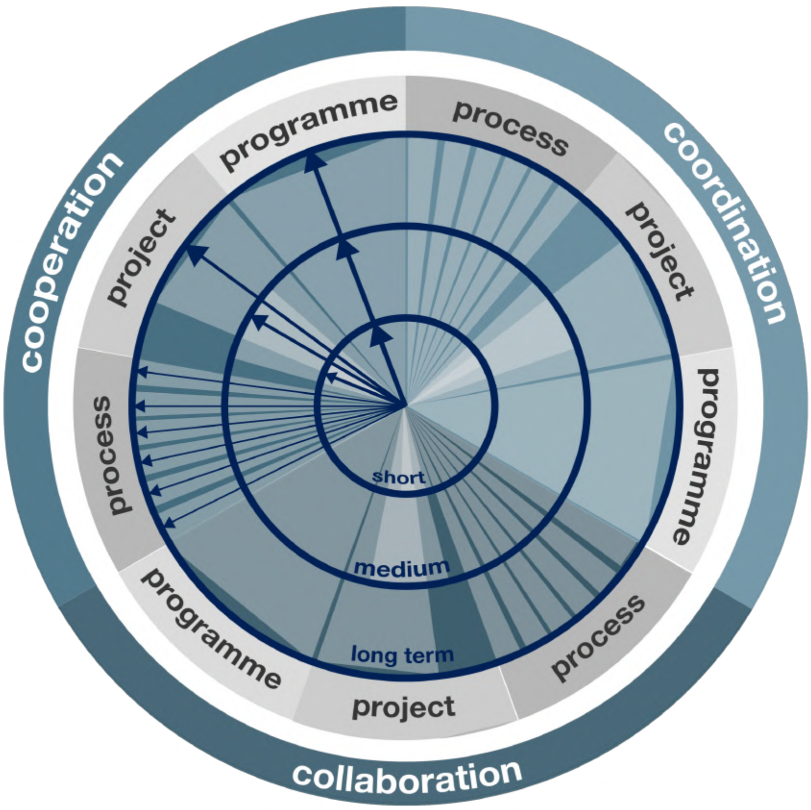

Fig. 5.8 Outline of the third core model

commonly attributed to these social structures. Thus, the two terms of "agents" and "stakeholders" respectively accentuate the focus on the subject implementing the action and the framing of that subject into a relational context.

5.4.2.b Distinguishing Local Actions by the Forms of Action

These dynamics can be observed in several different forms of actions, considering *"actions"* as *"structured sequences of activities like the provision of a service, the implementation of a project, the organisation of a public event, the preparation of a plan for a project, initiative or strategy"* [see also Chapter 1, section 1.4.3]. The different forms of action can be conceptualised in three main schemas: **processes, projects and programmes**[38]**.**

As introduced already in Chapter 4, the forms of technology support provided to local actions can substantially change by considering ordinary or extraordinary situations. **Ordinary actions** are characterised by activities that are **predictable, repetitive, known or formalised in advance and potentially persisting for an indefinite amount of time**. On the contrary, **extraordinary actions** are activities **not completely predictable or known in advance, beyond or in contradiction with normal routine, frequently associated with temporary endeavors lasting for a defined amount of time.**

Ordinary actions correspond to conventional **processes** implemented across the various sectors of city activities (production and transformation of resources, but also their management). **Processes include the provision of local services** (public and private services) **and other routine activities in the operational framework of city stakeholders** (e.g. periodical meetings). In these cases, the protocols among the actors involved are usually consolidated and can find their partial translation into a digital space tailored on the characteristics of the process itself or readapted from more general models.

Extraordinary actions correspond to what is considered a **project**, or rather an action characterised by its uniqueness and one-time arrangements for specific purposes. In the city context, projects include **urban transformations** partially changing the physical, functional and social profile of a part of the city[39], but also **initiatives having episodic nature** (e.g. public participation initiatives, festivals, commercial plans).

Programmes are a set of actions, that can include both **ordinary and extraordinary actions, connected by overarching aims.** Analogously to projects, they can be one-time initiatives managed on the basis of ad-hoc arrangements. But their development is closer to the setting up of new processes in terms of protocols and concurrent flows of distinct activities, as I am going to explain below.

Projects and programmes can require temporary ad-hoc technological solutions, while continuous or repeated consolidated processes usually relying on permanent or more static forms of support. However, as highlighted in Chapters 3 and 4, one of the main limits of web-based technologies is the fragmentation of the forms of technology support to users in a myriad of mono-purposes applications or their aggregation in generic containers of contents and activities. Thus, even within the framework of a single project or programme, web platforms rarely provide systemic solutions.

[38] The choice of these three labels for the second layer of the core model is determined by the facts that they correspond to a quite common terminology to indicate different schemas of actions in academia and for the general public.

[39] Embracing a complexity perspective to approach the city context, I do not assume that the agency over local transformations is limited to governmental authorities. On the contrary, I consider that collective structure and city stakeholders have the capability and capacity to plan and implement local changes [see Portugali 2011 about the concept that in the city everyone plans].

5.4.2.c Distinguishing Local Actions by their Temporal Dimension

The identification of these three schemas of actions in empirical research activities is connected to the **temporal dimension of actions** that constitutes the third layer of the model. Beyond the scale and domain of actions, the temporal dimension of the actions to be supported impact on the choices for the design of appropriate technology solutions and their overall sustainability (economic, social, organisational).

Processes, projects and programmes can be developed by concentrating the flows of activities in the **short term** (from days to months) or extending them in the **medium term** (from months to years) or **long term** (from years to decades). Examples of short-term processes are the maintenance operations of green areas at the level of city districts, lasting a few days at each iteration and repeated every 6 months. Long-term programmes can include, for instance, real estate or social housing development, but also integrated measures for the integration of immigrants at the city and regional scale. Examples of medium-term projects can include public consultations linked to the building of new infrastructures, while medium-term services can include social services outsourced by public agencies to the third sector every two years.

5.4.2.c Distinguishing Local Actions by the Structure of Operations

The fourth layer of this core model concerns **the internal structure of the operations to implement programmes, processes, and projects**. While the variability of local actions apparently makes impossible every generalisation of their common characteristics, the fact that web-based technologies are primarily technologies for the exchange of information among people allows focusing on the recurrent patterns concerning this aspect only.

The operations supported by the **interaction with information** on web-based technologies oriented to action can be discretised into five types:

- **analysis** of the context of operation based on the available information
- **planning** of the activities to be performed and communication of the plan
- **activation** of the human and material resources to implement the plan
- **management** of the on-going operations through the monitoring of human and contextual inputs
- **assessment** of the correspondence between the plan (or the expectations related to it) and the results of the implemented actions based again on their documented projection.

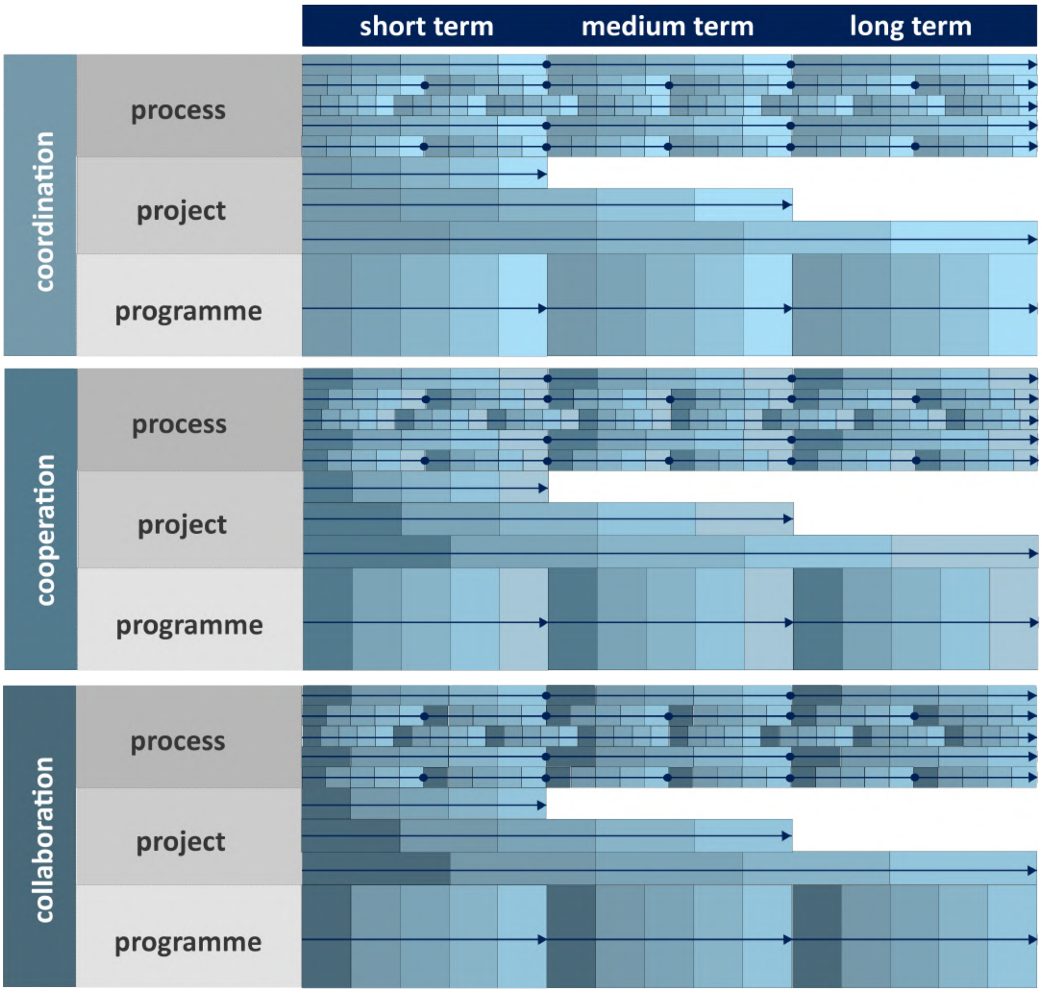

Fig. 5.9 Alternative representation of the third core model

As also illustrated in fig. 5.9, **the cycle of these operations is stable in its sequence, but it differs in its temporal dimensions in programmes, services and projects**. The periodicity of full cycles in programmes coincides with the milestones and the terms of included sub-programmes, projects and services variations, and it is subject to multiple iterations and progression. Projects are usually articulated in a one-time cycle where each phase can have a variable length, but rarely subject to iterations. Processes, related to the production or to the provision of services, usually include multiple parallel fast-pace cycles of operations that can have points of synchronisation at the short, medium, and long term.

The layers of the third core model had been used to analysing and interpreting the research and design experiences of the case studies reported in the Chapters 7, 8, and 9, by also considering the inputs from the literature. These inputs helped to define properties and peculiar characteristics of the dynamics, forms and structure of local actions and reasoning on them during the field and applied activities. Following, a more detailed discussion of the concepts and properties associated with each layer of the model.

5.4.3 COORDINATION, COOPERATION AND COLLABORATION

Coordination, cooperation and collaboration (3Cs) are three dynamics based on people acting together, or in other words performing collective actions[40]. In this work, I specifically address collective actions in the city and how possibly technology could support a part of these actions oriented toward local development outcomes.

5.4.3.a Properties of the Dynamics of Coordination, Cooperation and Collaboration

The interests in distinguishing among the dynamics labelled as coordination, cooperation, and collaboration started in the domains of operations management (supply chains and logistics), business partnerships, and strategy development, but without resulting into a unified theory or a consolidated schema [Weaver 2012]. Indeed, these terms are frequently used interchangeably in everyday communications. Often, they simply indicate an intensification of relationships among different actors [Weaver 2012]. However, in some cases "coordination" indicates a bond closer than in "cooperation", in other cases is the opposite. Similarly, "collaboration" can be considered more or less demanding than "coordination" and "cooperation" [see, for instance, the differences among Mattessich & Monsey 1992, Brown & Keast 2003, Amici & Bietti 2015, Bietti & Sutton 2015, Cienki 2015, Tee et al. 2019].

Brown & Keast [2003] proposes to consider these **dynamics in a continuous spectrum** articulated in cooperation, coordination, and collaboration as the result of the progressive integration of relationships among different actors. Baker [2015] suggests that **collaboration is a specific form of cooperation developed at the level of ideas and representations, instead than tasks and actions**. Tee et al. [2019] consider collaboration as based on coordination and cooperation, respectively intended as the ability and willingness to cooperate, or better pre-conditions and incentive to collaborate. Similarly, in the domain of CSCW [see also section 5.4.4], cooperation is based on coordinating interdependent activities, and collaboration is considered a well-managed form of cooperation [Schmidt 2008].

Cienky [2015] highlights a set of key dimensions that can help to appropriately characterise behaviours and cognitive models associated with the 3Cs, such as the time scale of activities, the consciousness of involved actors, their intentionality and perspective on the course of actions as agents or observer. Cienky does not try to establish a hierarchy or sequence among these dynamics necessarily. Following the Ciencky's example, but looking primarily at social interactions based on shared institutions, I mapped the recurrent characterisation of the 3Cs in relation to the **definition of goals and objectives, interdependence, commitment, resources, benefits and risks.** This mapping is based on the extensive literature reviews and synthesis developed by [Mattessich & Monsey 1992, Keast et al. 2007, Weaver 2012, McManara 2012, Tee et al. 2019] in Table 5.5. My interest is simply distinguishing their properties because, as pointed out also by McManara [2012], a kind of dynamic is not intrinsically more desirable than another when considering the interactions related to complex projects, services, and programmes in the public domain.

[40] ***"Collective action occurs when more than one individual is required to contribute to an effort in order to achieve an outcome"* [Ostrom 2004]. As clarified before, in the city, every action requires the effort of more than one individual to be performed.** Even a solitary walk in a park is actually the outcome of a multitude of actions performed by different actors having, as a result, the possibility for individuals to walk in a park, because the park exists, it is a green area in some way managed to allow its use for recreational purposes, it is under the competencies of specific authorities vigilating or assuring safety and security in that area, and so on. It is quite easy to imagine contexts where the absence of these conditions does not ensure or enable not even a safe solitary walk in a park or in a forest for unarmed or untrained individuals. In the case of a walk in a park, every individual is required to assume behaviours within the laws and norms in place, contributing to the collective effort of keeping the area functional to its intended purposes.

Table 5.5 Synthesis of the characteristics of 3Cs dynamics based on the literature and the relevant dimensions for this work

	Coordination	Cooperation	Collaboration
Goals and objectives (internal, external, jointly or independently defined, compliant with the mission or beyond)	Missions and goals are reviewed for compatibility within each involved party, keep pursuing internal objectives. External linkages are activated because some assistance from others is needed to achieve internal goals and objectives. In that cases, planning and division of roles regulate instrumental interactions.	Goals defined at a group or organisational level, and there is an individual interpretation of the mission pursued in cooperation. The involved parties work together, within existing structure and policies, to facilitate the achievement of individual goals[41] (still possible autonomously).	Mutual goals and plans that can be defined beyond the usual organisation goals and interests. A new common mission can be created. The involved parties work together because they want to pursue complex goals which cannot be accomplished individually.
Interdependencies (autonomy, planning, control, authority, leadership, decision making, conflict resolution)	The involved parties are autonomous, or semi-autonomous in the case higher level arrangements occur. In this second case, decision-making and control can assume centralised forms, organised in hierarchical structures[42] for a comprehensive planning. Otherwise, control measures and decision-making remain distributed. Organisations assume the needed roles, but they still work separately. However, relationships among executors are supported by their organisations. Internal leaders and authorities establish instead the modalities to allow coordination on specific tasks or projects. Leadership is partially shared while authority and accountability remain within each involved party. This duality requires some level of stability of the involved parties to enable reliable assessment and the formulation of a protocol. Conflicts can be addressed through neutral facilitators.	The involved parties keep their autonomy and limited planning is required to run the internal activities. Relationships are informal and interactions based on a need basis. Each organisation or group works separately relying on internal authorities (that remain accountable and responsible for the perfomed tasks). As a result, leadership is fragmented, and the implementation of cooperative dynamics happen at low level (without involving leaders). The involved parties also keep independent decision-making processes. Conflicts are proactively avoided managing independent flows of activities and reducing dependencies.	The involved parties are not autonomous. Their interdependence is based on shared interests and a collective responsibility and accountability over the interconnected tasks. Powers and control are shared and mutual, and there are arrangements to balance ownership and authority. Each organisation and its members may move outside their functional areas blurring the boundaries among different entities. The implementation of collaborative dynamics is highly based on the participants and their attitude, as well as on the emerging leadership of one or more of them to bring others together. Participative decision-making and negotiated conflict resolution ensure the sustainability of the collaboration. Comprehensive planning is required, as well as shared measure of success and goal achievement.

[41] These individual goals can be framed at higher level in a common orientation, that still remains something much lighter than defining a common goal as in the case of collaborative dynamics. This common orientation overlaps the concept of mutual awareness among the involved parties about what they are doing or oriented to do.
[42] McManara highlights this aspect thinking to complex operations requiring centralised coordination.

Commitment (formal-informal agreements, presence-absence of meta-structures to manage the collective arrangements)	Formalised agreements establish pre-conditions and conditions for expected coordination[43] and mutual commitment. There are no policies to manage collective arrangements. They may be developed at higher level and by external authorities, but not by the involved parties.	Informal agreements can create flexible links among different parties, working according to their mission and cooperating with others on the basis of individual commitments or by mandate. Policies to manage collective arrangements remain informal.	Commitment to a common mission established through formal and informal agreements, consolidated usually by joint actions undertaken for long term results. Policies to manage the collective arrangements are jointly developed by the involved parties.
Resources (assets, human resources, physical resources, systems, information, leadership, trust)	Resources internally available for coordination, but at an individual or organisational level and based on internal decisions. Physical and not physical resources can be temporarily exchanged to better achieve individual goals on specific tasks. System integration may occur if functional to this scope. Communication channels and roles are established to facilitate formal information exchange. Limited touchpoints between individuals, limited to executors of internal decisions or leaders working closer to create relationships based on mutual trust.	Resources remain separate and within the organisational structures of the involved parties. Limited resources may be shared for operational reasons. System integration does not occur. Information sharing is conveyed as needed, mostly on the basis of informal channels, and rarely formally. Active cooperation is usually implemented independently from leadership roles and based on one-to-one trust relationships. Trust relationships among organisations are not required, but may develop.	Pooling of physical and not physical, jointly secured. New structures or formal division of labour is created. System integration occur to better achieve the common goals. Well defined communication channels operating a many level with frequent formal and informal communications. New communication channels and information exchange protocols created as needed. Informal leadership, extra-organisational, is determinant to aggregate the involved parties and make the collaboration smooth and sustainable. Multilateral trust to build at upper and lower levels.
Benefits and Risks (individual, shared, low, high)	Limited risks (individual and shared) and increased benefits for all involved parties, mutually acknowledged.	Individual risks and shared benefits. Risks are usually considered low for each involved party, while benefits flow both on single entities and their aggregation.	Sharing of high risks and high rewards. Equal risks are shared by all the involved parties, but the benefits coming from the collaboration are more significantly higher than the ones individually achievable.

[43] Differently from what commonly stated in literature, "not expected coordination" may also happen independently from formalised agreements and based on voluntary engagement. Formal agreements usually are meant to reduce the uncertainty of these situations, still possible tough.

5.4.3.b Risks and Benefits of Coordination, Cooperation and Collaboration

As evident in Table 5.5, existing literature reviews and systematisation of the properties of the 3Cs dynamics underspecify the aspects related to **risks and benefits of acting together**. To this regard, Ostrom [2007] provides instead an extensive account of the factors affecting the definition of risks and benefits by the involved parties and the relationships among these factors. Even though Ostrom does not differentiate coordinative, cooperative or collaborative dynamics, she highlights that *"different forms of collective actions differ in regard to the distribution of benefits and harms to those in a group and those who are external to it"*. Indeed, the **net benefits of collective actions, especially in local development processes, are the result of *"structural variables" and "core relationships"*. Structural variables include the number of participants in the action, their heterogeneity, level of communication, freedom to be involved and exit. The core relationships explain the outcomes of different trends associated with the structural variables relying on the analysis of the reputation control mechanisms, trust and reciprocity among the involved parties to describe the levels of cooperation and identify the net benefits** [Ostrom 2007]. Thus, the benefits of being involved in collective actions cannot be predicted a priori as envisaged by economic theories such as the "Logic of collective action" of Marcur Olson [2009], but they must be contextualised. Ostrom also suggests that the **definition of risks and benefits should be based on the analysis of the core relationships in the context because not all the variables and relationships are actually observable or communicable by the involved parties.**

For instance, according to Olson, as group size increases cooperation success decreases. But this claim had been disconfirmed in many studies because the number of participants in collective actions has less impact in contexts where trust relationships are built over time and based on the clear connection between individuals' actions and reputation [Ostrom 2007]. Cities, neighbourhoods, organisations constitute the kind of environment where individual's actions are deeply framed in a dense web of social norms and structures [as seen in Section 5.2] determining that self-interest is more difficultly openly pursued without consequences or sanctions. Thus, Ostrom points out that individuals (and related upper-level social structures) tend to elaborate **contingent strategies adapted case by case on the basis of norms of reciprocity built over the years, action after action, into the public sphere**. These contingent strategies are oriented to increase their net benefits and limit the exposition to risks (as also assumed in the *"Interdependency hypothesis"*, see section 5.4.1).

On the contrary, in the literature, the failure of 3Cs dynamics is associated mainly with the misalignment of interests for self-interested agents and opportunistic behaviours coming from conflicting interests [Gulati et al. 2012]. This kind of assumptions and positions, summarised in the "leviathan" conception of work in organisations, had been quite relevant to inform the design of information systems that failed to support collective dynamics specifically because based on *"market mythology, radical individualism, the dichotomy of market and hierarchy, purely administrative vision of coordination, and so on"* [Schmidt 1994]. In this sense, the alternative perspective outlined by Ostrom is aligned with the conceptualisation of cooperative dynamics developed in CSCW for the design of technologies aimed at supporting people working together. For this reason, the **analysis of the context of collective actions potentially extends the understanding of how contingent strategies are developed in multi-stakeholder settings. Most important, the analysis of risks and benefits in the context can help to understand how these strategies and the related actions can be supported and harmonised through technology by taking into account the norms of social life and institutional frameworks[44].**

[44] Differently from usual CSCW settings, city activities and local development actions are not closed ecosystems but open ecologies. Thus, an institutional analysis is essential to model an apparently fragmented picture.

5.4.3.c Conflicts in Coordination, Cooperation and Collaboration Dynamics

Another aspect underexplored in the 3Cs literature is related to **conflicts management and resolution**. To this regard, it is important to understand that the city context is regularly characterised by conflictual relationships among different stakeholders (e.g. local government and businesses, non-profit sector and government or capital). Recurrent spontaneous strategies in these cases include **temporary coalitions** against one or more parties **leading to develop some forms of coordination, cooperation and collaboration**. But frequently **open conflicts are avoided by limiting interactions and by proactively working to reduce problematic interdependencies** (e.g. by internalising resources or multiplying outsourcing channels).

However, planning literature widely and deeply investigated the role of conflicts in city dynamics, especially as regarding the importance of conflicts to actually enable the development of coordination, cooperation and collaboration among different stakeholders. Indeed, **conflicts can drive these processes by facilitating the construction of a mutual understanding or shared meanings among the involved stakeholders** [Healey 1997, Forester 1999, 2009]. Conflicts can even become the **trigger for defining new practices oriented to overcome the resistance of traditional practices and burocratic perspectives** [Sørensen 2014, Agger & Sørensen 2018].

To this regard, Sørensen [2014] identifies two types of conflicts in multi-stakeholder settings:

- *conflicts of interests* that can result in shared actions as the involved parties need to negotiate and make mutual adjustments

- *conflicts of interpretation* that can result in shared actions as the involved parties are forced to progressively built shared interpretations of the framework in which they act.

As highlighted in Chapter 4, existing urban technologies do not address or support the resolution of conflicts among different stakeholders, nor conflicts of interests or interpretation. To explore this possibility, the analysis of conflicts in relation to the 3Cs dynamics are central in the third core model, as well as the analysis of risks and benefits for the involved parties in using the model to interpret filed observation and local actions.

5.4.4 OUTLINING PRACTICES AND META-PRACTICES ACROSS PROGRAMMES, PROJECTS AND SERVICES

Clarified the distinction among the key characteristics of coordinative, cooperative and collaborative dynamics, the study and experimentation of city technologies to support these dynamics require understanding how they are actually implemented into the real world, and specifically in local development actions. The concept of "practice" is central to this scope and to refine the second layer of the core model outlined before, and specifically how to study characteristics and profiles of programmes, projects and services in the city identified as three main schemas of actions.

5.4.4.a The Study of Situated Practices

The study of practices in the city context is central in urban disciplines, even though it has a different focus in planning and urban studies. In the first case, the analysis of planning practices is intended to investigate and theorise over the dynamics of participatory processes, governance issues, regulatory frameworks and perspectives for planning in itself [see e.g. Healey & Williams 1993 on regulatory systems; Forester 1999, Davies et al. 2012, Laws & Forester 2015 on participatory processes and governance issues; Albrecht et al. 2017, Yamu et al. 2017 on planning directions]. Urban studies analyse instead urban practices (and not planning practices) seen as the uses of the city spaces under the light of the concepts, institutions, discourses shaping city life [De Certeau 1985]. In this second case, the focus is always on a specific category of users in the city [e.g. Middleton 2011], sector or type of activities [e.g. Conradson 2003], or places and geographical areas [e.g. Drummond 2000]. However, general frameworks or model of multi-stakeholder practices have been developed neither in the domain of planning nor urban studies.

Turning instead toward informatics, it is easier to find theoretical constructs, frameworks and models to investigate and define contextualised practices, especially in the domains of Information Systems and CSCW[45]. However, in these two domains, the study of practices is approached in two opposite ways. On one side, research in Information Systems primarily uses pre-established theories about the nature of practices as lenses to analyse organisational arrangements and the integration of technologies in working settings [Feldman & Orlikowski 2011, Tavakoli & Schlagwein 2016]. On the other side, research in CSCW is anchored to ethnographic-inspired methods and to the direct observation of on-going practices oriented to the formulation of some *"sensitizing concepts"* helping to translate meaning and logic of practices in design inputs [Ackerman & Kaziunas 2017] without pushing toward general theories.

Inputs and previous conceptualisations in these two domains constitute a solid reference to highlight the key elements to be considered for analysing and studying practices on the field. Nevertheless, **readapting these tools to examine the reality of city practices is not straightforward because they have been developed to represent the dynamics of workplaces**, thinking mainly to small/medium groups within the same organisation and not to multi-stakeholder settings. For instance, the study of collective practices in the CSCW domain usually does not take into account power dynamics among individuals and sub-groups. This is not really changed in the last decades despite the awareness that their understanding (or misunderstanding) is essential to determine the failure or adoption of CSCW technology systems because these systems often tend to create or increase disparities among those benefiting of the system and those negatively affected by the system [Grudin 1988]. In the city context, it is even more essential than in closed workplaces to do not ignore power dynamics and making them central in the study of local practices.

I considered the work of Schmidt [2014, 2018a, 2018b] and Nicolini [2012] as the starting points for the characterisation of city practices. Schmidt extensively theorised about the intrinsic characteristics of practices, distinguishing them from the concepts of tasks, activities, techniques, and focusing in particular over the kind of practices built to support coordination and cooperation in work settings (the core of CSCW research). Nicolini, engaged primarily in organisational studies (that, as I mentioned in Chapter 2, directly feed research in Information Systems), extensively analysed all the interpretations and frameworks describing practices at a theoretical and practical level. Then, he developed a meta-framework incorporating the inputs coming from different schools of thoughts. These two bodies of work overlap in significant ways, while in the first case the primary focus is on the kind of artefacts and protocols mediating or enabling certain practices, and in the second case on the kind of relationships and institutions shaping practices.

[45] The complexity of new real-world problems that research in HCI would like to address is starting to determine a certain attention to the study of practices (especially emerging practices) as future possible research direction, even though this domain historically focused on the relationship between individuals and machines [Kuutti and Bannon 2014]. Nevertheless, the domain of HCI does not provide yet its own models and frameworks to analyse contextualised practices, assuming a unit of analysis beyond the individual and not limited to organisational systems.

Schmidt [2014, 2018a] emphasises the fact that practices in work environments include all those activities aimed at *"coordinating, aligning, evaluating, instructing, learning, training"* people. These activities allow the practical implementation of collective endeavours and they are usually based on *"anticipatory measures"* for the identification of the tasks to be performed, the resources to be allocated and the management of the responsibilities among the people involved in the process. At the same time, the definition of practices also includes a sort of repertoire of coping mechanisms to handle unexpected situations, moderate risks, adapt to variations and react to contingencies.

Nicolini [2012] identified a set of eight axes for the observation and analysis of practices. The author defined these aspects as follows:

- *"Saying and doing"*, concerning what actions are implemented and how there are represented in the common discourse
- *"Interactional order"*, covering not only the sequence of activities, but also how priorities and interests are established, and asymmetries reproduced
- *"Timing and Tempo"*, describing the temporal sequence of activities, and the temporalities and rhythms of practices
- *"Bodily choreography"*, regarding the material and symbolic aspects associated with specific human actions and bodily interactions
- *"Tools, artefacts and mediation work"*, projecting the use of specific artefact in the context, with its specific meaning and connection with other visible and invisible practices
- *"Practical concerns"*, inviting to reflect on the mundane consideration determining efforts, achievements and goals in the implementation of practices
- *"Tension between creativity and normativity"*, intended as the set of measures to adapt practices to conflicts and tensions between formality and informality
- *"Processes of legitimization and stabilization"*, outlining how practices are consolidated through the definition of insiders or outsiders, and other learning mechanisms.

While the Nicolini's meta-framework is extremely detailed in the characterisation of actions and drivers for the development and implementation of practices in a broader and complex social context, the Schmidt's work provides instead more support to investigate at a deeper level the role of technology in these practices. Indeed, he clarified some of the most important conceptual constructs describing the kind of (analogic or digital) artefacts enabling coordination and cooperation practices, such as the concepts of:

- *"artifactually inscribed protocols"*, as objects having the characteristics and properties to render the dynamics of specific work arrangements for the people involved (e.g. shift rotation table in a factory communicating who is at work, with whom, when, where, in which capacity, who is in charge, and so on) [Schmidt & Simone 1996]
- *maps*, intended as a common reference framework for actions (also based on the definition of "plan" provided by Suchmann 1987), communicating in implicit or explicit forms what can be

done or not in a certain context, without taking into account the variability of all contingencies that can impact over the actual implementation of actions and thus without prescribing effects
- *scripts*, intended again as a set of common reference frameworks representing the interdependencies among different activities, the conditions and pre-condition for actions, the available options and choice criteria, the sequence of activities and specific instructions for the people involved in a certain process [see Schmidt 1997 on maps and scripts details, and next section 5.4.5].

5.4.4.b. The Study of Meta-practices in the City

Considering the **contributions of both these authors**, Schmidt and Nicolini, I have decided to focus on specific contextualised practices as the ones in the city by identifying tasks, task order or procedures, timing and rhythms, tools and their role in actions, actors, responsibilities, and outputs of actions. The **"skeleton" of practices** that result from the hybridisation of the theoretical inputs from Schmidt and Nicolini can also be enriched with the constraints, meanings, and power relationship schemas shaping clusters of practices united by recurrent characteristics emerging from fieldwork and other sources. A few elements can help to **abstract the profile of these meta-practices from the skeleton of single practices**.

Among them:

- **the balance between normed and not-normed activities**
- **the recurring strategies for the handling of variations and contingencies**
- **the roles of each class of stakeholders involved in each practice, as established or perceived**
- **the ability of specific city stakeholders to envision the outcome of their tasks and decisions on a broader environment**
- **the value judgments made by the stakeholders involved in a certain kind of practices in specific circumstances and related assessment criteria**
- **the methods to explicitly or implicitly organise the activities, internally and externally**
- **the strategies and means to foster (or hinder) the cooperation, internally and externally.**

Indeed, as mentioned before, the works of Schmidt and Nicolini are not conceived for city activities, but instead for *"rigorously observable"* work practices of small groups [Schmidt 2018b] or intra-organisational activities that tend to be explicitly codified to a large extent [Nicolini 2012].

The adaptation of their inputs to the sphere of investigation of city activities requires to consider two major issues.

1) **City practices[46] are not necessarily or rarely fully observable** because they are:
    - never developed in a room, building or closed environment only
    - conditioned by multiscale interactions among multiple actors (not considered as individuals only, as clarified in the previous sections)
    - often happening in distributed forms and over extended or discontinuous periods of time
    - often **apparently invisible**.

The lack of specific "inscribed protocols" in objects, contracts, or devices associated with numerous practices and reciprocal actions among different stakeholders can give the impression of facing invisible practices,

[46] Consistently with the statements made explicit in previous chapters, I refer to city practices as structured actions, as for instance, those needed to deliver public and private services, implementing local initiatives, planning and negotiating future transformations.

sometimes observable in their effects, but not in their development (e.g. recurring coalitions or conflicts among city stakeholders and their management strategies). However, the **continuous learning process of living in organised society contributes to define what we can call "ascribed protocols"**. This expression refers to the ways of acting in a social setting based on the assumptions about the roles, intentions, capacity, capabilities, goals attributed to the other actors involved in specific actions.

The concept of ascribed protocols in city settings is based on the theorisation of our automatic actions in social settings formulated by Castelfranchi [2012]. This cognitivist argues that our actions are not simply based on risky and difficult reasoning about representations, believes, expectations based on the observation of others' behaviours, nor on the intuition or identification with others. On the contrary, most of our actions are based on innate mechanisms and *"cultural well-defined memory structures"*. Among these mechanisms and structures, Castelfranchi includes: norms and conventions; a common knowledge, shared values and memberships in given groups; assumptions about the knowledge of others in a given situation; projections of attitudes; memories of past events; recognition of certain action patterns toward specific goals; speech acts communicating attitudes, positioning, implicit or explicit knowledge.

As mentioned in sections 5.3 and 5.4.1, norms and conventions have a key role in determining coordinative, cooperative and collaborative practices at all levels of city social structures, and a wide range of assumptions shapes the very definition of these social structures, from small groups to communities, networks and classes of stakeholders (government, non-profit, businesses, academia, capital holders). Moreover, reputation and trust mechanisms in city settings are deeply affected by the history of interactions among groups, organisations, communities and the general attitude toward some of them. For instance, the close relationships and active collaboration among different segments of city stakeholders (assumed as pursuing stable socially recognised missions) can vary from a city to another on the basis of past events and level of knowledge sharing among them, even though the general framework of social norms and conventions can be similar (e.g. same region, same culture, same demographic profile). In these different settings, **diverse ascribed protocols are put in place by following clear rules, not observable, but easily knowable or understandable by triangulating fieldwork insights with other informational sources**.

As regarding the goal of exploring city technologies for the orchestration of local development actions, it is also important to highlight that **the study of practices already in place needs to be combined with practices that are not yet existing**. Indeed, the design and research problem of exploring these technologies raises from the real-world problem that resources and actions are weakly orchestrated, even with the enormous potentialities of available technologies. Design explorations in the absence of practices are still possible by approaching the dynamics to be investigated with an experimental attitude. For instance, Crabtree [2004] defines as *"breaching experiments"* the attempt to anticipate potential future practices by intervening on the present to understand how current arrangements react or adapt to new systems and innovation. **Future practices not yet in place can be outlined and become analysable, even without being strictly observable**. [See also Chapter 6, about Research through Design].

2) **City practices are usually inter-organisational (or inter-community and cross-network)**, and based on:
    - **multiple levels of rules** codified within each social structure involved in local actions
    - **informal rules** often enabling collective interactions
    - **rules changing over time**, and sometimes case by case
    - the coexistence between **formal rules and actually applied rules.**

To this regard, E. Alexander [1995] attempted to develop a **comprehensive theory of inter-organisational collective dynamics, modelled on the city dynamic**s of which he had direct experience by planning for decades [see also section 5.2]. His theory is transdisciplinary in its formulation and not reflecting city settings only. In his theory, Alexander addressed the multiple levels of rules regulating social interactions from micro-organisations (e.g. families) to macro-organisations (e.g. nation level). He focused on the **tension between formal and informal rules, means and structures contributing to a continuous design and redesign of the institutions** (intended as social norms and practices) of collective life.

Ostrom [2009] focused more specifically on the **nature of these rules** impacting on the relationships among different social structures sharing the same institutional context, adopting a pragmatic perspective on the description of power dynamics. She made explicit that rules are common agreements to make predictable other people actions, but also clarified the distinction between ***"rules-in-force"*** (established by regulations, laws, contracts, agreements, and thus explicit) and ***"rules-in-use"*** (working rules as interpreted and applied, and usually tacit). Indeed, **rules as human constructs are intrinsically malleable and ambiguous**. Ostrom also identified **seven types of rules defining situated actions and practices**:

- **Position rules**, establishing positions and roles of the involved actors
- **Boundary rules**, defining who is included or excluded and how positions and roles are assigned
- **Choice rules**, prescribing the actions that can be undertaken in various circumstances
- **Aggregation rules**, limiting the number of involved actors acceptable for collective actions and decisions
- **Information rules**, regulating communication exchanges
- **Payoff rules**, assigning rewards or sanctions to particular actions
- **Scope rules**, envisaging what should be the expected/desired/acceptable outcomes.

The attempt of analysing city practices at a meta-level can rely on bridging, on one side, the Alexander's generative perspective on the coexistence of multiple systems of rules and the Ostrom's account over the types of rules in complex multi-stakeholder settings, and on the other side, the contribution of Schmidt and Nicolini on the study of specific contextualised practices.

Beyond the issues discussed above, another relevant point to study city practices at a meta-level is being able to **potentially design appropriate forms of technology support to a multiplicity of situations, regardless of their differences and contingencies**. For instance, it is obvious that non-profit organisations working in distinct domains (e.g. education or health), ranging from small voluntary associations to structured charities, and operating at the neighbourhood or regional level, probably have quite different practices. At the same time, some of their relational protocols with other stakeholders can be similar, and a relevant part of their needs can overlap with other social structures having a similar mission, or scale of action, or internal structure, or positioning in the city ecosystem. Thus, it is reasonable to explore if there are recurring and transversal problems that could be addressed through design.

I am aware that the generalisation of practices is an open issue in disciplines such as CSCW that collected hundreds of detailed accounts of specific contextualised practices over decades. The problem with generalisation in that domain is associated with the lack of "evidence" supporting the transferability of findings from a practice to another, as well from small groups to a larger scale [Schimdt 1994]. Nevertheless, one the most important takeaways I learned during some Prof. Schmidt lectures[47] it that *our knowledge of practices is always based on the identification of what is similar and what is different in what we encounter for the*

[47] Schmidt's Masterclasses ECSCW 2017, Sheffield, UK; EUSSET Doctoral School 2019, Como, Italy.

first time in comparison with what we are familiar with already. Establishing parameters, axes, or a common framework of reference can help to carry out such comparisons. **Once identified differences and similarities (and especially their occurrences and stability), abstracting common rules and principles regulating certain practices can lead to the definition of meta-practices without claiming for the generalisation of contextualised practices that remain over-determined and hyper-specific.**

Undertaking this direction, the core model outlined in section 5.4.2 provides a preliminary clustering of the practices to be analysed in the city according to three schemas of actions. **The high-level partition in programmes, projects and services is intended to work as a first filter to divide the practices collected during the case studies into homogeneous sets as regarding temporal aspects and consolidation level.** These practices would be then analysed under the light of the other relevant attributes reviewed in this section.

5.4.5 TECHNOLOGY-MEDIATED INTERACTIONS TO SUPPORT COLLECTIVE ACTIONS ALONG THE PHASES OF ANALYSIS, PLANNING, IMPLEMENTATION, MANAGEMENT AND ASSESSMENT

One of the challenges to go back from the study of meta-practices to the definition of information systems intended to support these meta-practices (in this work, through a city-mirror like technology) is translating the outputs of the analysis of the meta-practices in a way that is consistent with the modelling of the forms of support provided by digital technologies (to multi-stakeholders, multi-purpose, multi-scale local development actions in this work).

To this regard, the notation called ARIADNE [Simone et al. 1996, Schmidt & Simone 1996], developed in the domain of CSCW, provides an example of a comprehensive conceptual schema combining the contextualisation of practices with a representation of actions supported by specific interactions with technology.

The ARIADNE notation, based on the meta-analysis of the evidence collected from in-depth field studies on several types of different practices, is built on a corpus of 26 *"propositions"* (i.e. key interconnected concepts, see Fig. 5.10 and 5.11). ARIADNE is specifically aimed at facilitating the construction of computer-based coordination mechanisms for *"any cooperative work"* [Schmidt & Simone 1996]. Starting from the evidence that cooperative actions[48] are enabled by specific mechanisms based on protocols and artefacts providing material support to the implementation of protocols [see Fig. 5.11 and 5.12], the authors propose to characterise the **software artefacts** (i.e. digital platforms) **intended to support cooperative work and coordinative mechanisms as tools** having two fundamental properties: **malleability** and **linkeability**.

The **malleability** is the result of providing a digital environment that is underspecified, or rather **versatile enough to enable users adapting the use of the tool to protocols that can change on fly, while remaining accessible and legible to users and, at the same time**, consistent with all the other elements defining the context in which users work (i.e. field of work). At the same time, the **linkeability** pertains the **capability of the tools to be integrated (linked) with other digital and analogic mechanisms enabling collective**

[48] As discussed in section 5.4.1, in the CSCW domain the expression "cooperative work" and "coordinative mechanisms" are used to include the full range of dynamics here distinguished in coordination, cooperation, and collaboration. In this section, I kept the use of the expression used in the original sources, while they should be interpreted in a broader way, closer to the framing of "collective actions" given in this work.

actions, and also to reflect the context of users and its changes in a way that is coherent with the functional and semantic aspects associated with situated actions. The combination of these two properties outlines a platform enabling the continuous **negotiation of changes and the dynamic adaptation of the tool** to new contingencies and action patterns, addressing the very challenge of supporting collective dynamics that cannot be completely predetermined in advance or framed in rigid workflows.

The notation developed by Schmidt & Simone [1996] to design platforms having these two characteristics is based on a sort of grammar of the constitutive elements of the practices that they had analysed at a meta-level. This grammar relies on a **lexicon and a syntaxis of categories of the elements contributing to cooperative work**. They include:

- the elements that concern the **actors called to work together (roles, tasks, human resources)**
- and the **context in which they work (informational, material, technical, infrastructural resources)**.

The value of this grammar is ideally helping:

- designers to shape a digital environment that is consistent with the operational context of users, not just in term of processes and functions, but also in relation to the meanings associated to roles and resources available to users

- organisations and structured entities to use the grammar to define their protocols in a way that address their needs

- end-users to adapt the protocols and their actions supported by technology to the contingencies they face [see Fig. 5.12].

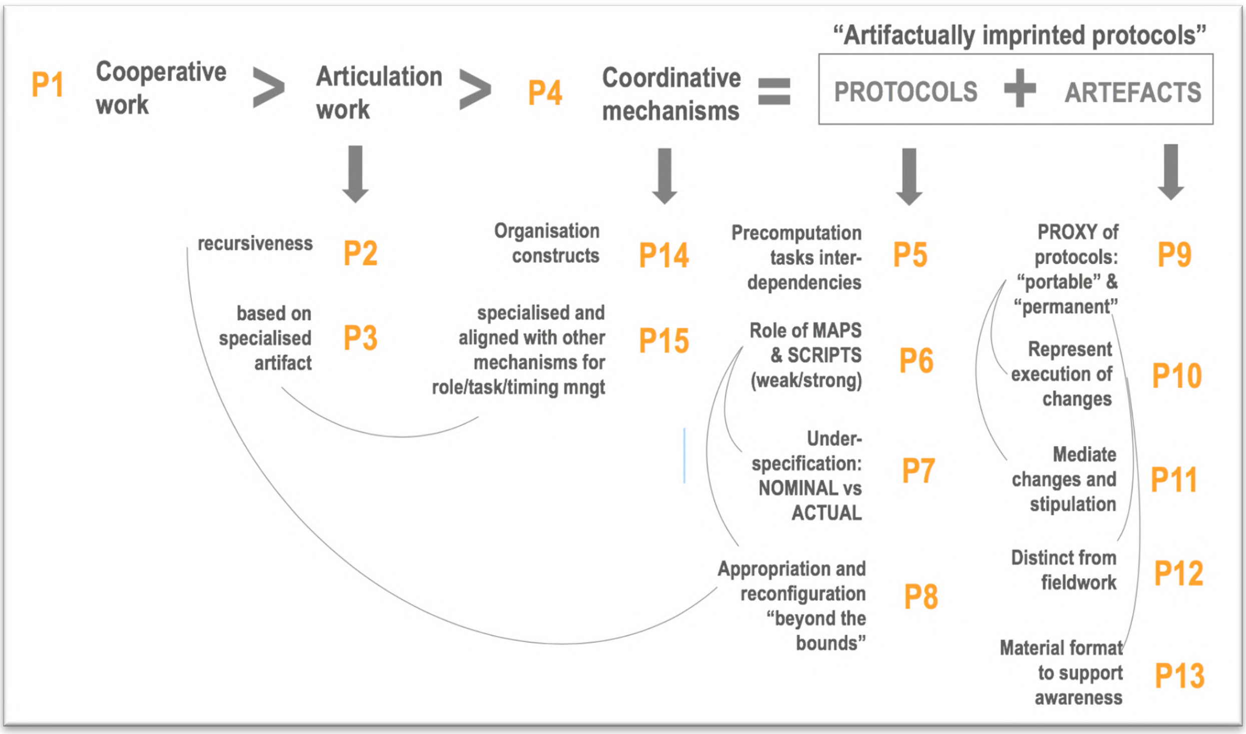

Fig. 5.10. Visual mapping of the 26 propositions constituting the conceptual foundation of CSCW system design, Part I (Source: personal elaboration – see Schmidt & Simone 1996)

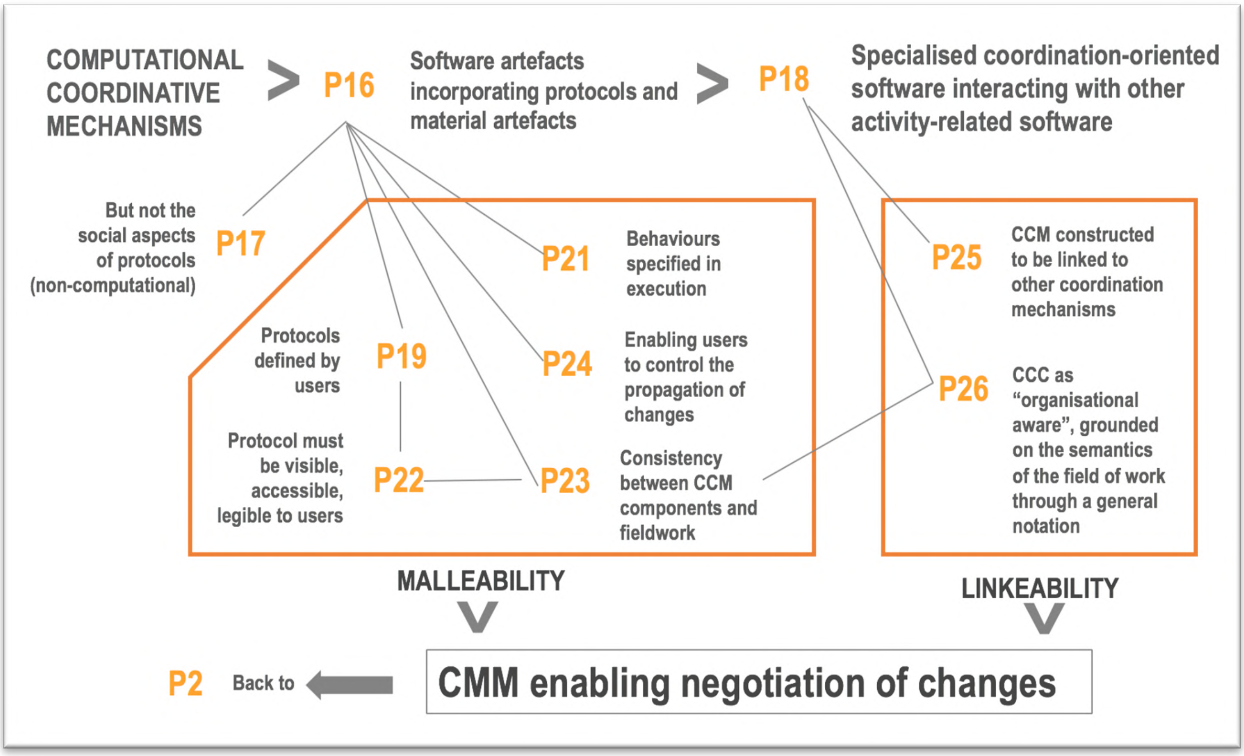

Fig. 5.11. Visual mapping of the 26 propositions constituting the conceptual foundation of CSCW system design, Part II (Source: personal elaboration – see Schmidt & Simone 1996)

The structure of the ARIADNE notation [see Fig. 5.12] and the logic used to build its grammar outline a practical and sensible approach to translate the concepts emerging from the analysis of the meta-practices in the city in a grid of requirements connecting users (city stakeholders) and their context of action (from physical, functional and social perspectives). Moreover, this notation provides an extensive list of examples of the **forms of technology support to the interaction with different types of resources**. For instance:

- locate, block or obtain the access, show, hide, publicise, conceal **informational resources**
- locate, procure, allocate, reserve, deploy, consume, transform **material resources**
- locate, procure, allocate, reserve, deploy, use **technical resources**
- reserve, use **infrastructural resources.**

This point is absolutely central to this work. As seen in Chapter 4, existing web-based technologies applied in urban settings tend to be intended as a medium to convey certain types of information, but usually not as an intermediary for actual actions over the city. On the contrary, looking at technologies supporting actions (and not primarily collective learning, social awareness, advocacy, or information dissemination), the **connection between technology-mediated interactions and changes in "the field of work" (through changes on shared resources) of city stakeholders become the backbone of city-mirror-like technologies.**

Thus, while carefully considering the peculiarities of city settings highlighted in the previous section, and especially the coexistence among multiple conflicting protocols, the "grammar approach" and the schema of interactions with different types of resources can help to characterise the **third level of the core model** presented in section 5.4.2. This level corresponds to the articulation of the macro-phases of **analysis, planning, implementation, management and assessment** along with the development of programmes, projects and services. The kind of technology-mediated interactions with other users and the identified contextual resources can be analysed along with the various phases of activities and across different practices and meta-practices examined in the case studies reported in Chapters 7, 8, 9.

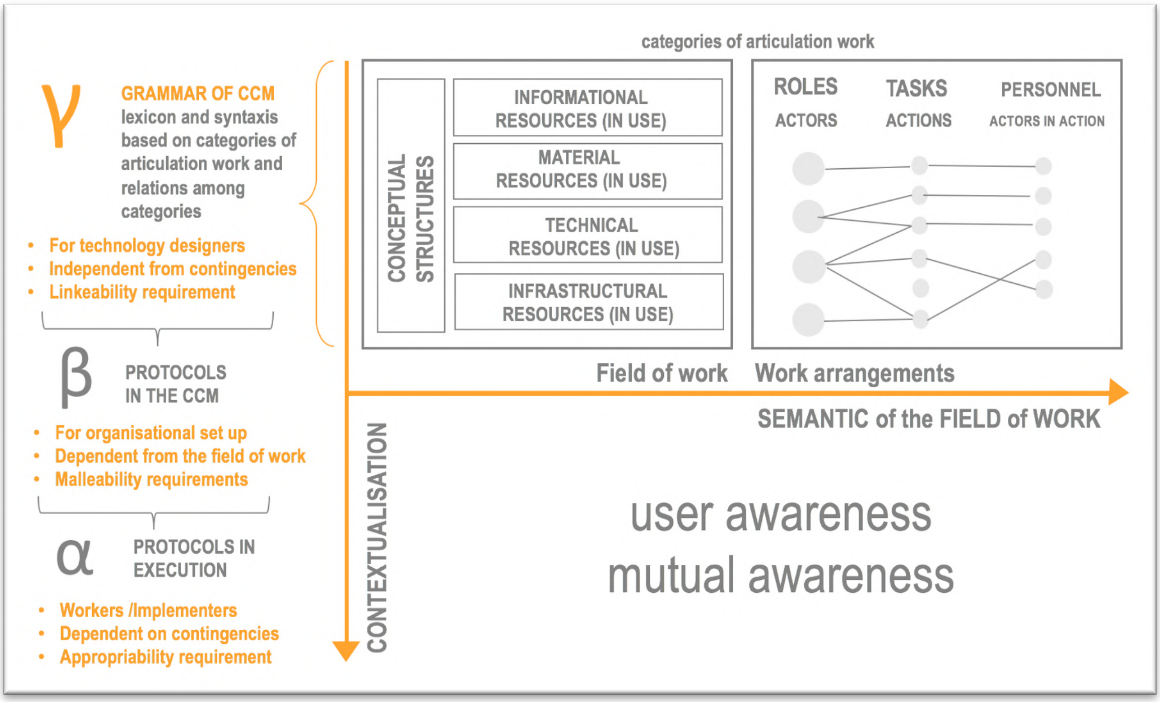

Fig. 5.12. Visual schema of the skeleton of the ARIADNE notation
(Source: personal elaboration – see Schmidt & Simone 1996)

5.4.6 BASIC CONCEPTS FOR THE STUDY OF INTERACTIONS IN WEB-BASED TECHNOLOGIES

The literature examined in the previous three sections provided an in-depth account and contextualisation of the components of the third core model. The review addressed the 3Cs dynamics, the ways to approach the analysis of city practices, and the interactions with digital technologies in collective actions at a general level. The last aspect to be addressed concerns the specific research object of web-based technologies and the kind of interactions with these technologies. Web-based technologies had been chosen because of their potential to connect people in city applications [see Chapter 1], but also because web platforms and tools are relatively easier to study than other emerging technologies in terms of:

- interactions, primarily with texts, visual contents, and multimedia contents
- interfaces that are bidimensional
- functionalities on the users' side mostly related to the management and exchange of information.

A vast literature oriented to an audience of practitioners (e.g. user researchers, designers, web developers, software engineers) covers all the operational aspects related to the analysis, design, development, and evaluation of web-based technologies. Several of those texts had been quite useful to support the practical aspects of the applied research conducted in the case studies, but an extensive review of the peculiarities of web-based technologies is beyond the scope of this dissertation and this section. Here, **I refer instead only**

to the conceptualisation of interactions proposed by Rogers et al.[49] [2019] in the domain of HCI/Interaction Design for the refinement and application of the third core model to explore the implications of specific design choices in city-mirror-like technologies. The conceptualisation proposed by Rogers et al. has the hybrid form of a set of design principles and a design schema, indicating the essential elements to connect the definition of the characteristic of a digital environment in relation to the users' needs and its applicative context. These elements include:

1. the recommendation for using **design metaphors** as a general guide for developing intuitive interfaces

2. a high-level classification of the **types of interactions** with a digital system to anticipate users' expectations case by case and assess the consistency of the design outputs

3. the corpus of **theoretical and conceptual constructs** (such as mental models, behavioural theories, specific visions and paradigms framing the role of technology) to inform the design process.

1. Rogers et al. [2019] highlight the importance of adopting "**interface metaphors**" to make understandable to users the overall conceptual models of a digital environment in intuitive forms through analogies with familiar analogic tools and actions. The use of metaphors in the design of digital systems largely recurs to spatial analogies borrowed from our lived experiences of space, but also from architectural practice and urban design (as well as often urban theories borrows metaphors from the information space of technologies).

2. The high-level classification of the "**interaction types**" with digital tools (mainly referred to web-based technologies) proposed by Rogers et al. [2019] include:

   - Instructing a system to execute commands
   - Conversing with a system in terms of inputs/outputs exchange
   - Manipulating object in the digital environment (or in a physical space connected to it)
   - Exploring contents and objects
   - Responding to inputs and requests coming from the system itself.

   While the ARIADNE model defined the interactions with digital systems to support cooperative efforts in relation to the context of work and the type of associated resources that the system is called to manage [see section 5.4.3], this classification is strictly focused on the operations happening in/on the system through an individual user. Thus, they provide complementary lenses both for generating alternative and reflecting on the implications of specific design choices in the prototypes of city mirrors affecting the ability of the system to support collective actions in urban settings and its appropriateness to serve the intended uses.

[49] This choice is due to the specific nature of that work that is a popular reference both for practitioners and researchers working in the domain of HCI and Interaction Design. It is also extremely accessible to a general audience, and therefore to urban practitioners and researchers. In addition, the granularity of the concepts I refer to is adequate for the purpose of simply having a light infrastructure for the analysis of the empirical part of this research through the core models, avoiding technical details inappropriate for the intended audience. As specified in section 5.1, I oriented the literature review on a selection of pivotal or representative works only, instrumental in clarifying key concepts within a TD integration strategy of different disciplines.

3. Commonly accepted and widely used **theoretical and conceptual constructs** include, for instance, the well-known framework about the **"gulf of evaluation and the gulf of execution"** elaborated by Norman in the 80s' [2013]. That framework highlights, in simple terms, the need to let users understanding how systems work aligning (or subordinating) the considerations related to the design and execution of system with the mental model that users can have or autonomously construct from their direct experience with a system. While still valid in principle also for city technologies, this framework provides tough limited practical guidance for their design. Indeed, **one of the main issues with technologies having a city orientation is precisely the need for harmonising coexisting multiple mental models potentially conflictual.** On the other side, the designer's perspective on the city is usually quite limited and personal, and thus rarely projected toward solutions for making this harmonisation of perspectives and system interactions consistent.

Looking specifically at digital technologies accompanying users in their activities in their context[50] (e.g. at work, in recreational social spaces, in urban settings), including web-based technologies that are increasingly used on mobile devices, there are **two opposite visions of the role of technology developed by Weiser and Rogers**. Weiser outlined a vision of the role of technology as serving primarily the purpose of making users' life easier, anticipating, addressing and serving their needs having a ***"calming effect"*** on users [Weiser & Brown 1996]. Rogers instead contrasts this vision by proposing to orient the design efforts toward ***"engaging technologies"*** to activate the personal resources of users toward playful and learning practices, behavioural changes, and even improving the practices related to scientific inquiry and research [Rogers 2006]. The third core model presented here, and the proposal of the City Mirror, look instead at technologies for collective actions. These technologies are not supposed to necessarily calming users, but helping in the resolution of conflicts of interests and representations. On the other side, these technologies want to be intended for engaging the social structures in which users operate and focusing on vital activities, instead than accessory or recreational ones. As a result, the **interactions envisioned with city-mirror-like technologies are driven by the chance of making easier the interaction with the city itself and the opportunity of supporting and collectively addressing shared challenges.**

To conclude, a practical note on the components of web-based technologies as regarding the user's interactions, especially for the audience of urban practitioners and researchers. The main components of the web-based technologies that will be analysed in the case studies include, for instance, the user's registration and profile, the notification system, the structure of the visual interfaces such as the ones based on interactive maps or on grids and wall of textual contents, the contents units and how there are organised, and so on. We are all familiar with this kind of components through the daily use of the most common web application, but they will be isolated in the discussion of the case studies and analysed in detail in relation to the potential alternatives to better fit the needs of different segments of users.

[50] In chapter 1, I specified that these technologies are also defined as ubiquitous technologies.

5.4.7 SUMMARY

In the previous sections, I have furtherly detailed the third core model by reviewing and discussing the relevant literature across different disciplinary domains linked to its four layers. Following, in Table 5.6, the summary of the main elements highlighted by the review to frame the forms of technology support to the orchestration of local development actions.

Table. 5.6 Key concepts and aspects for detailing the third core model

levels of the core model	characterisations and aspects to be considered
coordination, cooperation, collaboration	▪ ***Goals and objectives:*** defined internally or externally to the social structures involved in the action; joint definition or compatibility assessment; compliant with the mission or beyond it; defined within existing structures and policies or autonomously; mutuality; participation to the goal because of internal limitations or by choice ▪ ***Interdependencies:*** decisional and operational autonomy; centralised or decentralised decision-making and control; high-level or low-level planning, or comprehensive or sectorial; fragmented or organic leadership of the action; involvement and mutual arrangements at high or low hierarchical levels; avoidance and resolution of conflicts ▪ ***Commitment:*** formal-informal agreements, presence-absence of meta-structures to manage the collective arrangements ▪ ***Resources:*** assets and available for 3Cs dynamics; shared or not shared resources; physical or human resources shared; level of information and systems sharing; implementation dependent or independent from leaderships; need or marginality of trust-based relationships ▪ ***Benefits and Risks:*** Individual risks and benefits for single units and higher-level structures; shared risks and benefits among the stakeholders involved; high or low risks and on what aspects; structural variable of risks and benefits (number of participants in the action, their heterogeneity, level of communication, freedom to be involved and exit), core relationships related to risks and benefits (reputation control mechanisms, trust and reciprocity among the involved parties); contingent strategies for risk reduction and benefit increase ▪ ***Conflicts:*** conflicts of interests requiring mutual adjustments; conflicts of interpretations requiring shared interpretations of the context of action
practices and meta-practices associated with programmes, processes, projects	▪ ***Oridnary vs Extraordinary actions*** ▪ ***Short, Medium, Long Term*** ▪ ***Articulation of Programmes, Processes, Projects*** ▪ ***Practices:*** what actions are implemented and how there are represented in the common discourse; sequence of activities, but also how priorities and interests are established, and asymmetries reproduced; temporal sequence of activities, and the temporalities and rhythms of practices; material and symbolic aspects associated with specific human actions and bodily interactions; use of specific artefact in the context, with its specific meaning and connection with other visible and invisible practices; practical concerns determining efforts, achievements and goals in the implementation of practices; set of measures to adapt practices to conflicts and tensions between formality and informality; how practices are consolidated through the definition of insiders or outsiders, and other learning mechanisms

	▪ ***Mediation work in practices (and mata-practices):*** artifactually imprinted protocols; maps communicating in implicit or explicit forms what can be done or not in a certain context); script (interdependencies among different activities, the conditions and pre-condition for actions, the available options and choice criteria) ▪ ***Rules in meta-practices:*** "rules-in-force" (established by regulations, laws, contracts, agreements, and thus explicit) and "rules-in-use" (working rules as interpreted and applied, and usually tacit); levels of rules and coexistence of multiple set of rules; informal rules enabling the action; rules changing over time; Types of rules: - position rules about positions and roles of the involved actors - boundary rules defining who is included or excluded and how positions and roles are assigned; - choice rules, prescribing the actions that can be undertaken in various circumstances - aggregation rules, limiting the number of involved actors acceptable for collective actions and decision - information rules, regulating communication exchanges - payoff rules, assigning rewards or sanctions to particular actions - scope rules, envisaging what should be the expected/desired/acceptable outcomes.
forms of technology support to analysis, planning, implementation, management, assessment of actions/context of actions	▪ enabling users to work together by **arranging roles, tasks and human resources through malleable (versatile and flexible) protocols** that can be changes on fly, while **remaining accessible and legible to users** and, at the same time, consistent with all the other elements defining the context in which users work ▪ adapting the context in which users work by - locating, blocking or obtaining the access, showing, hiding, publicising, concealing ***informational resources*** - locating, procuring, allocating, reserving, deploying, consuming, transforming ***material resources*** - locating, procuring, allocating, reserving, deploying, using ***technical resources*** - reserving, using ***infrastructural resources.***
study of interactions within/on web-based technologies	▪ ***design metaphors*** ▪ ***types of interactions*** with a digital system: instructing, inputs/outputs exchange, manipulating digital objects (texts, visual contents, and multimedia contents), exploring contents and objects, responding to inputs and requests coming from the system itself ▪ ***underlying model(s) of the reality and its representation on the system***

5.5 CORE MODELS AND RESEARCH QUESTIONS

This section recalls the first set of research questions the interdependence between users' representations, city context and local actions in City Mirrors in relation to the core models. To this regard, it is useful specifying that the role and function of the core models is two-fold. On the one hand, the core models constitute the third block of a design theory oriented to inform the design of City Mirrors. They provide the set of theorethical constructs essential to frame the purpose of such platforms (supporting the orchestration of collective actions in the city) and instantiate their principles of form and function (or rather configuring a multi-stakeholder, multi-purpose, multi-scale shared online environment). On the other hand, the three core models shape the knowledge infrastructure to answer the first set of research questions.

RQ1_What characteristics of the users involved in local activities are significative and acceptable to be represented in a City Mirror for enabling city stakeholders to understand the social context of their actions?

In relation to RQ1, the first core model organised the multiple layers for a holistic representation of the users operating in the city context, taking into account the implications of being part of multiple social structures bounding potential offline and online actions. For each layer, the model provided a set of properties and aspects characterising the framing of the user within groups, organisations, communities and networks. At the same time, the model indicates a set of properties characterising these social structures as collective users themselves. Building on this knowledge infrastructure, the empirical and applied research reported in the case studies is going to explore the implications of representing these characteristics on a shared platform and to what extent and under which conditions they can be represented.

RQ2_What factors should be considered for matching the specificity and uniqueness of local development actions in urban environments with the openness and generality of the online environment provided by a City Mirror?

In relation to RQ_2, the second core model sets the appropriate level of abstraction to look at local development actions from a systemic perspective, focusing on the patterns and relationships across the city systems (physical, functional, social) and infra-systems (resources, relationships, values). Indeed, observing and analysing local actions at this level, the focus of the interventions of a City Mirror in the context will be in the identification of recurring schemas regardless the contingencies of the case studies.

RQ3_What type of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a City Mirror in comparison with other existing tools?

In relation to RQ3, the third core model expand the operational space for technologies meant to be multi-stakeholder, multi-purpose and multi-scale by outlining a) the schema of the different types of collective actions associated with the three dynamics of coordination, cooperation and collaboration and b) the forms of technological support to the various phases of these actions. The insights coming from the case studies will help to understand more specifically the difference between current solution communication-oriented and the proposal of the City Mirror.

5.6 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 5 to the three outcome spaces outlined in Chapter 2, Section 2.7. Analogously to the previous chapters, the contributions of Chapter 5 are briefly described in the table below.

Table. 5.7 Mapping of the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 5
SYSTEM KNOWLEDGE	THEORETICAL CONTRIBUTION	[SECTIONS 5.2, 5.3, 5.4] The main contribution of this chapter consists in **three core models** connecting the essential concepts to analyse and operationally addresses the **modelling of**: ▪ **Users as part of collective social structures** that, on one side condition understanding and actions of individuals, and on the other side express a coherent corpus of characteristics partially unifying the single actions of individuals under a common frame that become readable ▪ **Cities as ecology of systems and infra-systems** internally connected through the flows of actions and interactions among users of urban resources and city technologies, overcoming part of the limitations of descriptive urban models and city ontologies ▪ **Technologies as instrument to operationally support existing practices or enable innovative future practices** associated with coordinative, cooperative and collaborative mechanisms among diffent stakehodlers in the frame of common institutions, exploring alternative options beyond the current uses of web-based technologies.
	METHODOLOGICAL CONTRIBUTION	
	EMPIRICAL CONTRIBUTION	
TARGET KNOWLEDGE	FOR RESEARCHERS	[SECTIONS 5.1-5.4] Chapter 5 includes a **preliminary mapping of concepts and frameworks developed across multiple disciplines**, mainly urban disciplines and informatics. According to the transdisciplinary framework adopted in this work, this mapping helps in hybridising these concepts by discussing differences and complementarities among the aspects usually considered in different disciplines. The disciplinary bridges resulting from this operation can contribute to understand and address the complex problem of realigning use of technologies in cities and local development goals. Indeed, the three core models are analytic and design tools (as they will be used in the next chapters), but also intended as a starting point for further theorethical and empirical research.
	FOR TECHNOLOGY DESIGNERS	
	FOR URBAN PRACTIONERS	
	FOR CITY STAKEHOLDERS	
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	

TRANSFORMATIONAL KNOWLEDGE	USERS	[SECTION 5.2] The proposed model of technology users frames them as part of multiple social structures (groups, organisations, communities, networks) which in turn can be considered as "collective users". This model attempts to **translate the complexity of human relationships in a simplified schema that can potentially be used to move forward the reductive mono-dimensional conceptualisation of users as customers**, taking into account the fluidity of roles and the plurality of identities of individuals operating in urban contexts.
	CITY	[SECTION 5.3] The proposed model of the city conceptualises the city as ecology of systems (physical, functional and social) and infra-systems (determining meanings, responsibilities and shared identities). This model moves the attention from the description of urban components and their relationships (that is predominant in geographical models and predictive models) to the **identification of action patterns and rules in actions due to the nature and organisation of city systems and infra-systems**. In this way, the model proposes a framework of social and functional interactions in the city to support the analysis and design of city technologies intended to be multi-stakeholder and multi-purpose.
	TECHNOLOGY	[SECTION 5.4] The meta-framework of the role of city technology maps the forms of technology support across different families of urban activities, taking into account the specificity of coordinative, cooperative, and collaborative practices, but also temporal and structural aspects of these activities that are relevant for the design of appropriate solutions. This models provides an high-level schema to **look at the forms support provided by technology abstracting from specific sets of tasks and considering other relational and operative elements affecting decisions and actions in a complex context such as the city**, where a web-based technology is only one of the components of the information environment for users.

PUBLICATIONS

The following publications and/or presentations included part of the contents or concepts presented in Chapter 5.

- Lupi L., (2019) **Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development**, IASDR 2019, Manchester, United Kingdom. *[Long Conference Paper, Design]*

- Lupi L., (2018). **Mirroring the City. Toward Web-Based Technologies to Support City Stakeholders in Local Development Actions**, Extended abstract at the Swiss Inter- and Transdisciplinarity Day 2018 – Inter- and Transdisciplinarity in a Digital World, Lausanne (CH). *[Extended Abstract, Poster and Conference Presentation, Research methods].*

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Following, I listed a small part of the references used in this chapter, limited to the direct references in academic sources. However, it is relevant to acknowledge that many more should be included by considering:
a) the *indirect references* that contributed to stratify my understanding of cities, social structures and technologies over decades
b) the *informal references* to the kind of practical knowledge acquired through practice and experience in implicit and explicit forms
c) the references difficult to trace back in a linear way.

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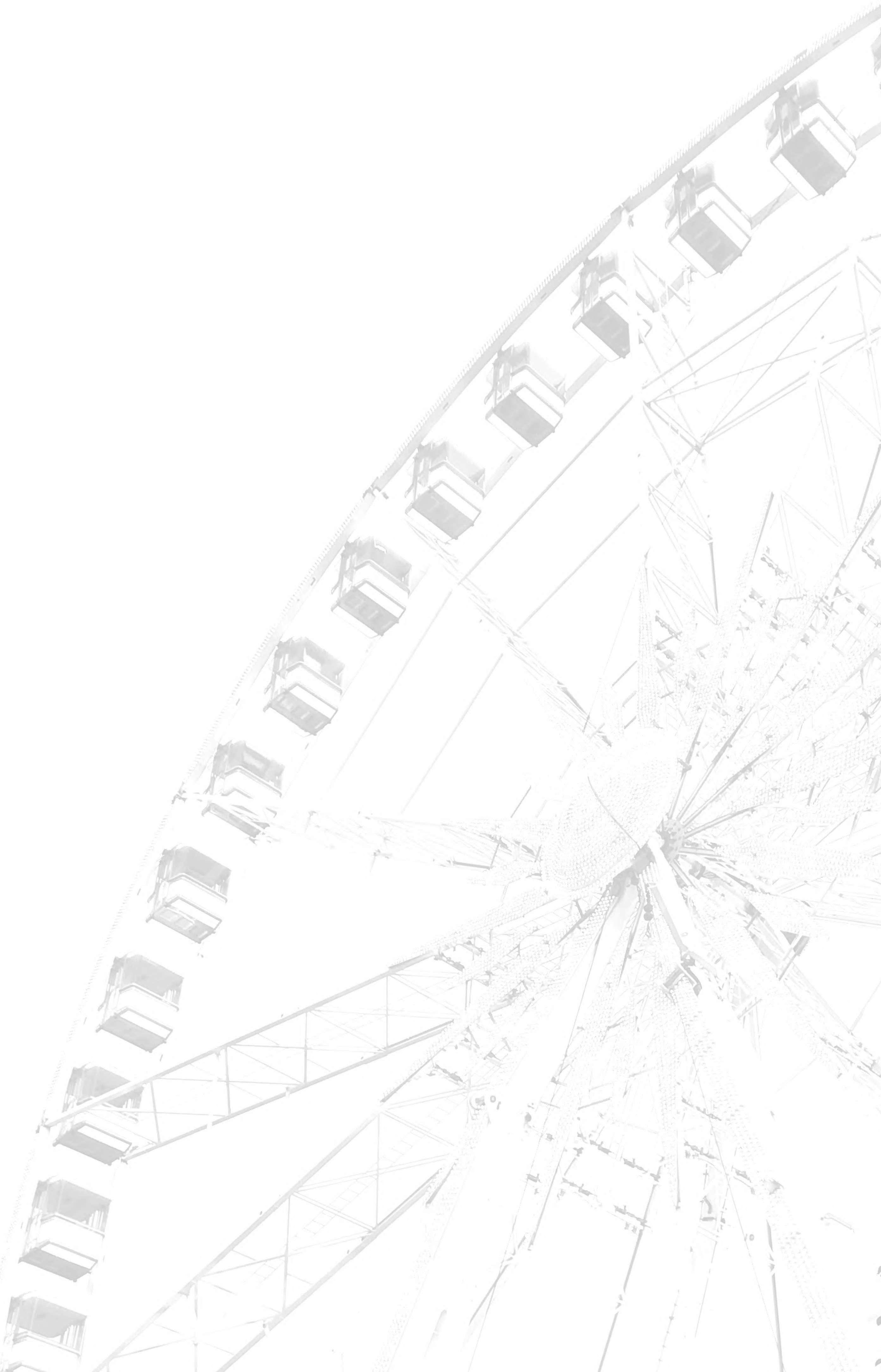
CHAPTERS 6.

DESIGNING CITY MIRRORS: METHODOLOGY FOR THE EMPIRICAL AND APPLIED RESEARCH



CHAPTER 6. OVERVIEW

Chapter 6 explains the methodology that structured the applied and empirical research for exploring design solutions, limitations, potentialities and implications of a multi-stakeholder, multi-purpose, multi-scale web-platform to support local development actions.

Chapter 6 is organised into eight sections. The first six sections describe rationale and modalities for the implementation of the applied and empirical part of the research, by proceeding from the higher to the lower layer of the methodology structure. The last two sections made explicit the boundaries of the research and the contributions of the chapter.

- Section 6.1 recaps how the transdisciplinary framework and the TIDS protocol led the research up to this point. This section also introduces the **structure of the methodology** that oriented the following steps.
- Section 6.2 specifies that the **research logic** with which the applied and empirical research had been approached followed abductive reasoning mechanisms, accordingly with the research goal of elaborating a theory on web-based city technologies.
- Section 6.3 provides the arguments in support of the choice of pursuing a **research strategy** based on multiple case studies, explains the procedure for the definition of the case studies, and then discusses strengths and weakness usually associated to the case study research in relation to the specificities of this work.
- Section 6.4 unfolds the rationale of choosing a multi-method **research approach** to address the goals of this work, and then introduces the selected methods and how they had been combined throughout the research process.
- Section 6.5 describes how the **case studies** had been constructed for exploring different alternative instantiations of the base models of the users, city ecosystem, and technology role (described in chapter 5), as well as for covering the three phases of the design process of a digital artefact.
- Section 6.6 explains how the selected **research methods** had been applied in each case study and across all of them, by specifying the key elements of the research tactics and techniques used for the data generation and analysis.
- Section 6.7 illustrates the **research boundaries**, by discussing personal standpoints, quality criteria and limitations of the research.
- Section 6.8 summarises the **chapter contributions**, accordingly to the outcome spaces of transdisciplinary research.

Connection with previous chapters. Chapter 6 makes explicit how the methodology structuring the applied and empirical part of this work is consistent with the research framework presented in Chapter 2 and how the base models presented in Chapter 5 had been used in the research process. In particular, this chapter clarifies the methodological and practical aspects of implementing the ***"Integration through methods hybridisation"*** and ***"Integration through artefacts"***, two of the strategies for creating a bridge across disciplines in transdisciplinary research [see Chapter 2, section 2.3 or Hadorn et al. 2008].

Connection with the following chapters. Chapter 6 provides a common framing for the three case studies, each of which is reported in detail in the next three Chapters 7, 8 and 9. Moreover, Chapter 6 includes the key elements of the techniques applied during the case studies for developing theory and assessment framework of web-based city technologies presented in Chapters 10.

CHAPTER 6. DETAILED TABLE OF CONTENTS

6.1. INTRODUCTION TO THE METHODOLOGY

The problem of understanding how web-based technologies could support city stakeholders in local development actions is primarily a **design problem** because of the absence of specific platforms designed for this scope or having the appropriate characteristics. At the same time, it is also a **research problem**. Indeed, the study of the relationships between the different systems of the city and its representation in a digital environment is still fragmented. The synthesis of these two problems corresponds to understanding how to design web-based platforms able to provide a digital environment consistent with the physical, functional and social reality of the city ecosystem in order to effectively support local actions implemented by different actors, for different purposes and at different scales [see Chapters 3 and 4].

The investigation of this multi-dimensional problem requires undoubtedly a holistic analysis of current city dynamics and the role of technology within them. Nevertheless, it also requires the exploration of a "near future" in which web-based technologies could become the enabler of social innovation processes, sustainable practices and new governance models, by exploiting their pervasiveness, flexibility, and accessibility.

Therefore, the methodology developed in **this work combines applied and empirical research**. The applied research focused on elaborating new design solutions to anticipate this near future and experimenting them in real settings. The empirical research covered two other points: a) studying the nature and structure of city dynamics to translate them into the design of future city technologies, and b) analysing the implications of introducing new technologies based on the logic of city dynamics into real settings [Fig. 6.1].

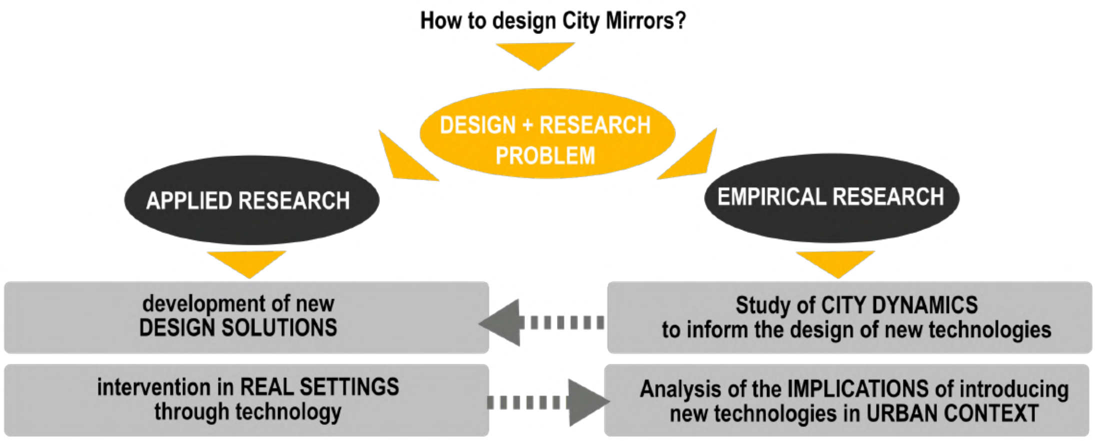


Fig. 6.1 Schema of the applied and empirical research associated to the problem under study

6.1.1. METHODOLOGICAL IMPLICATIONS OF A TRANSDISCIPLINARITY RESEARCH FRAMEWORK

The methodology that structured the empirical and applied part of the research is aligned to the transdisciplinary framework describing the characteristics of this work at a higher level [see Chapter 2, Section 2.1.2]. This section recapitulates how the transdisciplinary framework influenced methodological choices [Fig. 6.2].

Establishing **transdisciplinarity as a research framework** states explicitly that the research **inputs come from different disciplines** and that the attention is on hybridising their concepts and methods in new forms appropriate for addressing the problem under study. In Chapter 5, the practical application of this framework had been proven in the hybridisation of concepts and theories from informatics and urban disciplines for the elaboration of core models about urban social structures, city systems and forms of technological support. This chapter focuses instead on explaining the process implemented for **hybridising methods and techniques** used for the applied and empirical part of the research.

A **transdisciplinary research framework** also entails that the horizon of the research is oriented toward outcomes that are primarily socially relevant [Pohl et al. 2017]. This orientation impacted on methodological choices because it led to consider the **engagement of the stakeholders** affected by the problem under study as an essential part of the research process. The unpredictable nature of this engagement process requires the **methodology to be necessarily flexible and reactive**, or sufficiently plastic for accommodating unexpected evolutions of the research in a coherent way.

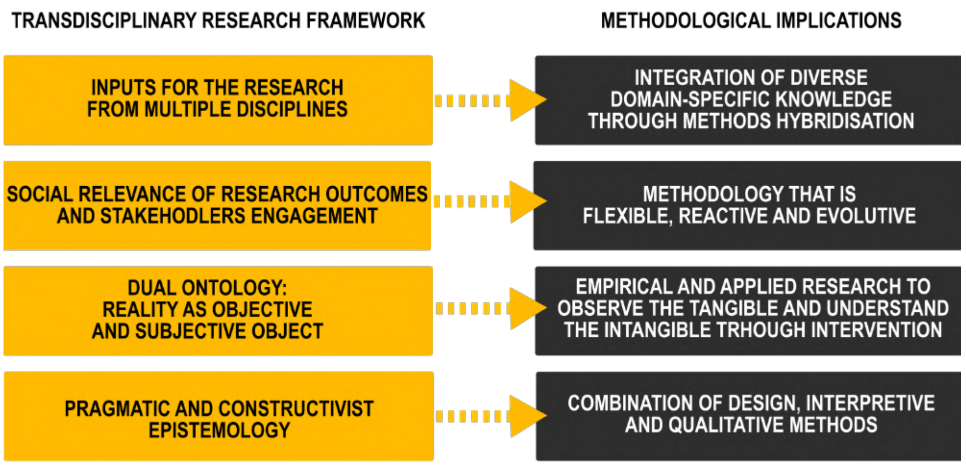


Fig. 6.2 Methodological implications of transdisciplinary as research framework

Lastly, setting transdisciplinarity as research framework also involved to formulate specific decisions about the ontology and epistemology of the research, and then developing the methodology accordingly to these. As regarding the research ontology, the Transdisciplinarity Axioms formulated by Nicoleuscu provide theoretical foundations for considering city and technologies in their objective and subjective existence that is socially constructed [see Chapter 2, section 2.5]. The methodological implication of this **dual ontology** is decoupling the study of the tangible aspects of reality from the study of intangible ones, respectively performed through observation and through intervention. The dual ontology and the problem-driven nature of transdisciplinarity research concurred in fixing the **epistemology of the research as social constructivist and pragmatic** [see Chapter 2, section 2.6]. The research methods adopted in this work are widely considered appropriate in association with these ontological and epistemological paradigms.

6.1.2. STRUCTURING THE RESEARCH METHODOLOGY WITHIN THE TIDS PROTOCOL

The structuring of the research methodology is organically included in the operational protocol that links the analysis of the problem to the elaboration of theoretical models, strategies and guidelines to deal with it. Indeed, the TIDS protocol binds together the theoretical, empirical and applied aspects of the research into an organic flow [see Chapter 2, section 2.4].

In the previous chapters, I reported the first three steps of the TIDS protocol:

- the systematic analysis of the problem and its conceptualisation along the axis of users' representation, city model, and technology role (Chapter 3)
- the definition of the specific research object that is a web platform designed accordingly to the City Mirror proposal, whose properties had been defined for difference from other existing technologies and on the basis of the previous conceptualisation (Chapter 4)
- the development of base models on users, city and technology based on a critical literature review and hybridisation of consolidated concepts in informatics and urban disciplines (Chapter 5)

These three steps correspond to faceting the problem, refining the research object, and elaborating the base models for studying the research object. At this point, field and design activities are required to study the instantiations of the core models in different configurations of the research object. The methodology structuring is the step connecting the formalisation of the core models with the study of their instantiations [see Fig. 6.3].

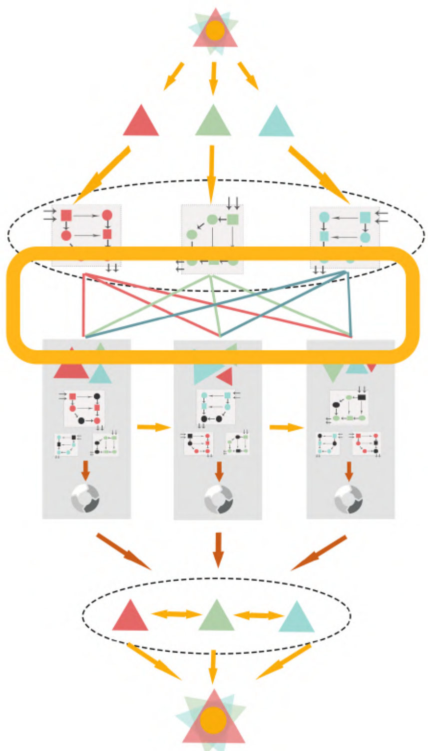


Fig. 6.3 Mapping the methodology structuring within the TIDS protocol

Within the TIDS protocol, the research methodology had been structured by taking into account the goal of addressing the two main research questions that are respectively focused on:

- the interdependence between users' representations, city ecosystem components, and forms of technology support to local actions
- the characteristics of a design process for a multi-stakeholder, multi-purpose and multiscale web platform intended to work as city technology.

Consequently, the methodology had been oriented to allow the study of these interdependencies and the design process under a plurality of perspectives and in a comprehensive way by strategically managing the instantiation of the base models.

6.1.3. STRUCTURE OF THE RESEARCH METHODOLOGY

The research methodology is structured into three levels, hierarchically organised [Fig.6.4], concerning:

a) the high-level characteristics of the research methodology (logic, strategy, approach)
b) the systems of inquiry leading the research (methods)
c) the procedures for the implementation of the research activities (techniques).

Considering the **novelty and fragmentation of research about the city applications of web technologies**, it is essential to highlight the **lack of theories or comprehensive frameworks** to understand the phenomena at the intersection between city ecosystem and the web technologies. Nevertheless, many concepts and findings of previous research in informatics and urban disciplines help in interpreting a few parts of these phenomena and making sense of the observations and insights generated by field and design activities. Therefore, the **research logic** iteratively applied during the entire applied and empirical research process is based on **abductive reasoning** mechanisms.

Considering what mentioned before about the importance of **elaborating new design solutions** for studying constraints and implications of web-based technologies aimed to support local development actions, the research focuses on the development of three examples of such technologies instantiating the City Mirror proposal in different forms. These three examples of City Mirror-in-the-making constitute the backbone of a **research strategy based on multiple case studies**, combining applied and empirical research.

Considering the need of **addressing simultaneously the design problem and the research problem** associated to web-based technologies reflecting city dynamics, the **research approach** adopted in this work relies on **multiple methods that belong to design, qualitative and interpretive systems of inquiries**, coherently with the ontology and epistemology of the research.

Considering the utility of integrating knowledge and inputs from different disciplines to achieve the research goals within a transdisciplinary framework, the **methods and techniques** selected for the implementation of the research are consolidated both in informatics and urban disciplines. Building on methodological convergences, these methods had been individually hybridised and then integrated to cover distinct aspects of the research. These methods are **research for design, research through design, action research and grounded theory**.

Research logic, research strategy, research approach, research methods and techniques will be explained in the next sections. However, before to continue, it is necessary to disambiguate the exact meanings of these expressions as used in this work. Indeed, these terms are frequently interchangeably used in literature.

Moreover, distinct disciplines or communities often have different preferential denominations for the same methodological components. To avoid any misunderstanding with the reader, I refer to the terms "Methodology", "Methods" and "Techniques" as distinct concepts hierarchically organized [Kothari 2004, Mills 2014], and to "research approach" and "research strategy" as elements defining the methodology [Mills & Birks 2014]. Following the working definitions of these expressions as consistently used in this thesis.

- The **Research Methodology** is the way to address the research problem systematically, and it contains the rationale of the choices for addressing the problem in terms of research strategy and research approach.
- The **Research Logic**[1] is the form of reasoning that connects empirical evidence collected through field activities to the theoretical aspects of the research. It can be deductive, inductive or abductive.
- The **Research Strategy** is the action plan to reach the research goal (and it can be implemented through theoretical research, empirical research, applied research, case study research, experimental research, computational research, review-based research, and their combinations).
- The **Research Approach**[2] is the set of philosophical assumptions (epistemology, ontology), procedures of inquiry (mono-method, mixed-method, multi-method) and selected methods to address the research problem by keeping a consistent alignment between epistemology, ontology, and methods [3].
- A **Research Method** is an organic set of procedures required or designed to generate a specific type of knowledge for answering the research questions (e.g. action research, grounded theory)
- A **Research Technique** is a procedure composed by data collection activities, or data analysis activities or both (e.g. interviews, survey, contextual enquiries, design workshops, thematical analysis of data, visual mapping of concepts).

The specific nature of the problem under study in this work led to an extensive **overlapping between common research techniques and design methods**. A design method is used as a research technique if the reflections, processes and products generated from the implementation of a design method are collected as data sources and then analysed through research techniques. As it will be explained in section 6.6, the goal of most of the activities performed throughout the research process was two-fold: structuring the contextual knowledge required to progress the design of the case studies artefacts, and on the other side, providing new elements for studying the problem at a theoretical level and generating new knowledge.

[1] The Research logic is sometimes defined also as *research approach* [e.g. Sanders et al. 2012], when the research approach is referred uniquely to the connection between hypothesis formulation and empirical observations and conclusions.

[2] The expressions **research approach** and **approach to the research** are often used interchangeably, while in the second case the approach to the research is not related to the methods of investigation, but to the axiology of the research, i.e. the value and purpose given by the researcher to his/her investigation [see Chapter 2, section 2.7]. This is particularly frequent in the literature on action research methods, participatory design methods, research trough design methods, that have in common the fact of being often aspirational and oriented toward social change aims.

[3] If the research approach is based on a mono-method system of inquiry, **research approach** and **research method** collapse in one only layer. This is the reason why frequently the expression *research approach* and *research methods* are used interchangeably. Indeed, in the case of a research relying on one method only, we have one ontology and one epistemology, and therefore there is an intrinsic alignment between philosophical assumptions and system of inquiry, unless the selected method is not appropriate to the research goal or the techniques with which it is implemented are incoherent with the ontological and epistemological assumptions of the research.

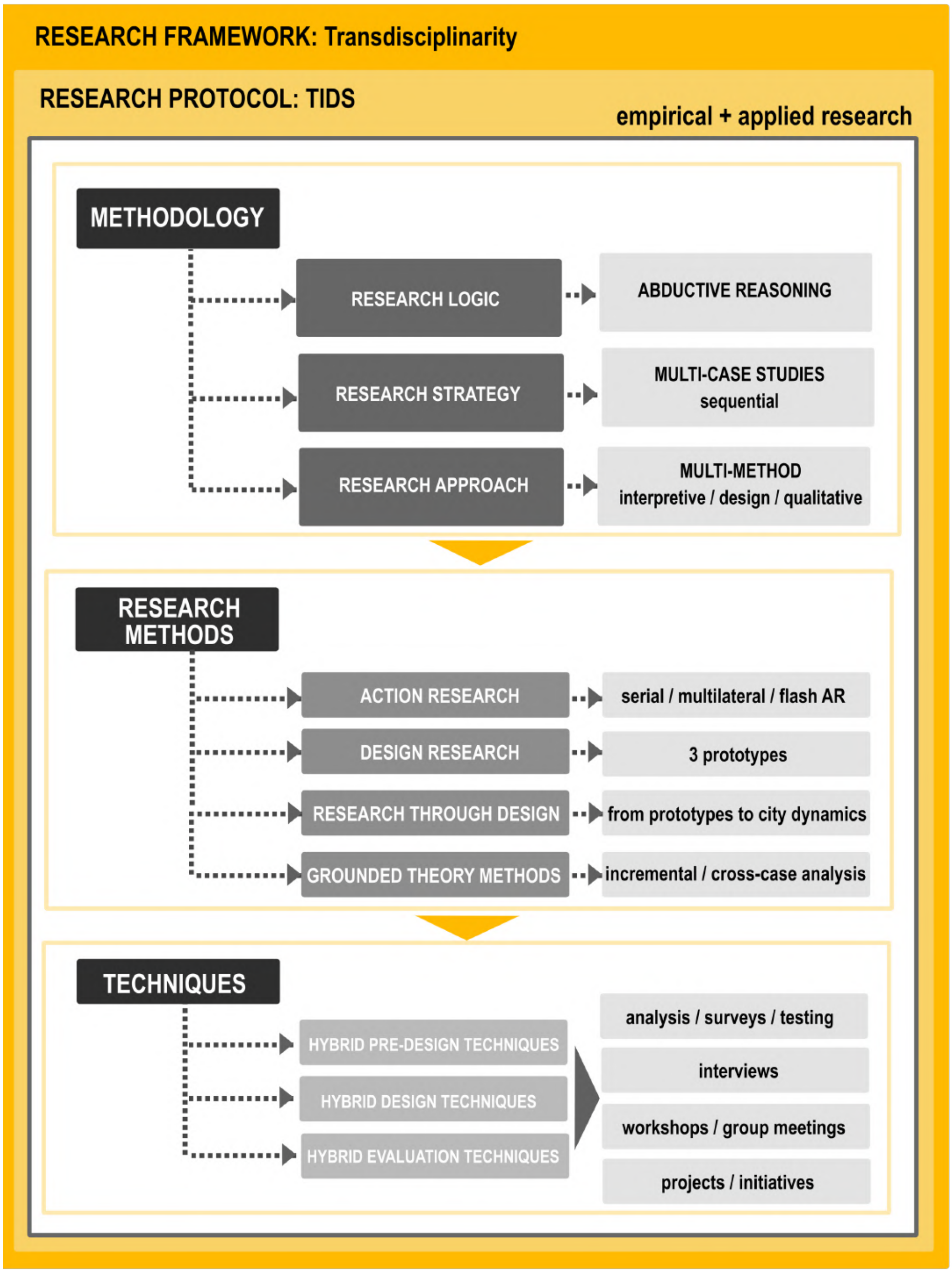


Fig. 6.4 Structure of the Research Methodology

In the next three sections, I discuss the research logic, research strategy and research approach applied in this work.

6.2 RESEARCH LOGIC: ABDUCTIVE REASONING

The abductive reasoning is a research logic characterised by a **continuous exchange between practice and theory** under the form of mutual enrichment between empirical insights and consolidated knowledge [see Fig. 6.5]. In other words, the abductive logic is an iterative process of interpretation and generalisation of contextualised observations through logical inferences leveraging on their connection to other theories able to explain one aspect of the phenomenon under study [Fisher 2001, Aliseda 2006, Holmström 2009, Walton 2014, Philipsen 2018].

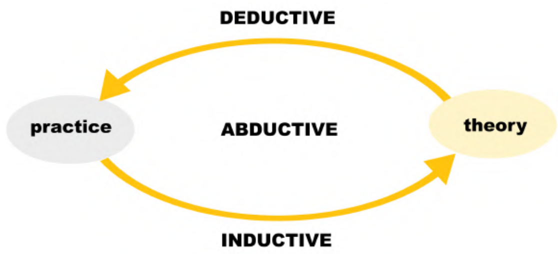


Fig. 6.5 Schema of the connection between practice and theory in deductive, inductive and abductive reasoning

The choice of adopting an abductive logic in the empirical and applied part of this research is based on four arguments. Firstly, the **lack of appropriate theories or frameworks** to explain the relationships between city and web-based technologies. Secondly, the **problem under investigation is a design problem**, and the abductive reasoning is the essential characteristics of the design approach to problems, always based on a synthesis of previous knowledge and variation for building new knowledge [Cross 2006, Kolko 2010]. Thirdly, the application of abductive reasoning is considered a successful path in **transdisciplinary studies holistically addressing multi-dimensional problems** [Hadorn et al. 2008, Bergmann et al. 2012]. Lastly, an abductive logic to generate new knowledge is usually adopted by most of **disciplines with transformative aims**[4]. Indeed, many analysis and examples reported in the literature are associated with urban planning and urban development [Khisty 2000], constructive design research and technology development [Lee et al. 2011, Gregor et al. 2013], systemic or creative thinking [Thagard 1997, Tomiyama 2003], and future studies [Patokorpi& Ahvenainen 2009].

While the four arguments listed before strongly support the choice of relying on abductive logic as the way for generating knowledge during the research process reported in this disseration, it is worthy to specify also why deductive or inductive logics are instead not appropriate alternatives for this research. This clarification is required because deductive and inductive logics are largely applied in other PhD works and conventionally expected in the frame of a PhD programme, including mine.

The **deductive reasoning** is usually aimed at testing or confirming a hypothesis based on a general existing theory in the setting of a particular case study or environment. The major assumption of deductive logic is that if the premises are true also the conclusion will be true because of the link between premises and conclusions rely on logic processes only [Hyde 2000].

[4] Disciplines with transformative aims are disciplines intrinsically oriented to produce a change in the world, instead than focusing on describing the world as it is or as it was. For instance, geography is a descriptive discipline, while urban planning is a transformative discipline.

Beyond the fact that an appropriate theory for the scope of this work is not existing, I excluded to adopt a deductive logic because even formulating a hypothesis to be tested is difficult. Indeed, elaborating a hypothesis for the specific problem under study is risky and pointless without an empirical grounding and direct knowledge of what should be considered because web-technologies intentionally aimed at supporting local development actions are not existing yet.

To this regard, it is important to make explicit that **the City Mirror proposal is not a theory or a research hypothesis to be tested [5]. On the contrary, it is a conceptual tool critically constructed for investigating the problem in its empirical and design aspects**. The design proposal had been developed on the basis of the analysis of the problem and the review of existing web-based technologies, but not with a descriptive or explanatory intent. Indeed, the point of the research is not establishing the truthfulness or correctness of the proposal in itself. The purpose of using the City Mirror proposal is to discover the elements to be considered for envisaging the use of web technologies in local development actions and, in the end, elaborate a preliminary design theory based on these elements. The effectiveness of a design proposal is assessed on the basis of its capacity to make the problem more understandable than before.

The inductive reasoning is based on the systematic collection of contextual pieces of evidence of a phenomenon for formulating a theory [Flack & Kasas 2000, Hyde 2000]. The assumptions for the application of inductive reasoning are that:

- existing theories do not describe the phenomenon under study
- it is possible to carry out a comprehensive and systematic data collection to build robust findings for describing the phenomenon.

These two assumptions are also the main weaknesses of inductive reasoning. Indeed, while a topic is uncovered by specific theories, probably some of its aspects are already be conceptualised, described, or confirmed by other theories. The application of a pure inductive logics excludes the possibility of exploiting conveniently the insights coming from these other theories during the formulation of the theory, but only for its ex-post validation. Therefore, the formulation of a theory following an inductive reasoning relies exclusively on the collected data. Associated with this point, it is difficult to assess the completeness of the data collection and there is a high risk that the theory is not transferable or generalisable because too much dependent on the data collection context.

I excluded to rely only on inductive logic in this work for two reasons:

- the contribution of existing theories about specific aspects of digital technologies, city dynamics or both provide essential basis and breath to the insights coming from the empirical observations and applied research
- demonstrating the completeness of a systematic data collection for investigating a variety of city dynamics and contexts by relying only on inductive reasoning is not feasible, even at a small scale.

The abductive approach is then a third alternative to the pure inductive or deductive approaches, overcoming their weaknesses by adopting a pragmatic perspective [Saunders et al. 2012]. It does not assume to be possible collecting all the possible pieces of evidence for investigating the research problem, but at the same time, it is based on trusting in the validity of previous studies to cover specific aspects of the insights coming from observations. In other words, abductive reasoning is based on the integration of deductive and

[5] In design research, the expression "*design hypothesis*" [Cross 2006] is used to indicate an under-defined design solution that can work also as a conceptual framework for the research exploration. In this work, the expression "design proposal" is used with this exact meaning, but preferred to the expression "design hypothesis " to do not generate confusion about what is the scope of that conceptual tools in readers more used to the idea of hypothesis as something to be tested.

inductive reasoning. The meaning of the observation and patterns coming from empirical and applied research activities is figured out by merging the knowledge acquired by the direct experience of phenomena with the knowledge coming from the integration of theories and frameworks able to explain specific rules of the observed phenomena at higher level [see Fig 6.6].

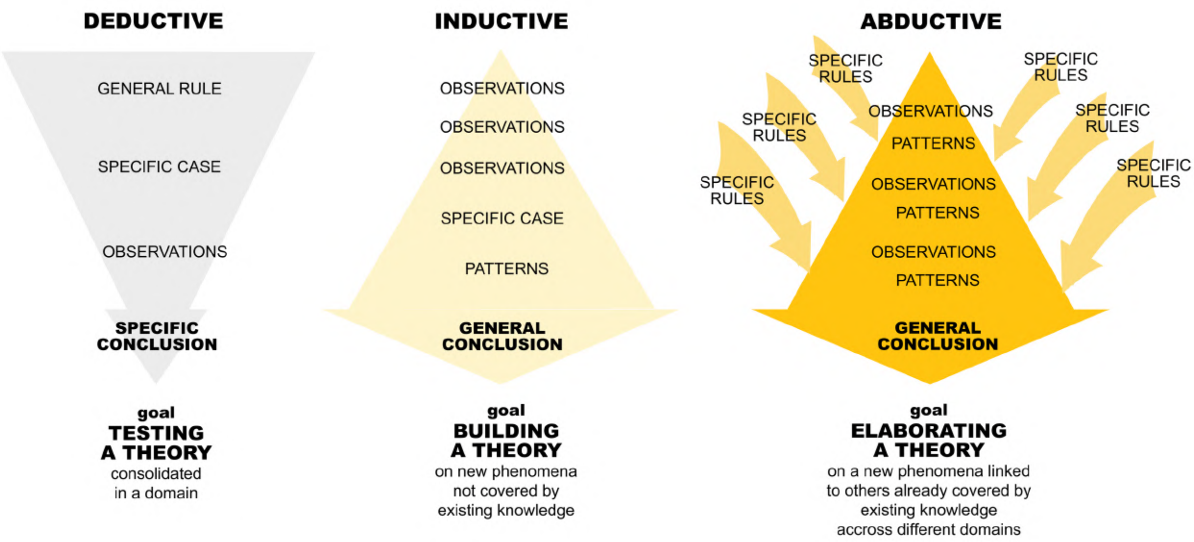


Fig. 6.6 Schema of the development process and goals of deductive, inductive, abductive reasoning

6.3 RESEARCH STRATEGY: MULTIPLE CASE STUDIES

The research strategy adopted in this work is based on the construction of three case studies. Each case study is focused on the design process of a web platform instantiating the City Mirror proposal, including the analysis of the design and field activities associated to the projects and initiatives accompanying the development of each platform.

Accordingly to the two main research questions, the goal of the research strategy was operatively enabling the investigation of the design process of multi-stakeholders, multi-purpose, multi-scale web platforms, and at the same time, exploring the interdependence between users ‘representation, city activities, and role of this type of technologies in urban actions.

The following two sub-sections explain how the multi-case strategy had been defined and how this research strategy addresses the limitations frequently associated with case study research.

6.3.1 RATIONALE OF THE MULTI-CASE STUDY STRATEGY

The three case studies are structured within and around the design process of three web technologies having some specific characteristics matching with the key aspects of the City Mirror proposal.

These **three web technologies are intrinsically focused on city applications with local development aims,** such as:

- a civic social network intended to support local activities (case study 1, FirstLife)
- a platform aimed to infrastructure cooperative governance processes at urban level (case study 2, WeGovNow)
- a data portal for enabling the use of city data by local stakeholders (case study 3, MK:Insight 2.X).

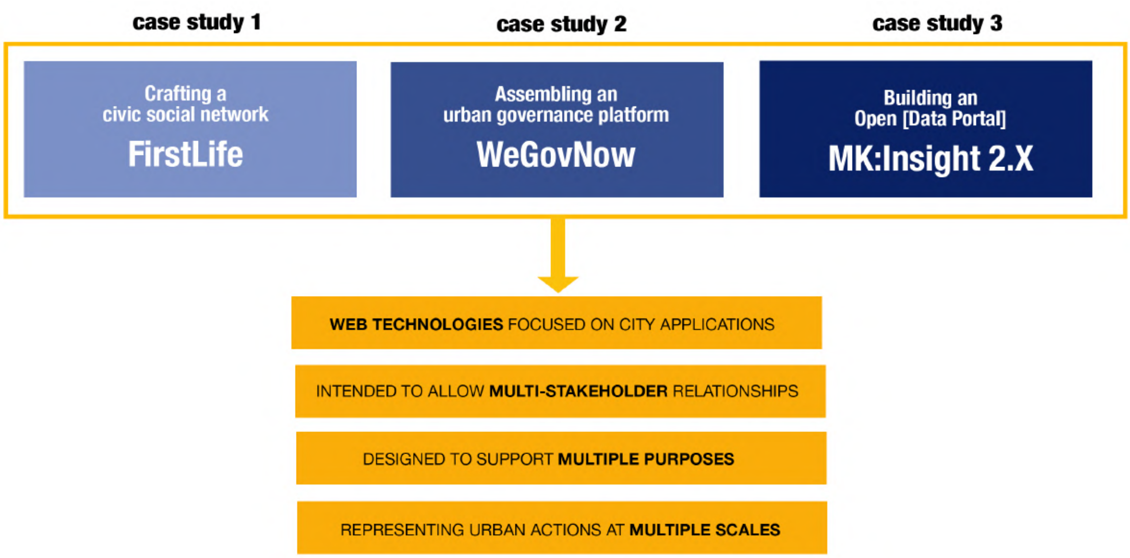


Fig. 6.7 Schema of the characteristics matching the three case studies with the City Mirror proposal

The starting point in common among the three design processes was the need of rethinking standard web technologies applied in urban actions (of which social networks, e-gov tools, and data portals are significant examples) moving beyond the logic of commercial products focused on the relationship between customers and owners. Therefore, one of the goals leading the prototype design in all three cases was developing solutions able to **support a plurality of relationships among organisations, communities, groups, and networks**, reflecting the way social connections are actually formed into the city. This intent was coherent with the proposal of a City Mirror in reference to the creation of a **multi-stakeholder environment**.

The three prototypes to be developed were also oriented **to support a plurality of goals and activities** of these different stakeholders, and not only the main purpose of the platform administrator/owner/client. In pursuing this vision, the prototypes were also intended to be thematically open, not limiting the supported topic to narrow domains, as it commonly happens in urban technologies (such as parking apps). These two aspects should configure a **multi-purpose environment**, as in the proposal of the City Mirror.

Lastly, the city orientation of the design process of the three prototypes was also anchored to the understanding that urban activities with local development aims imply dynamics happening simultaneously at multiple scales, going from the neighbourhood to the metropolitan region. As a consequence, the three prototypes were aimed **to support actions at different geographical scales and inter-scalar interactions** on the platform and offline, in line with the City Mirror proposal.

Considering the consistency between the expectations associated to the design processes of the three prototypes and the key aspects defining the City Mirror proposal, **I planned and organised my investigation**

by structuring three case studies based on the design processes of FirstLife, WeGovNow and MK:Insight 2.X.

I had been personally involved into the three design processes with different roles that allowed me to perform the data collection activities required to build my research, as detailed at the end of this chapter (see section 6.7.1). Beyond the unique opportunity of contributing through my work to the definition of the three platforms, **the importance of studying real prototypes of City-Mirror-in-the-making is connected to the fact that they were/should be/are preliminary examples of web technologies intentionally designed to challenge the status quo of urban ICT applications.**

As emerges from the analysis reported in Chapter 4, most of the current web-based technologies used in urban actions implicitly or explicitly support one perspective assumed as dominant into the actions. This dominant perspective de facto shape the boundaries and the way topics are framed, but also what type of activities requires a technology mediation for being implemented in offline settings. For instance, the use of a Facebook page for promoting a municipal initiative is intended to support primarily the purposes of the organisers of the initiative and/or page administrators. Similarly, urban dashboards and e-government tools frame users in a static relationship with the Public Administration, as citizens or voters or taxpayers, that reflect only the perspective of the Public Administration on the users' roles. Also, again, data portals still are centred on the needs of one data producer, instead than the plurality of data users. As will be introduced in section 6.5 and discussed in Chapters 7-8-9, the three platforms in the three case studies were aimed to challenge this "standard" way of conceiving the relationships among users and the role of technology in local actions.

The effort of imagining alternatives to the consolidated schema proposed by current technologies (one dominant stakeholder, purpose, and scale) and exploring an alternative schema instantiating the City Mirror proposal (multistakeholder, multipurpose, multiscale) required the development of concrete examples outlining a different future for city technologies. During the process, **FirstLife, WeGovNow and MK:Insight:2.X functioned as "boundaries objects"** for exploring the implications of that proposal in its practical aspects and real working settings.

As mentioned before (Chapter 2, Section 2.3), the expression "boundary object" [Star 1989, Star 2010] is used in this work to indicate a digital artefact that help in creating a **common understanding** about what we talk about when we imagine a web technology based on different logics than the other existing platforms. Moreover, the prototypes, even as concept, allowed **experts and not-experts to reflect together** on the **practical implications of future technologies designed as multistakeholder, multipurpose, multiscale** in their everyday activities, projects, relationships, values, problems. Within a transdisciplinary framework, using prototypes or artefacts is indeed an effective strategy for building a bridge between researchers and city stakeholders to reveal issues, constraints and forming a better understanding of the context.

6.3.2. CASE STUDY RESEARCH AND MULTI-CASE STUDIES STRATEGY

In the previous section, I explained the rationale of my research strategy based on three case studies of web-based city technologies instantiating the City Mirror proposal. This choice is also supported by the fact that **case study research is widely recognised as a robust research strategy for analysing complex issues through holistic and in-depth investigations** [Yin 1984, Yin 2014, Fegin et al. 1991]. Moreover, in general, a case study research strategy should be preferred in the situation *"when the boundaries between phenomenon and context are not clearly evident"* [Yin 1984], as precisely in the situation of integrating a new kind of web technologies within urban actions.

The goals usually associated to a case study research are **exploring a problem** in its context, **describing the development of a phenomenon**, explaining **how and why some factors are related** under certain conditions [Yin 1984]. Beyond them, there is also the goal of **interpreting and conceptualise a theme** [McDonough and McDonough 1997, Johansson 2003, Simons 2009]. These four goals of case study research are deeply intertwined considering that exploration, description, explanation and conceptualisation can configure both alternative or progressive paths of investigation toward a better understanding of the research problem, as it is also confirmed in the development of this research.

The **major advantage of using a case study strategy is the opportunity to collect data about the phenomena under study in their context**, where the activities take places [Yin 1984]. As mentioned before, I had been personally involved in the design process of the three platforms. My position within the design team of the three projects and, at the same time, as professional conducting the engagement activities with local stakeholders provided me insights from the two perspectives of technology providers and users. The involvement in activities and operational contexts on both sides enabled me to study comprehensively the design process, as well as the implications of design choices on urban actions as perceived in different settings [see also section 6.1.7].

The **major weakness of case study research**, especially when there is a single case study, is the **lack of other cases for replicating the research process** or the inability of the findings coming from a single case to provide generalisable conclusions [Yin 1984, Tellis 1997, Zainal 2007]. These weaknesses are usually addressed by carrying out multiple case studies to ensure more robust findings. In the following two sub-sections, I will discuss the replicability and generalisability of findings from case studies in relation to my research strategy.

6.3.2.a. Discussing uniqueness and replicability of case studies

The **common concerns about the uniqueness of case studies** and their difficult replicability **reflect positivist paradigms**, also when referring to qualitative research [Harrison et al. 2017]. The uniqueness of a case study is a problem if we postulate the interchangeability of context, people, researchers under the scope of a positivist epistemology aimed to establish an objective truth supposed to be universal [Schwartz-Shea & Yanow 2013]. On the contrary, the specificity of case study research based on non-positivist paradigms (as this work) is that context, people, researchers are not assumed as interchangeable, but as channels to access or to generate a deep or systematic knowledge of a specific phenomenon. Therefore, **the goal of the case study research under non-positivist paradigms** is not establishing an objective truth always valid, but **identifying reasons and connections among different factors in a specific context and critically reflecting on how they could be transferred in other contexts** [Schwartz-Shea & Yanow 2013].

Indeed, the key mission for the researcher engaged in case study research is moving beyond observable facts through analytic procedures for distinguishing between what is specific of the case study context and what can be reasonably considered as invariant to the context. As a consequence, the impossible **replicability of a case study is not an issue in not-positivist research**. The central point is eventually to investigate how the invariants identified in a case study research recur in other settings, or the reasons they do not. The point is never enabling other researchers to recreate the same conditions that lead to the findings of the previous study, simply because the mix of people and contextual factors are historically and geographically overdetermined and not replicable.

In this work, I decided to investigate multiple case studies to progressively cover the various aspects of the base models concerning users' representation, city systems and forms of support provided by technology in urban actions [see Chapter 5] and to explore the implications of putting a City-Mirror-in-the-making in different contexts. The **robustness or replicability of findings does not come from the recurrence of the same observations and facts in each case study, but from the stability of invariants emerging from the application of the analytical lens constituted by the base models along the research process.**

The intent of having three case studies was not to provide a comparative analysis among different and incomparable platforms and design processes. Indeed, each platform as a design product is unique by definition [Stolterman xx], but also the people involved in each design process brought their unique perspective on urban activities and technology. However, as regarding the prototypes as design products, the study of invariants focused on the components of the prototypes that also characterise general classes of urban/city technologies such as location-based social networking sites, engagement platforms, and data portals. As regarding the engagement of local stakeholders into the design process, the analysis focused on identifying recurrent patterns and invariants in reference to the type of activities, type of actors involved in each project or initiative, the nature and structure of their relationships, the expected forms of technology support. The analysis both of the platforms and the instances brought by the participants in the study do not focus on contingencies, that are the aspects that can hardly be replicated.

6.3.2.b. Discussing the generalisability of findings from case studies

To describe the balance between the specificity and generalisability of findings in case study research, it is useful to refer to the classification of case studies formulated by Stake [Stake 1995]. He divides case studies into three groups: **intrinsic, instrumental and collective case studies**. They are respectively focused on:

- the specificity of the context under study
- the potentiality of the case study to explore a more general category of subjects and objects
- the opportunity to investigate phenomena at a higher level by linking data from different sources.

Instrumental and collective case studies, differently from intrinsic case studies, support a wider generalisation of findings.

According to Stake, my three case studies are intrinsic as regarding the development of a specific prototype, but at the same time are instrumental and collective case studies. Indeed, each platform belongs to a more general class of technologies, and the applicative scenarios for such technologies defined by the participants in the study cover typical and recurrent city dynamics. In the next chapters, after briefly reporting the specific characteristics of each prototype (considering it as an intrinsic case study), I will focus on the contribution of each case study as instrumental for understanding the implications of design choices into the design process and as collective tool for investigating the relationship between users, city and technology [see Chapter 6, 7, 8].

For the generalisation of findings, I applied three procedures considered in literature as reliable ways to generalise findings coming from case studies. To this purpose, several methodological studies include:

- using **multiple sources of evidence** during the data collection to triangulate the empirical results [Yin 1984, Yin 2009, Yin 2014,]
- focusing on **pattern-matching** across different case studies [Campbell 1975]
- searching for **external confirmation in previous theories** through abductive reasoning [Schwartz-Shea & Yanow 2013].

During the development of the case studies, I iteratively applied these three procedures, by using direct and indirect sources to gather information related to my case studies [see Sections 6.6], adopting an abductive logic to interpret the empirical findings under the light of consolidated knowledge and new elements [see

Section 6.2], and focusing on studying the relationships among the components of the base models in real settings for identifying stable and recurrent patterns [see next Chapters 7, 8, 9].

In reference to the **final goal of the work that is developing a theory based on the findings coming from the case studies**, supporting arguments can be found in the methodological studies of Yin [1984] and Hamel et al [1993]. They specify that the generalisability of findings in case study research rely on the theory to be formulated "rather than on population" examined during the field work. In other words, **the validity of a theory based on case studies depends on the correspondence between the appropriateness of data collected through research process based on the case studies and the level of detail, granularity of concepts and epistemology of the theory in itself.** Moreover, as widely recognised in literature [Eckstein 1975, Doak et Mills 1994, Rueschemeyer 2003, George and Bennett 2005, Levy and Goertz 2007], theories relying on case studies aspire to extract the meaning from data and outline the implications of the observed phenomena, not to describe a phenomenon in naturalistic terms. As expressed by Steinberg, the *"logic of generalisation is founded on an understanding of the relationship (including the degree of similarity, or unit homogeneity) between that which is measured and the larger class of phenomena to which it belongs".* [Steinberg 2015]. He continues specifying that is the prior knowledge of the researcher on the topics investigated through the case studies that allow him/her to infer much more information from a specific element then the factual data extractable from it.

As made explicit in the previous chapters, the theory presented in Chapter 10 is intended to provide an analytic, design and evaluation framework for web-based technologies aimed to create a multi-stakeholder, multi-purpose and multi-scale environment, according to a pragmatic epistemology. It is not intended to be a general descriptive model of city dynamics or a general theory of interactive systems. The granularity of the concepts described in the theory refers to macro-systems outlining at a high level the interactions between users, city and technology. The clusters of system requirements and evaluation criteria refer to the macro-components usually composing web platforms with urban applications, such as map-based interface, or user profile management features.

6.4 RESEARCH APPROACH: MULTI-METHOD

In the previous section, I mentioned as one of the primary aims of a research strategy based on case studies is to conduct an in-depth analysis of a research problem in a specific context that can reveal interesting elements about a topic, and to involve participants in the research in generating the required information [Stake, 2006; Merriam, 2009; Simons, 2009; Flyvbjerg, 2011; Yin, 2014]. According to this aim, **the use of multiple research methods is recommended as a way to have a comprehensive view on topic, context, and meaning of results coming from the cases studies** [Stake 2006; Merriam 2009; Flyvbjerg 2011; Yin 2014].

Considering also this recommendation, the research approach followed in this work is a **multi-method research approach** based on the **combination of design, interpretive and qualitative methods**[6].

[6] In the following sections and chapters, I keep referring to the expression "research methods" accordingly to the working definition given in section 6.2 and to the classification in qualitative, interpretative, or design methods as specific labels grouping a plurality of methods belonging to the same system of inquiry.

6.4.1 MIXED OR MULTIPLE RESEARCH METHODS: DIFFERENCES AND RATIONALE OF THE CHOSEN RESEARCH APPROACH

Before going into the detail of the selected research methods, I am going to disambiguate the expressions *mixed methods* and *multiple methods* to avoid any misunderstanding on their difference and the specificity of the approach following reported. The expression *mixed methods* is almost constantly associated to the combination of qualitative and quantitative methods having different operational and epistemic roles. Differently, a *multi-method* approach relies on a plurality of methods, operationally concurrent and chosen among those epistemically homogeneous [Schwartz-Shea & Yanow 2013].

In the application of mixed methods approaches, qualitative and quantitative methods are usually used in sequence, by applying qualitative methods to outline the essential points of a research problem and then quantitative methods to measure the correlations among different factors in that context. Or viceversa, to explore through qualitative studies the meanings and reasons of findings defined through quantitative methods. It is very frequent that in these studies the qualitative part is subordinate to the quantitative analysis, because they ensure a different level of potential certainty of results. In that cases, the predominance of the positivist epistemology associated to quantitative methods is assumed as superior respect to the pragmatic epistemology associated to qualitative methods [Schwartz-Shea & Yanow 2013].
On the contrary, a multi-methods approach is usually based on the combination of a plurality of methods, that can be both of the same type (quantitative or qualitative) or different (qualitative and interpretive), but applied in parallel in order to reach a rich comprehensive understanding of the research problem at multiple levels or under multiple perspectives [Schwartz-Shea & Yanow 2013]. The selection of these methods and their application is usually contained within a specific epistemic horizon that support their equipollence, while covering potentially different roles in the research process [Fig. 6.8]

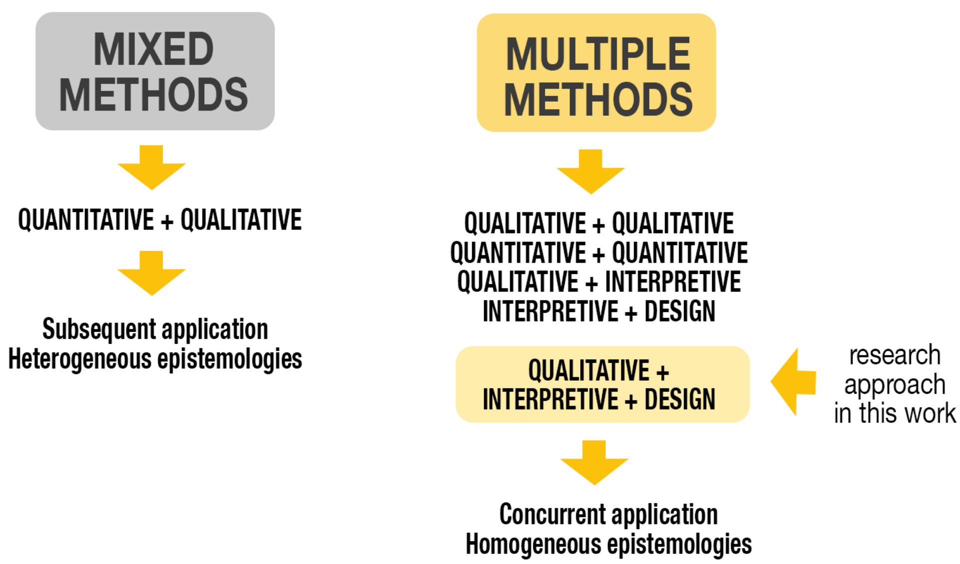


Fig. 6.8 Schema of differences between mixed methods and multiple methods

By defining my research approach as multi-method, I explicitly state that I applied different research methods framed within different systems of inquiry without assuming the predominance of one or another, exploiting instead their strengths and balancing their weaknesses in a coordinated way under a common pragmatic and constructivist epistemology. In particular, what characterise the combination of systems of inquiry differentiate in this thesis is the integration of design methods in addition to more common interpretative and qualitative research methods.

The choice of adopting a multi-method research approach based on the three systems of inquiry of qualitative, interpretive and design methods is motivated by the fact that the empirical and applied research for investigating a deep design problem necessarily relies on the implementation of activities aimed at investigating city dynamics, and at same time defining the instantiation of the city mirror proposal in a prototype. Therefore, I decided to fully exploit these activities to generate knowledge for the contingent purposes of the projects reported as case studies in the next chapters, and then elaborate that knowledge at a higher level for elaborating a theory about the capabilities of city technologies for supporting local development actions.

6.4.2 QUALITATIVE, INTERPRETIVE AND DESIGN METHODS: DIFFERENCES AND COMPLEMENTARITIES

Considering that the labels "Qualitative methods" and "Interpretive methods" are often used interchangeably or merged in literature[7] [Tracy 2012, Schwartz-Shea & Yanow 2013], and that documented uses of Design-driven Methods [Jones 1972] to produce scientific, explicit and transferable knowledge are still not mainstream across the different disciplines considered as roots for this study [see Chapter 2, section 2.2.2], I am going to briefly outline here their fundamental **differences and complementarities concerning what is considered as data and how data are processed for the generation of knowledge**[8], and then how these systems of inquiry are specifically combined in this work.

The term "data" in qualitative, interpretive and design research methods rarely correspond to *"symbols that simply exist and have no significance beyond their existence"* [Ackoff 1989], as for instance numbers or visual signs without a defined meaning. According to the pyramid Data-Information-Knowledge-Wisdom proposed by Ackoff [1989], more frequently these research methods deal with information, knowledge and even wisdom already incorporating meanings, connections, explanations and reflections. External Information, Knowledge and Wisdom (indicated now on as "data*") are used in these research methods to generate new knowledge and understanding of phenomena within the scope of the research. Then, data* include at least chunks of texts as basic units to be considered both as material resources to count and manipulate or as traces of meanings to be analysed. More frequently, data* in qualitative, interpretive and design-driven research methods include structured sets of information reporting, for instance, description of facts and phenomena, specific perspectives on a topic, stories, documental traces, artefacts, and so on.

[7] Schwartz-Shea & Yanow [2013] explain this fact by referring to the dominant dichotomy between quantitative and qualitative research methods, and then they distinguish between qualitative-positivist methods and qualitative-interpretive methods, having different scope and epistemology. Tracy [2012] do not distinguish between qualitative and interpretative research methods, but consider the possibility of having different forms of qualitative methods under different paradigm (positivist, post-positivist, constructivist, critical, post-structuralist). In this thesis, I did not used qualitative methods under a positivist epistemology, as already stated in Chapter 2, section 2.6.

[8] Discussing the general characteristics of qualitative, interpretive, and design methods is out of the scope of this chapter. Extensive descriptions, analysis and example can be found in: e.g. Tracy S.J. 2012 (qualitative), Schwartz-Shea & Yanow 2013 (interpretive), John Christopher 1972 (design).

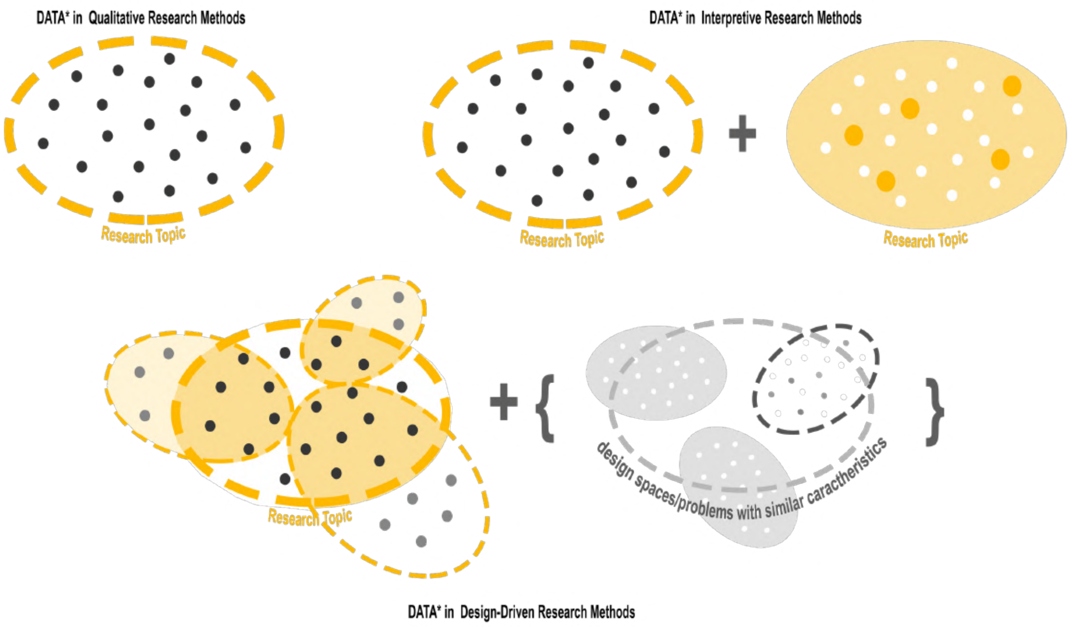


Fig. 6.9 Schema of what is considered as data in qualitative, interpretive and design methods*

The key difference between qualitative and interpretive methods concerning what is considered as data* is that, in the first case, data* include everything is traced in the documental sources collected for the study, while in the second case data* include also what is not traced in the sources, such as the reflections of the researcher about an observed phenomenon or dynamics, the annotation of the collected materials concerning context and situation to which they related, but also complementary sources helping to explain the absence of certain elements in the materials or the study. Similarly to interpretive methods, design-driven research methods consider as data* everything is within the sources for the study or complementing them, but also additional sources analogically related to the study and helping to frame a situation, problem or solutions in relation to different situations, problems or solutions having some elements in common with the one under investigation [see Fig. 6.9].

The analysis and elaboration of data* to generate new knowledge follows different paths in the three systems of inquiry defining my research approach. Qualitative and interpretative research methods are both oriented to elaborate a deep understanding of a phenomenon through *thick contextual descriptions* of empirical observations and then, in a few cases, developing theoretical contributions [Tracy 2012]. However, the core activity of qualitative methods is classifying and thematising data* accordingly to distinct preferential directions or aspects of a phenomenon. Differently, interpretive methods are oriented to reconstructing the net of relations and connections among data*, within and across the various aspects of a phenomenon, on the basis of pre-existing theories or connecting the elements of emerging theory through reasoning-based processes. From another perspective, design-driven research methods focus instead on ordering data* and connections among data*, selecting them by the relevance for the study, and then defining the boundaries of the operational space for intervening on a phenomenon as result of the grid of constraints and degree of freedom emerging from the analysis [see Fig. 6.10, 6.11].

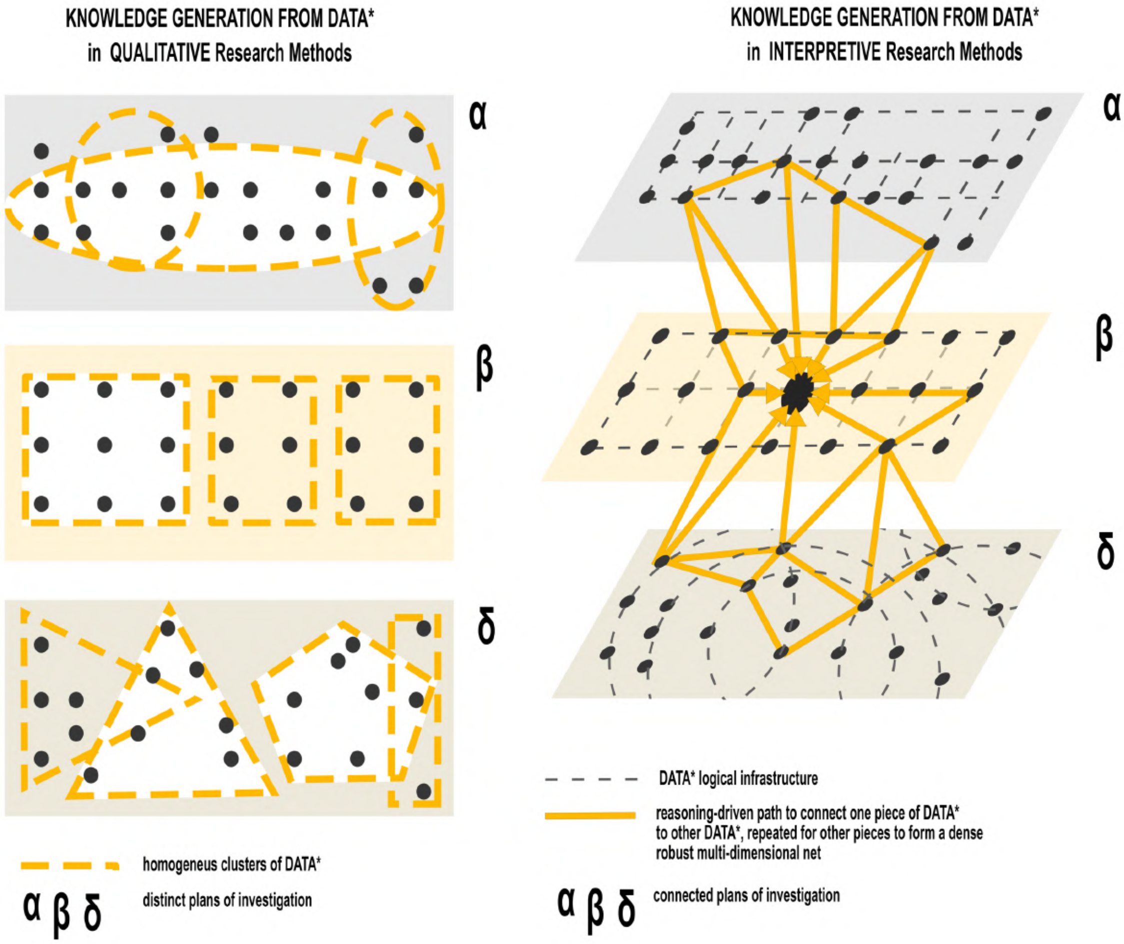


Fig. 6.10 Schema of how data are processed in qualitative and interpretive methods to generate knowledge*

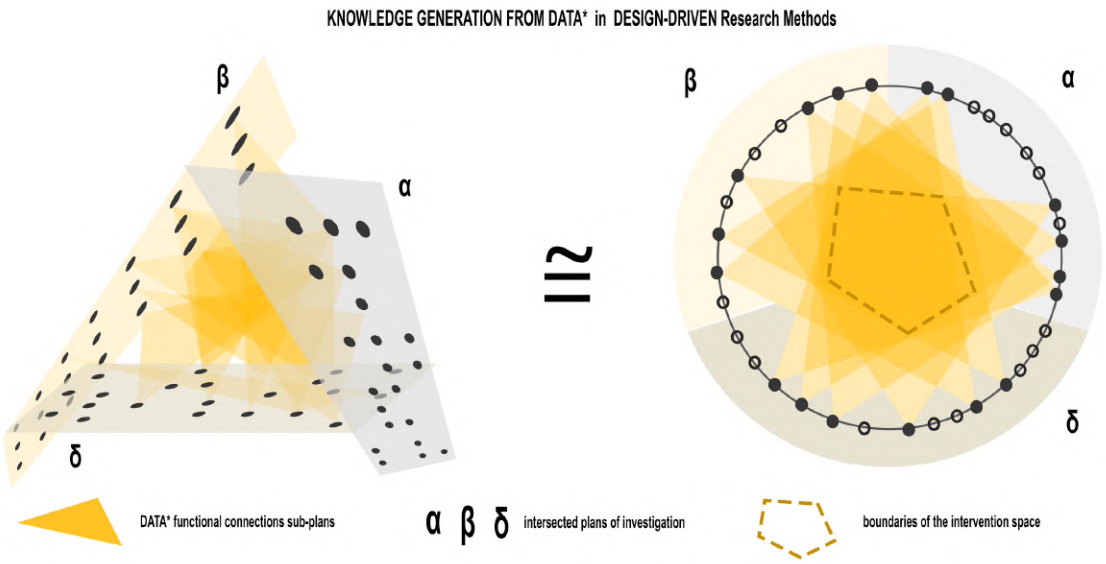


Fig. 6.11 Schema of how data are processed in design-driven research methods to generate knowledge*

These three systems of inquiry are combined in this work to structure the activities of data collection and analysis related to each research method chosen to implement the research, as it will be explained in the next sections. Here, I anticipate that:

- **Qualitative methods** for data* collection had been used throughout the entire research process including interviews and contextual enquiries, documents and contents collection, community-based activities such as group meetings and discussions, and so on. Qualitative methods for data* analysis had been mainly used to **breakdown and cluster the significant elements observed through field and design activities and to define a general schema for reasoning on the emerging patterns at higher level.**
- **Interpretive methods** had been used to deepen and integrate the sources and analysis outlined by using qualitative methods, **working on details and to build the skeleton for scaffolding and incorporating insights and findings generated by using design methods**.
- **Design-driven research methods** had been instrumentally used for the **data* generation** to inform both qualitative and interpretative analysis, and on the other side **incorporate in the design process the inputs coming from the on-going analysis or to make them transferable across different situations, contexts, applications**.

In synthesis, the choice of combining different systems of inquiry allow me to thematically analyse the materials collected on the field (qualitative methods), but also explain meanings and reasons for phenomena studied by introducing a new "object" in the environment (interpretive methods) and iteratively defining the boundaries of the operational spaces for this intervention by looking at the context and at the lesson learned in the process (design methods).

The application of qualitative, interpretive and design methods and the combination of two or more of them is a common research practice into the fields indicated as main disciplinary roots of this work, furtherly supporting the choice of a multi-method research approach that could seem apparently unusual[9].

6.4.3 INTRODUCTION TO THE SELECTED METHODS

The clarification on the systems of inquiry that lead this work facilitates the understanding of the research methods described in this section.

The multi-method approach adopted in the development of my study is based on the following four research methods:

- *Research for Design* indicated as Design Research (DR)
- Research through Design[10] (RtD)
- Action Research (AR)
- Grounded Theory (GT).

[9] As a very general heuristic, we can say that qualitative or/and interpretive methods are often intertwined with design methods in Urban Informatics, Information Systems and Urban Design because of the importance of specific artefacts to generate new knowledge, internal or external to the design process in itself. Social and Community Informatics, as well as Urban Planning and Urban Studies, tend instead to rely on qualitative or interpretive methods respectively for empirical and theoretical works, but the boundaries among the two paths are very blurred in many cases. Interpretive methods are considered the core of CSCW studies and combined with qualitative methods but always oriented to design purposes, and a similar schema is apparently emerging also in the design branch of Human Computer Interaction research while not yet consolidated.

[10] Research through Design is mentioned in urban disciplines as "Research by Design". In this thesis, I refer to the expression "Research through Design" also as synonym of Research by Design, always referring to design-driven research.

These methods, selected as appropriate for investigating the research and design problem of City Mirrors, are also characterised by the fact of being **established and recognised both in informatics and urban disciplines**. Therefore, the fact that they are defined and applied in these disciplinary domains motivated my choice of relying on them and facilitated the development of the **transdisciplinary strategy of the "Integration through Methods"** (see section 1.4.2).

After a short introduction providing the definitions and essential characteristics of the selected methods based on the literature and their positioning in the main domains covering this study[11], I am going to specify how and why these methods had been integrated into my research. Then, after the introduction to the case studies in section 5.3, I explain how these methods had been applied in each case study and for the cross-case analysis in section 6.6.

Action research is a set of *"self-consciously collaborative and democratic strategies for generating knowledge and designing action in which trained experts in social and other forms of research and local stakeholders work together"* [Greenwood & Levin 2006]. The main aims of Action Research are generating valid social knowledge, from an academic perspective, and contributing to outline direction for a change, from the perspective of involved stakeholders. After the definition of a problem to be addressed accordingly to the framing of the stakeholders involved in the research, the generation of knowledge to set the basis for addressing the problem or discovering more element on the problem follows cycles of **planning of alternative actions**, **implementation of actions** (factual or conceptual or simulated), **observation and description of the effects** and implication of the implemented actions, and lastly **reflection and assessment** of the value, feasibility, validity, or even desirability of the envisioned change [see also Bradbury 2015].

Grounded Theory methods are conventionally considered as a set of procedures to orient the analysis and collection of data for exploring a new domain, new practices, or other phenomena that are not yet formalised into descriptive or explanatory theories [Glaser & Strauss 1997]. However, Grounded Theory methods should be more correctly intended, not a series of steps to be followed, but as *"a way of thinking about data"* [Charmaz 2006]. The tension between codification of these methods and principles defining its nature led to the development of several different versions of Grounded Theory methods, from the ones trying to fit under positivist epistemology and posing attention to procedural details, to the ones emphasising its value to guide a systemic and rigorous analysis of data while carried out in a fluid manner. Other versions postulate the need of using external theory only in the final phase of "validation" of the developed theory, in contraposition with the ones highlighting the importance of building on the consolidated knowledge to generate new contextualised knowledge [Charmaz 2006]. At a general level, Grounded Theory methods indicate the process for a progressive refinement of the axes or categories or dimensions needed to explain or describe a phenomenon, by proceeding from an "open coding" of the collected material, to the clustering of codes and categories governed by a general principle or under a macro-theme through an "axial coding", to end with the selection of the a limited set of aspects, dimensions and categories that can be outlined in their facets and properties by relying on the consolidation (or "saturation") of the elements grouped in the axial codes, and the related instantiation that can be traced back to the units initially considered in the open coding [Bryant & Charmaz 2007]. It is important to mention that Grounded Theory methods can be adapted both to qualitative or interpretive system of inquiry by deciding to include factual evidences only or also not-traditional data coming from the on-field observations and notes of the researcher (usually called "memos").

[To add: design research and research through design]

[11] Supporting evidence from the literature to show that these methods are used in the discipline selected as roots for the study and how they are usually applied will be integrated in the revised version of this draft because of time constraints for the submission. A better framing in the literature will be provided for the next section as well in relation to the combinations of the various methods.

6.4.4. INTEGRATION SCHEMA OF THE RESEARCH METHODS

The choice of relying on four research methods can seem unusual. However, the selected research methods are expression of practices commonly associated and integrated both in the domains of informatics and urban disciplines dealing with the design of new artefacts, whether they are urban plans or interactive systems. Two examples can help in clarifying this statement.

When a planner or an urban designer approach the development of a new plan or project (or even policy and urban process), one of the first steps is usually the analysis and comparisons with other instruments and solutions already available or implemented in the same context or in different settings, to understand their limits and potentialities and to what extent they can be transferred in the new output to be produced. The development of this output (plan or project) can follow experimental paths, iterative cycles, and often requires the definition of new methods, tools and processes to reach the intended results (Design Research). Progressive and radical practices in planning are aware of the importance and practical relevance of grounding these solutions on the deep understanding of the context through the view and perspectives of the interested parties operating in the areas where planners are going to intervene. This awareness frequently leads to activate real engagement processes with the relevant social forces following also unusual and informal paths, or completely codified in other cases (e.g. "Conferenza dei Servizi" in the Italian context). This engagement (often moving completely in parallel to more superficial and marginal participatory processes opened to the wide public) are explicitly aimed at identifying the main problems to be addressed, but also elaborating feasible action plans or defining their boundaries, or critically reflecting on the risks of their implementation for their revision (Action Research). The gradual development of the solutions used as an object of discussion and reflection in these settings help to highlight new issues and alternatives, otherwise hidden, and construct a common ground among the participants, but a more robust and objective knowledge to use as the basis for the development of the plan or project (Research through Design). The experience gained project after project, and plan after plan, integrated with an increasing knowledge coming from the comparison between direct and indirect insights stratified over time, can lead the planner or urban designer to formulate a set of principles, sub-principles, guidelines, theories to be instantiated case by case as conceptual infrastructure for future projects (Grounded Theory).

A similar articulation between practice and knowledge generation can also be outlined in the case of technology designers, perhaps working on specific classes of technologies or applicative domains, by integrating into their activities responsive and attentive forms of engagement of prospective users and relevant stakeholders, progressively reflecting and conceptualising the outcomes of these experiences in stratified forms.

In this work, I tried to rationalise this natural integration process between Design Research, Action Research, Research through Design, Grounded Theory, that often remains largely implicit or not structured in practice[12]. In this way, I made explicit the contribution of each research method to the advancement of the research and the generation of knowledge to address the Recomposing Problem.

[12] As mentioned also in Chapter 2, the gap between the kind of knowledge generation associated with the practice of planning and urban design and the kind of knowledge generated in academic context within the related disciplines is particularly deep. In the second case, in the net majority of academic sub-communities (except for the one of planning theory), methods borrowed from social sciences are predominant if not exclusive. This is simply due to the professionalization of the academic activities and the standardization of the kind of knowledge produced in these domains on the basis of historical contingencies that led the internal codification of these disciplines in the Anglo-Saxon context (where they are strongly tied to geography and sociology) to become predominant also in other contexts where no strict codification had been produced. Differently, in other contexts including Italy, France, Spain, Poland and others, urban disciplines are closer to architecture and design disciplines (and grounded on humanities at large, especially history and philosophy). The resulting knowledge generation from applied experiences in these contexts tends to be primarily oriented to address social forces at large, but not necessarily closed academic communities. Thus, the level of

The integration of these research methods is schematised in Fig. 6.12. On the left, we can see Design Research and Research through Design methods, and on the right Action Research and Grounded Theory. DR and RtD provided complementary perspectives on the prototypes of the case studies, respectively focused on the design of artefacts and on the interpretation of the design choices in the context. AR and GT are consolidated qualitative methods, that can also be used as interpretive systems of inquiry as done in this work. These four methods had been frequently connected two by two into the research process because the outputs of one method informed the inputs coming from the others in a dynamic cycle.

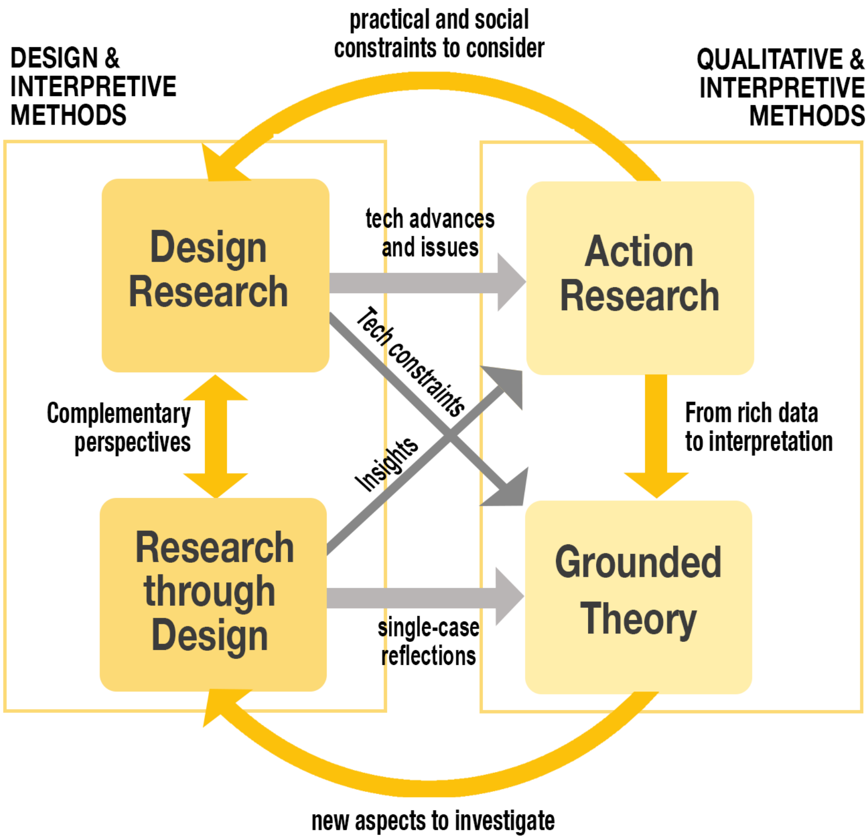


Fig. 6.12 Schema of the integration of the research methods

6.4.4.a. Design Research and Research through Design

Design Research and Research through Design methods had been combined during the entire research process relying on their **complementary perspective and role**. In Design Research, the knowledge gained during the preliminary research and the design process is functional to develop specific solutions for the artefact to be produced. In the Research through Design, knowledge is generated by using design products (ranging from prototypes, concepts, virtual materials, multimedia) as an explorative means to enlighten underexplored phenomena, contexts, dynamics.

codification is lower and not necessarily expressed in academic production [see Biraghi 2019 for an extensive overview of this phenomenon in the last century]. This does not imply the non-existence of such knowledge connecting design interventions and planning operations in a reflexive way, but only its dissemination in other forms within and outside the academic context. Notable example are: Gregotti & Eco 1966, Benevolo 2011, Secchi 2013, Gregotti 2013, all in Italian and, interestingly, translated in other languages that do not include English.

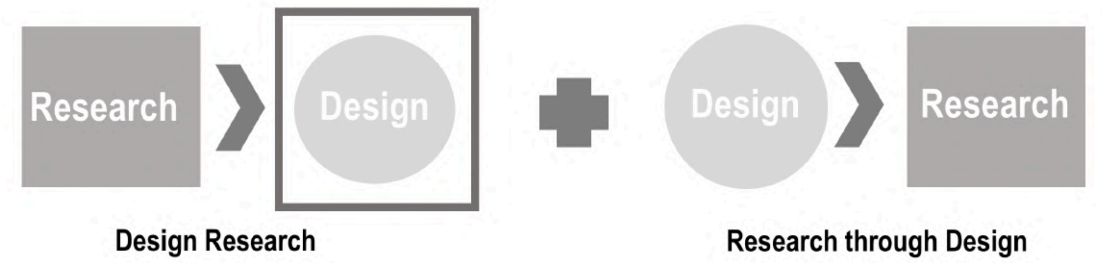


Fig. 6.13 Schema of the relation between Research and Design in DR and RtD

6.4.4.b. Design Research and Action Research

Design Research and Action Research had been associated during the design process of the three case studies by using participatory techniques and constantly refocusing the process on the priorities and needs of the participants in the study. A wide range of city stakeholders had been involved in the elaboration of applicative scenarios and system requirements for the three prototypes by reflecting on needs, activities, and real issues that could benefit of the technological support of a multi-stakeholder, multi-purpose and multi-scale platform. **The exploratory nature of these design processes led to identify a series of design problems to be faced and solutions to test in real-world settings. At the same time, new applicative scenarios outlined new practical and social constraints to consider for experimenting new solutions in real world-settings**.

6.4.4.c. Action Research and Grounded Theory

Action Research and Grounded Theory had been associated by considering the experiences, lessons learned, and applicative scenarios elaborated with the participation of city stakeholders in the research and design processes of City Mirrors as the corpus of materials to be iteratively processes by using Grounded Theory methods.

6.4.4.d. Research through Design and Grounded Theory

Research Through Design and Grounded Theory methods had been associated because the critical analysis and reflections about the elements coming from the design process of each prototype are then progressively stratified, assessed, systematised and refined to cover the six axis of the theory on the City Mirror capabilities as final output of the research. Relying on the research questions and the core models presented in Chapter 5, the analysis of each design instantiation of a City Mirror focused specifically on the interdependences between user representations, city actions, and role of technology along the axis constituted by the physical, functional, and social systems of the city, as well as the disconnection zones linked to values, relationships, and local resources. The application of Grounded Theory methods allowed to further elaborate the insights developed during the activities of each case study through a cross analysis of the three case studies. The cross-case analysis helped to identify general concepts, high-level requirements and evaluation criteria to support the design and adoption of city technologies. Conversely, the progressive clarification of the concepts included in the theory ("saturation", see section 6.4) oriented the exploration, information generation, and analysis along the development of the single case studies.

6.4.4.e. Transversal Connections

There are also transversal connections among DR and GT, as well as between RtD and the AR. Research on the actual development processes of information technologies trying to instantiate the City Mirror proposal provided a realistic account of the technical constraints to be considered for reasoning on the capabilities of such technologies (DR and GT). At the same time, the reflections accompanying the design process provided insights for better understanding the context of actions and dynamics of engagement activities, as well as the patterns behind new applicative scenarios raising from city activities (RtD and AR).

6.4.4.f. Problem-centred and process-oriented research methods

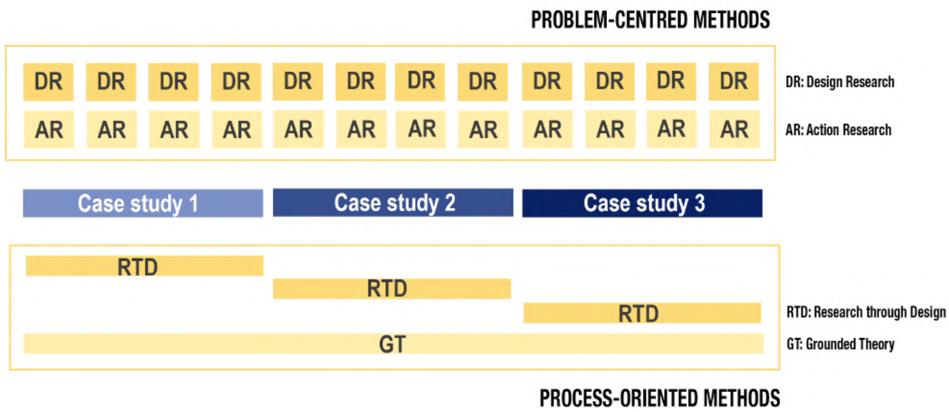


Fig. 6.14 Schema of the combination between problem-centred and process-oriented methods

Another significant element characterising the combination of these specific methods in my study is the **complementarity between problem-centred and process-oriented methods**, as illustrated in Fig. 6.14

Design Research and Action Research are both problem-centred, in the sense that the investigation originates always from a specific contingent problem. In this work, Design Research methods covered a sequence of problems in each case study related to different aspects of the prototypes and to different social formations involved into their design process. The advances in the design or development of the prototypes had been evaluated against the applicative scenarios coming from the engagement of potential users of that technologies, but the same time, it relied on users' inputs for identifying practical and social constraints to be considered in the design gathered through Action Research methods. This association of Design Research and Action Research enabled the formulation of socially robust answers to the research questions regarding structure and constraints of the design process of city technologies.

Research Through Design and Grounded Theory methods are instead both process-oriented, in the sense that they accompanied the entire research and design process, iteratively constructing and refining the analysis at the level of the single case study and for the development of the grounded theory. Therefore, the application of these two methods allowed me to create a unifying path along the research process, despite the contingencies and specificity of the problems faced through Design and Action Research.

In section 6.6, the application of these four methods is explained in detail by specifying their role and the prevalent techniques used in each case study and for the cross-case analysis. But first, it is necessary to get familiar with the nature of the case studies and their characteristics.

6.5 CONSTRUCTION OF THE CASE STUDIES

As introduced in Section 6.2, the research strategy for understanding how to design a City Mirror is based on three case studies. Each case study represents one possible instantiations of the City Mirror proposal, as a web platform designed to support multi-stakeholder dynamics, multiple purposes within urban actions and processes, and multiple scales as regarding the implementation of local activities.

This section introduces the case studies by specifying how they had been defined in relation to the research questions and the design process to which they are associated with. Each case study will be then examined in detail in a dedicated chapter [see Chapters 7, 8, 9].

6.5.1 INTRODUCTION TO THE CASE STUDIES

Case study 1 reports on the design process of **FirstLife**, a civic social network developed and tested mainly in the City of Turin, Italy. Its scope was to create a new type of social network aimed to support civic activities, public participation, co-production of services by enhancing spatial interactions among users, especially proximity interactions, such as at the neighbourhood scale. This principle had been translated into the design of a platform in which the main interface and way to access to contents was through the map, a spatial representation of users' activities, traced by the user-generated contents they create on the platform. The ambition of FirstLife as civic social network was to find a way for breaking the mechanisms fostered by global online social networks (e.g. Facebook), such as the extended user profiling for commercial purposes, the segregation of like-minded users (filter bubble phenomenon), or the engagement-for-engagement (social network addiction). On the contrary, FirstLife wanted to enhance diversity and plurality of interactions as they happen in real life and contribute to the active use of a digital tool for implementing concrete social innovation and local development actions in the city. In doing so, the design process moved into an unexplored domain in which meanings and practices were to be established on different logics that the existing mass social networks, and these logics required to be discovered. In this sense, the prototype of FirstLife had been used as a research tool for investigating how to design a positive and constructive social network environment by discussing alternatives, solutions, and barriers with people and working together on a tool evolving on the basis of new needs and applicative scenarios. Thus, **I refer to the design process of FirstLife as a "crafting process" because it was driven by an experimental attitude in iteratively producing, assessing, transforming the platform in itself as a material object, and continuously evolving as regarding the relationship between design team and stakeholders involved into the process.**

Case study 2 had been developed within the project of **WeGovNow**, a platform for supporting cooperative governance processes in the city. Its scope was moving from the paradigm of the e-gov to the one of the we-gov. In other words, from using technology to intermediate the relationship between Public Administration and Citizens, to use technology for building new cooperative relationships between public and private actors to improve the local governance. The proposal of WeGovNow was to implement this paradigm shift by integrating into a unified platform a set of digital tools already existing, such as a deliberative platform, a community mapping tool, a reporting application, a crowd-mapping system, and test the new unified platform in two Italian cities (Turin and San Dona' di Piave) and London, UK (Borough of Southwark). The main challenge of designing WeGovNow as a cooperative governance platform was not just to work on technology, but outlining new governance models through the use of technology. Working on existing platforms for new purposes and new applicative scenarios deeply questioned assumptions and logics under their design, pointing toward alternative solutions and meanings of the available functionalities. At the same time, working on defining new governance models and cooperative services by using technology as a frame helped the partners involved in the process in building a greater awareness of the political, social, and practical implications of design choices. Considering this context, **I refer to the design process of WeGovNow as an "assembling process" because the space for elaborating new solutions for an alternative urban governance relied exactly on the way in which each single components was wedge with others, but also on the harmonization of heterogeneous aspects of institutional roles, urban problems and governance orientations in different cities called to use the same platform.**

Case study 3 documents and analyses the proposal of refactoring MK:Insight, the Open Data portal of the City of Milton Keynes (UK). The main goal of the design process of MK:Insight2X was to overcome the underuse of the existing platform by outlining new design solutions to transform the data portal into a tool effectively addressing the needs of different stakeholders operating in the city. The limited use of Open Data portals is a well-known problem affecting this typology of technology (not only the Milton Keynes data portal), and it is becoming more critical at urban scale where the public discourse tends to associate the availability of data to the starting of local development processes driven by public organisations and businesses. At the same time, tensions between cities framed as "data machines" and issues about the redistribution of the benefits related to the production of data are increasing all over the world. In order to address this mismatch between increasing requests of data publicly available and the limited use of existing Open Data, the redesign process of MK:Insight2X started from rethinking the components of an Open Data portal, revealing assumptions and practices embodied or hidden in its functioning, or simply not covered by the current functionalities of Open Data Portal. This process had been grounded also on the idea that an Open Data portal requires to be "open" to the needs and practices of people that could make a positive use of data in the activities they implement into the city. The exploration of new functional configurations and data practices for local development actions ended up into the elaboration of a proof of concept as final output. **I refer to the design process of MK:Insight2X as a "refactoring process" because the technology of the open data portal, as well as the process of production and use of Open Data in the city, have been analysed and decomposed in their essential components with the aim of outlining how to reconfigure them accordingly to new meanings, applications, and visions.**

As specified in section 6.2, these three case studies have in common the fact of being centred on web-based technologies specifically oriented to support a variety of stakeholders in city activities at different scales, and therefore consistent with the City Mirror proposal in their aims. The development and analysis of the three case studies had been driven by the goal of laying the groundwork for answering the high-level research questions driving this research:

> *RQ_A: How to translate the interdependence between people, their local actions and the city context into the design of web-based technologies?*

> *RQ_B: How to structure the design process of web-based technologies for orchestrating the plurality of interests, goals, activities and settings of local development processes?*

In the next two sections, I am going to explain the rationale for constructing the case studies to address these two research questions.

6.5.2 CASE STUDIES AND INSTANTIATIONS OF THE CORE MODELS OF THE CITY MIRROR PROPOSAL

In Chapter 5, I presented how the three facets of the Recomposing problem had been analysed by critically approaching the literature to elaborate the three core models concerning the:

- representation of users in multi-level social structures
- modelling of city activities accordingly to the structure of urban systems and to an ecological vision of their interdependence focused on the infrasystems
- definition of the role of technology in relation to coordinative, cooperative and collaborative dynamics.

These three models had been elaborated to provide the conceptual foundations for investigating the implications of the City Mirror proposal as a research and design problem. However, **approaching the design of a City-Mirror-like platform in a manageable way requires to focus on a subset of the layers outlined by the three base models** at the time.

Each case study covers a specific combination of layers and elements of the core models concurring to define the intended targets of the platform to be designed (as user layers), its scope and functionalities (technology layers), and the applicative domains to be considered (city layers). In this way, accordingly also to the TIDS research protocol applied for structuring my research process [see Chapter 2, section 2.4], **each case study can be seen as an alternative configuration of the three aspects characterising the Recomposing Problem and the City Mirror proposal** [see Fig 6.15].

The longitudinal **in-depth analysis of each case study** and the transversal analysis **across the three case studies** are then the essential steps to identify recurrent, stable or invariant elements for studying the connections among the three models, and addressing the RQ_A. Indeed, each case study is considered on its own to explore the problem of how to design a City Mirror in the frame of an applied research, but at the same time as means for exploring the interdependence between users, city activities and forms of support provided by web-based technologies. The sum of the three case studies provided a better understanding of the invariants of the problem and worked as one comprehensive stratified case study [see section 6.2.3.b], resulting in a set of concepts, classes of requirements and evaluation criteria for City Mirror-like web technologies [see Chapters 10, 11].

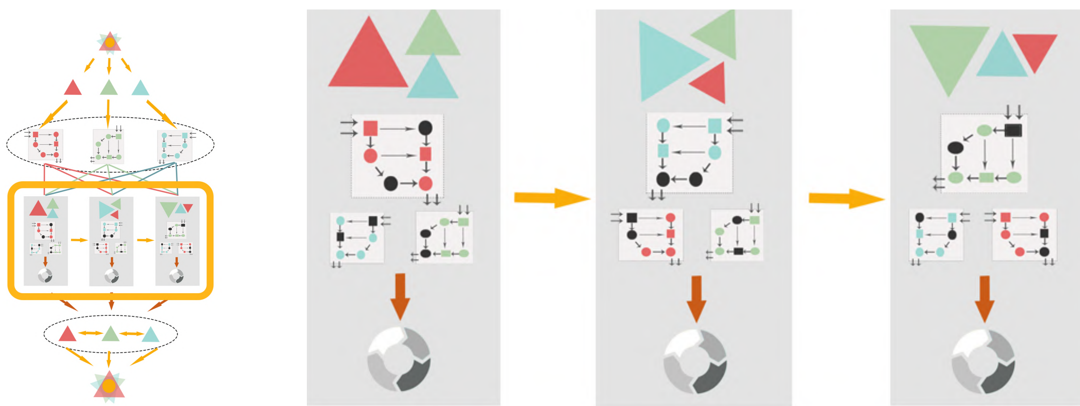


Fig. 6.15 a) Mapping the case studies definition in the TIDS protocol b) zoom of the three different combinations of the base models in the three case studies

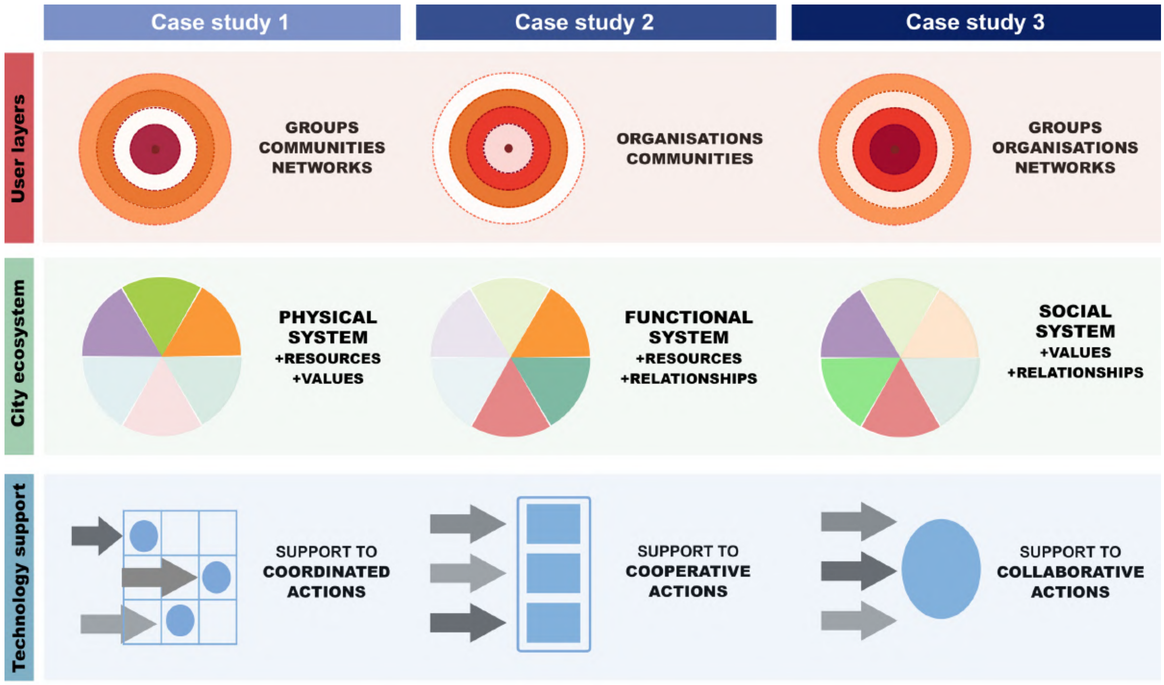


Fig. 6.16 Synoptic view of the case studies respect to the sub-set of core models components and layers

6.5.2.a. Layers of the User Representation

As regarding the social structures examined in Chapter 5, each case study provided the opportunity to deeply investigate different models of interactions among groups, organisations, communities and local networks.

The first case study, as a civic social network, allowed to analyse the needs and practices of formal and informal groups, within and aside organisations, operating in a centralised or distributed way in many domains and at multiple scales. At the same time, most of the initiatives followed and supported during the design process of the platform enlightened the recurrent elements across a wide range of place-based communities and communities of practice, as well as in territorial, professional and personal networks. Several organisations have been involved in the experimentation of the prototypes, but usually only through dedicated groups.

The second case study, concerning new technology-supported governance models in the city, necessarily entailed the close relationships with public, private and non-profit organisations involved in local processes allowing to outline their instances across a multiplicity of settings and contexts. At the same time, it provided insights on the definition of communities and their agencies in the different settings and contexts, as well as details on the dynamics between organisations and communities. Groups and networks across organisations and communities had been identified, but their relevance was limited in the city dynamics analysed in relation to the platform scope.

The third case study, focused on the mechanisms of data production and use in the city, provided the opportunities to analyse the dynamics within formal and informal networks composed by multiple stakeholders, but also the roles and operations of groups and organisations working in association with these networks. Communities (especially place-based communities) remained in this case a sort of background target, always present, but not directly involved in the analysed dynamics.

The constant dialogue and joint work with several groups, organisations, communities and networks provided the elements for answering the *RQ1: What users characteristics should be represented on a City Mirror for offering at the local stakeholders a better understanding of the social context in which they operate?*

6.5.2.b. City Ecosystem

As regarding the insights on the dynamics within and across the systems and infrasystems of the city, each case study provided a wide overview of their ecological functioning across a variety of domains and at all city scales. However, the specificity of the types of technologies examined in each case study and their applicative scenarios provided deeper insights on a sub-set of these systems and infrasystems. Indeed, also the progressive construction of the case studies had been driven by the purpose of "covering" all the systems with comparable levels of detail.

The case study of FirstLife was centred on the use of interactive maps, coordination dynamics across multiple units and social structures, and applicative scenarios of city activities going from micro-initiatives to national-level programmes replicated in multiple cities. As a result, it provided the opportunity of focusing the analysis on the actions and interactions within urban settings at different scales, but also the dynamic link between these spatial interactions on one side, and the values driving specific actions in the city or the resources conditioning their implementation strategies.

The case study of WeGovNow focused on the transformative actions over the city oriented to generate new physical resources, create new services, produce new knowledge and institutions through the cooperation among multiple social forces potentially supported by technologies for planning, voting, designing, proposing, reporting, and so on. Thus, this case study rendered a comprehensive picture of several types of processes into the functional system of cities, the influence of the available resources, and the nature of the multi-stakeholder relationships associated with the various processes.

The case study of MK:Insight 2.X deeply enlightened the dependence of the success of data technologies from the composition of the social system in the city and the values driving the mutual relationships among different stakeholders. In this case, as in the previous ones, the analysis of one system or infrasystems cannot be disconnected from the others, but the dynamics related to data generation and use were relatively stable regardless the functional domain or the scale of application of data-driven interventions.

The variety of applicative scenarios and technologies explored across the three case studies helped to formulate a comprehensive answer to the question *RQ2: What factors should be considered for matching the specificity of the city context and the patters of local development actions with the unspecificity of the online environment defined by a City Mirror?*

6.5.2.c. Forms of Technology support

As regarding the type of technology involved in each case study, I specified in section 6.2 that FirstLife is a location-based social networking site, WeGovNow is a city dashboard and MK:Insight2X is an Open Data portal (see Chapter 4 for more details on these typologies). Beyond their typology, each case study provided the opportunity to analyse in depth applications and limitations of different roles of these technologies in city dynamics, in relation to:

- the interactional patterns among users (coexistence, competition, coordination, cooperation, collaboration at different scales)
- the phases traceable in most of local development actions across programmes, projects and services (analysing, planning, designing, implementing, managing, monitoring, assessing).

While all the three platforms dealt with coexistence and competition issues, case study 1 examined in particular the modalities of supporting coordination practices at different scales, case study 2 investigated how to support cross-domain cooperation mechanisms, and case study 3 explored the boundaries of technology-mediated collaboration dynamics among different stakeholders.

Moving from the interactions among users to their actions in the city, each platform was intended to support a subset of the phases mentioned before. FirstLife envisioned a support for discovering and analysing what it was happening in the city, and at the same time help in managing the documentation, organisations and communication of local actions. WeGovNow planned to support the design and implementation of urban transformations, by providing also the tools for monitoring their evolution. MK:Insight2X projected the data portal toward an active support to the planning and design of data-related actions and, at the same time, toward the assessment of the local information needs and the utility of the available data for city stakeholders.

Reflections emerging from the case studies about the potential roles of the prototypes in city dynamics addressed the RQ3: *What type of processes and decisions in local development actions could be adequately supported by a web platform having the characteristics of a City Mirror in comparison with other existing tools?*

To summarise, these different configurations of the City Mirrors core models characterising the three case studies provided the orientations for answering to the research question *"How to reflect the interdependence between users representations, city ecosystem and role of technology in local development actions?"* and related sub-research questions [see Fig. 6.17].

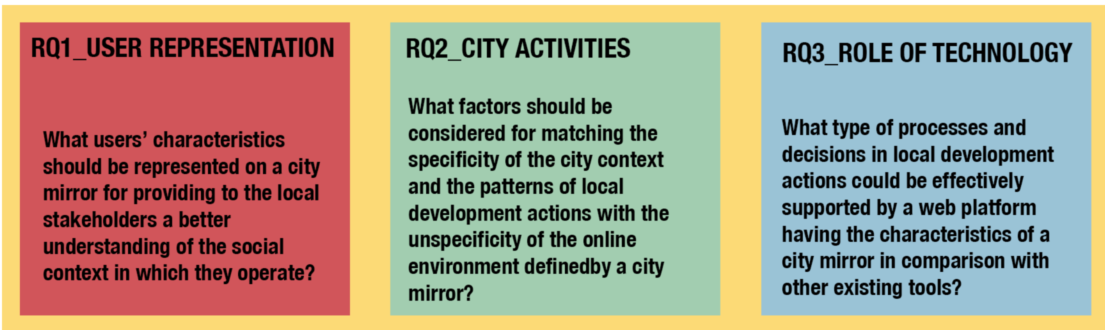


Fig. 6.17 Sub-research questions related to the interdependence among users' representations, city model and role of technology in a City Mirror

6.5.3 CASE STUDIES AND DESIGN PROCESS OF A CITY MIRROR

The composition of the three case studies reflect not only different configurations of the base models, but also the intention of to study the design process of a City Mirror in a complete way. Indeed, one of the major limitations of researches on the design of digital artefacts is: the focus on one only phase of their design process.

As stated by Wulf et alt. [2011], a comprehensive case study exploring the entire design process of a digital artefact should be composed by three phases:

1) the empirical analysis of practices in a specific applicative field, preceding the design phase
2) the design phase resulting in the definition of a new technological artefact
3) the appropriation of the designed technology over a longer period of time in the post-design phase, focused on analysing the impact of certain functions and design options of the new artefact on the pre-existing social practices.

Nevertheless, as noted by Wulf et al., it is hard to cover an entire design process within a single research flow because the timing of projects, funds availability, as well of PhD program deadlines limit resources and opportunities to continue the research for an indefinite time. Therefore, the contingencies of a practice/design-based research usually lead to explore one the tree phases or all of them, but with a different level of detail and priority respect to the design or research focus.

This thesis is not an exception to the issues pointed out by Wulf et al. because of the time, projects and deadline constraints related to the three case studies considered in the applied research. However, I selected and defined the aspects to be investigated through the field activities with the intent to cover in detail at least one of the three phases of a whole design process in each case study. The result is that I had the opportunity of studying the specificities of the three phases, while in different projects.

In the **first case study**, associated to the development of the civic social network FirstLife, the focus is on the **design phase**. As will be further explained in Chapter 6, This kind of technology was intended to explore and anticipate non-existing practices of cooperation and collaboration at City level and the ways a civic technology could support these future practices. Therefore, the pre-design and post-design phases, while reported and connected to the design phase, have a secondary importance compared to analyse and discuss constraints and innovation spaces brought to the forefront by actually implementing this web platform and testing it against real operative settings within the city and in partnership with many stakeholders.

The specificity of the **second case study** is related to assembling already existing e-government technologies (associated to consolidated practices) and extending their potential applications under the light of new social and governance paradigms (see Chapter 7). In this context, the focus of the investigation was on the **post-design and evaluation phase**, trying to explore in-depth the implications of reframing these technologies and existing practices. Similarly to the first case, the other two phases of pre-design and design are carried out and analysed to complement the insights associated to the activities related to the post-design and evaluation phase.

The **third case study** is instead focused on the **pre-design phase** and the analysis of practices and urban processes gravitating around the production and use of city data (see Chapter 8). Indeed, the critical factor in technologies such as the Open Data portals is their very limited use. Therefore, to explore practices and uses of data in city processes is an essential first step for rethinking how to design data portals starting from a deep understanding of the context of technology. The design and anticipation of the post-design phases had been explored within the activities of the third case study to contextualise the findings coming from the pre-design phase within the design flow.

Briefly, the sum of the three case studies cover an entire design process analysing in detail pre-design, design and post-design phases. At the same time, each case study covers internally all three phases with a different level of deepening determined by the specificity of the technology under study (see Fig. 5.10).

	case study 1 FirstLife	case study 2 WeGovNow	case study 3 MK:Insight
PRE-DESIGN PHASE	complementary elements	complementary elements	primary focus
DESIGN PHASE	primary focus	complementary elements	complementary elements
POST-DESIGN PHASE	complementary elements	primary focus	complementary elements

Fig. 6.18 Schema of the primary and secondary focus in the study of the design processes of the three case studies

A synoptic view of the case studies [see Fig. 6.19] helps in highlighting other differences and complementarities across the three case studies. These elements will be detailed following, by grouping them accordingly to the three phases of the design process.

	Crafting a civic social network FirstLife	Assembling an urban governance platform WeGovNow	Building an OPEN city data portal MK:Insight2.X
PRE-DESIGN & CONTEXT ANALYSIS	TURIN and PIEDMONT REGION (IT)	CITY OF TURIN (IT) SAN DONA DI PIAVE (IT) SOUTHWARK (LONDON- UK)	MILTON KEYNES (UK)
	RETHINKING THE FUNCTION OF SOCIAL MEDIA BEYOND THE INDIVIDUAL FOR CIVIC PURPOSES	**RETHINKING EXISTING E-GOV TOOLS AND GOVERNANCE PROCESSES** IN A UNIFIED PLATFORM FOR A COLLABORATIVE GOVERNANCE OF URBAN TRANSFORMATIONS	**RETHINKING THE ROLES OF DATA PRODUCERS AND DATA USERS** RESPECT TO CITY DATA AND DATA-ENABLED URBAN ACTIONS
SYSTEM DESIGN & APPLICATIONS	DESIGN OF A **NEW PLATFORM**	**MIXING OF EXISTING COMPONENTS** IN A NEW PLATFORM	**REFACTORING** OF A PREVIOUS PLATFORM
	PEOPLE-BASED DESIGN PROCESS	**AGENCY-BASED** DESIGN PROCESS	**CHALLENGE-BASED** DESIGN PROCESS
	FOCUS ON **FEATURES** AND **INTERFACES**	FOCUS ON **WORKFLOWS** AND **SERVICES COMPLIANCE**	FOCUS ON **DATA, DATA PRODUCTION** AND **USE OF DATA**
SOCIABILITY EVALUATION &TECH CONSTRAINTS	**INTERNAL EXPERT EVALUATION** BASED ON EXTERNAL ASSESSEMENT	NEGOTIATION **INTERNAL EXPERT** VS **EXTERNAL NOT EXPERT EVALUATION**	**EXTERNAL NOT EXPERT EVALUATION**
	RETROSPECTIVE	**CONTEMPORARY**	**PROJECTIVE**

Fig. 6.19 Synoptic view of the case studies respect to the characteristics of their design processes

6.5.3.a. Context

By looking at the context under analysis in the pre-design phase, we have three different situations as regarding the geographical cover, and the intrinsic constraints of each project as well.

Case study 1, FirstLife, had been developed mainly in the City of Turin, by working actively in different neighbourhoods, districts, as well as in projects and initiatives at urban scale. At the same time, a few partnerships and collaborations extended the applicative scenarios at the Piedmont Region and at a national scale. Therefore, while Turin provided the main context of the research, issues and problems of other cities and regions significantly helped in understanding the generalisability of results emerging from a specific environment such as Turin to other settings in Italy.

Case study 2, WeGovNow, was based on three pilot sites in three cities: San Dona' di Piave, Turin, and London. These three cities, respectively a small, medium and large city, provided interesting inputs for analysing the impact of their size on the expectations from information technology in open governance processes. Moreover, they made essential to face the different sensibilities of two socio-political and cultural contexts such as Italy and the UK. Lastly, the fact that the trial site in London was limited to one borough supported further reflections on the relationship between the metropolitan and the district scale in a global city. At a smaller scale, this dynamic had been studied also in Turin, between the city and the neighbourhood selected for the project interventions.

Case study 3, MK:Insight2.X focused on the city of Milton Keynes, the last of the British new towns. Milton Keynes provides a particular context to explore the topics of this work because of its population, composed mostly by people arrived in the city in different times from other places and constituting a very intercultural fluid environment. In addition, the status of new town historically supported a strong propensity for technological innovation by public and private sectors. However, Milton Keynes is still considered as a satellite of London, and this implies to a set of well-known city dynamics at a regional scale regarding mobility, workforce, and capital distribution (observed in the Piedmont Region and in Italy as well in the case study 1).

Then, it is worth noticing that the inputs coming from the context of Milton Keynes, a city existing from a few decades only, provided also a complementary perspective on urban issues compared to the one of the cities analysed in case study 2, all historical cities. Lastly, the research activities in Milton Keynes contributed in deepening the understanding of the differences and similarities between Italian and British context, considered also in case study 2.

These singular urban settings, as well as the tensions they highlighted between different scales and socio-cultural environments represented a complex test bench during the research process. Moving from the geographical aspects of the research context to the intrinsic constraints associated to each design process, it is important to mention their operational frameworks, agenda, partnerships schema, and proponent's roles.

FirstLife was a project of the "Social Computing research group" at the Department of Computer Science of the University of Turin. The project was carried out by relying on investments and autonomous financial resources of the group, and therefore was not framed into a specific research project with established outputs, deadlines, partnerships. This resulted in a fluid agenda of activities (research, design, development, dissemination) and a variety of partnerships or collaborations at short and medium term with many different actors operating on the territory. The University, as lead of the project, was explicitly intended to implement its *"third mission"*, or rather contributing at the social, cultural, economic development of the territory by operating as a public actor working for the public interest. This openness of the project allowed to reactively respond both at the challenges coming from the development of the FirstLife platform and the new opportunities coming from the active and proactive participation in local initiatives, accordingly also to the issues to be investigated through dedicated research activities.

WeGovNow was a H2020 European Project imposing specific activities, outputs, and deadlines in the framework of established partnerships among the universities, agencies, public administrations and companies in the project consortium. This resulted in a fixed agenda with specific goals and roles for each project partner, with the University of Turin to coordinate the technological implementation of the platform. In this case, the research associated to the case study 2 had been carried out accordingly to the project milestones and work packages, by collaborating with the public administrations involved in the project (2 out of 3), the development team of the Department of Computer Science of the University of Turin, and the other development teams for specific activities.

MK:Insight2.X was contextualised into one strand of research on Smart City of the “Intelligent Systems and Data Science” research group at the Knowledge Media Institute of the Open University, and at the same time, within the long lasting cooperation of that team with the City Council and other organisations in Milton Keynes. This framework allowed a certain flexibility in agenda, goal, output, and deadlines, but limited the spectrum of partners involved in the activities. It is worth noticing that in this framework, the University as entity proposing the project acted similarly to a private consultancy or business, offering vision, expertise, and solutions to third parties as a service. In this sense, this framework reflects the specificity of the British economic and institutional environment.

These **different configurations of the context** in which each example of City-Mirror-in-the-making was supposed to be integrated and the **different operational frameworks** of the three development projects allowed me to consider a wide range of factors to address the research question RQ4: *“What social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?”*

6.5.3.b. System Design

By focusing on the design phase, the three case studies refer to different types of design objectives, engagement forms and priorities.

The objective in Case Study 1 was to design a new platform, in terms of technological components, interactions and functionalities, but also as regarding the platform scope. The design objective of Case study 2 was to harmonise and mix a set of existing platforms by transforming their scope without disrupting their structure. Case study 3 pursued the objective of renovating a pre-existing platform, by keeping its scope and completely rethinking its structure. These three situations cover a wide range of circumstances recurring in the design of digital artefacts that could imply developing something new from scratch, reusing something already existing, or refactoring something that proved to do not work as intended. In all three circumstances, one essential element is the balancing between functional requirements (referred to what the system do) and non-functional requirements (how the system is perceived, its meanings, its use). The way this balancing had been achieved followed three different patterns: cyclical and iterative in the first case, progressive in the second case, and explorative in the third case (see Sections 6.3, 7.3, 8.3).

The engagement forms adopted during the design process focused on involving people as:

- part of multiple social structures in Case study 1
- agents of organisations with specific goals, responsibilities, and competencies in Case study 2
- representatives of specific categories of stakeholders united by needs, problems, and capabilities in Case study 3.

Briefly, these three engagement forms respectively inform a people-based, an agency-based and a challenge-based design process, influencing the elaboration of the different requirements emerging from the three perspectives of potential users. From an operational perspective, the engagement of stakeholders had been framed, respectively, into a Participatory Design, a Service Design and a Co-Design process (explained in Section 5.5.3).

The priorities considered along the design process of the three case studies are significantly diverse. The priority in Case study 1 was on defining the functionalities of FirstLife by focusing on the platform features and interfaces. Case study 2 prioritised the definition of new services based on consolidated technologies, by focusing on the compliance between the workflow of these new services and the logics of the components to be assembled. Case study 3 focused on the nature of data, as well on the production and use of data, to meet the priority of tracing and enhancing the information exchange among the platform users. In doing so, the three processes considered a wide range of requirements for shaping platforms aimed to provide primarily a consistent representation of the context (FirstLife), urban processes (WeGovNow) and data-driven social interaction rules (MK:Insight2X).

The last details defining the characteristics of the design phase into the three projects concern the composition of the development teams and the available resources. The development team of FirstLife was composed by a group of web developers and another nucleus conducting all the "non-coding" activities, working independently while coordinating their activities. WeGovNow involved seven teams for the technological part of the project that needed to coordinate their activities, and two separated teams dedicated to engagement activities. MK:Insight2.X involved a small team working simultaneously on the technological and urban aspects of the project. These three operational settings were also respectively characterised by:

- moderated availability of human and technological resources for the implementation of the platform, but high commitment of team members (at a personal, professional, ideological level)
- good availability of human and technological resources, but low commitment of team members (limited to the project contractual duties and responsibilities)
- limited availability of dedicated resources, both as regarding human and technological sides, but high level of commitment, while asymmetrical unbalanced in favour of research goals more than development goals.

These situations influenced the types of approaches adopted during the design phase and, while not affecting specifically my research process, impacted heavily on the advancement of the development of the three platforms to finalise the design choices, as will be discussed at the end of Chapters 7, 8, 9.

As evident in the description of the key elements defining the design phase in each case studies, they represent three **distinct examples of potential approaches** to the design of City-Mirror-like platforms. Their analysis and discussion allowed me to address in a comprehensive way the research question RQ5: "*What types of approaches could be applied in the design process of a City Mirror for balancing functional and non-functional requirements associated to the perspective of different stakeholders and to the competing goals of local activities?*" Most of all, a direct experience of a variety of approaches to the problem provided sufficient elements to identify potentialities and limitations of each of them.

6.5.3.c. Evaluation

By focusing on the evaluation phase of the design process of *City Mirrors-in-the making*, it is important to made explicit that this research investigated the evaluation of technologies in progress or at their early stages for identifying which could be the appropriate evaluation criteria emerging from the practice to inform and guide the design process of city technologies. In this sense, the approaches to the early evaluation of digital artefacts experienced in the three case studies necessarily differ from other evaluation approaches assuming finished products or trying to assess their adoption after a long time from their release [more details in Section 6.5.4]. These experimental approaches had been characterised by different relationships between:

- "technology providers" (i.e. the development team) and the "technology users" (i.e. local stakeholders)
- timings for the "expert" and "non-expert" assessment, as well as "technology" and "city" sides
- procedures for defining the appropriate evaluation criteria case by case.

In case study 1, considering the iterative and cyclical nature of its design process, the cyclical evaluation of the prototype was carried out as an internal assessment within the development team based on the external informal assessment of the stakeholders involved into the design process. In other words, by testing the platform in working environments with the stakeholders was possible to clearly identify the "social desiderata" case by case, and then furtherly elaborate these desiderata into evaluation criteria to be proposed at the participants in the process at the following occasions and validated them together. Therefore, this retrospective analysis of the functionalities provided by the platform in relation to the emerging social desiderata and evaluation criteria was based on observational procedures [see Chapter 7].

In case study 2, considering the complexity of getting along many development teams and administrations, the evaluation of the prototype proceeded in a negotiated way, by alternating evaluation sessions with the development teams and evaluation sessions with the stakeholders involved in multiple iterations. In this way, the social desiderata of the latter group (non-experts) were compared with the needs or requests of the development team (tech experts) in an almost simultaneous way, and homogenised into a shared system of rules for their prioritisation. Desiderata, needs, and priority rules informed an analytic elaboration of evaluation criteria that could take into account both the specificities of the urban processes and the technological constraints of the platform [see Chapter 8].

In case study 3, considering the exploratory nature of the proposal concerning the data portal, the evaluation focused on the "rules" to shape the functioning of the next prototype, and not on the prototype in itself. This projective approach to the evaluation relied almost exclusively on the assessment of not-expert carried out by considering their working environments and the applications of city data. This scenario-based procedure led to identify social desiderata, needs and constraints for assessing the future platform against the stakeholders' expectations, outlining a set of evaluation criteria looking both at the platform and at its domains of application.

These different experimental approaches to the evaluation of the examples of City-Mirrors-in-the-making provided by the three case studies allowed to address the research question RQ6: *"What criteria should be considered for evaluating the correspondence between platform functionalities and the expectations of city stakeholders?"* At the same time, the discussion of pros and cons of these different approaches presented in the next chapters could support the effective use of the resulting evaluation criteria within more formal and standardised assessment procedures [see Section].

To summarise, the diversity of the three case studies respect to context, constraints and development of their design processes had been a fundamental aspect for elaborating robust answers to the research question *"How to structure and manage the design process of a City Mirror?"* with the related sub-research questions (see Fig. 6.20). Indeed, both in the longitudinal analysis of each case study and in the cross-case analysis, the analytic effort focused on iteratively testing the new findings against the evidences progressively collected in the research process, refining the explanations in more general terms or revising the association between concepts, components, and relationships to identify variables and invariants of phenomena (see Section 6.4.4).

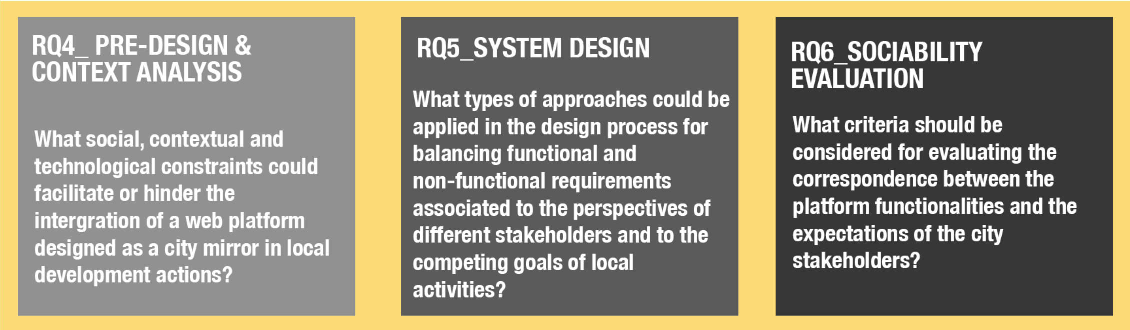


Fig. 6..20 Sub-research questions related to the structure and management of the design process of a City Mirror

It is important to highlight that the composition of the three case studies followed a constructivist approach due to the impossibility of envisaging the evolution of the research at the beginning of my path, in particular in reference to the development of each single project or to their sequence until 2019. Therefore, the research had been progressively designed and redesigned accordingly to the new opportunities coming from these projects, and it is not as obvious outcome of the three projects. Along the process, the choices made for conducting the research had been driven by the goal of keeping an internal coherence of the study and enhancing the complementarity of the case studies.

6.5.4 CASE STUDIES AND DEVELOPMENT OF THE RESEARCH

The implementation of the multi-case study strategy had been based on the **sequential development of the three case studies**. In particular, this **sequential development advanced through a double helicoidal process**, confined between the theoretical steps of the problem deconstruction and analysis perfomed at the beginning of the work, and the final step aimed at generalising the findings of the empirical observations and applied research into a coherent theory [see Fig. 6.21].

The sequence of the three case studies draws a major helix, in which every convolution corresponding to the development cycle of one case study leads to the convolution of next case study, that is in part informed by the knowledge gained in the previous one. For instance, the first case study provided an extensive insight about the opportunities, limits and implications of representing urban activities on a map-based interface integrated by social media contents. In the following two case studies, a map-based interface was still one of the important components of the system, but the focus of the research moved toward the exploration of new aspects regarding the spatiality and its relationship with the stakeholders needs not previously examined in the first case study. As complementary outcome, the following two case studies offered the opportunity to confirm or integrate the findings related to the first case study in a different context in order to understand the limits of their generalisability or transferability (see Section 6.7).

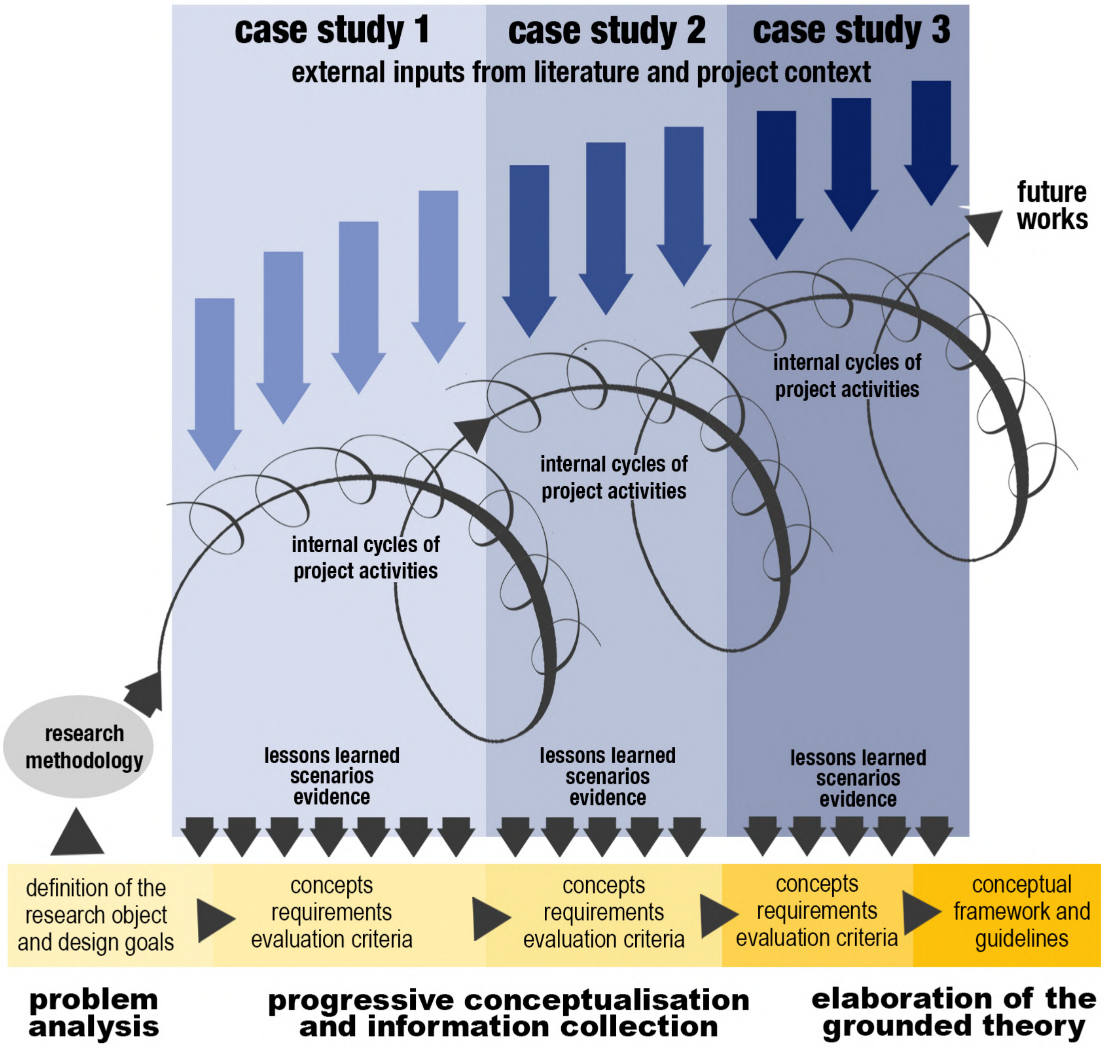


Fig. 6.21 Schema of the research development

Then, **every case study internally advanced through local cycles combining action, analysis, design, and conceptualisation of contextualised findings.** These activities that I performed as part of my research where intertwined with many other activities for the implementation of the project in itself carried out by the development team.

The **external inputs for the advancement of the research** in each case study and along the entire process came from:

- **theories, analytic frameworks, and consolidated knowledge** on one or more aspects emerging from the design process (e.g. the pragmatics of maps)
- **examples, studies and applications** related to the type of platform under design (e.g. social media tool, gov-platform, open data portal)
- the **collaboration with local stakeholders in their projects** (e.g. non-profit organisations, public institutions, and businesses in welfare services, urban regeneration, cultural initiatives)
- the **topics explored through field activities** (e.g. identity, inter-organisational cooperation, percpetions of city spaces).

Lessons learned from the design processes, applicative scenarios and evidences progressively gathered and analysed had been then **systematised in a set of concepts, requirements, and evaluation criteria** to inform the design of web technologies reflecting city dynamics (see Chapter 9).

The data collection activities for each case study had been organised and carried out for one case study after another, with limited temporal overlapping as shown in in Fig. 6.22[13]. On the contrary, data analysis activities had been performed during the development of each case study as regarding new materials and sources, but also in a continuous dialogue across the three case studies to compare factors, concepts and dynamics recurring in each of them.

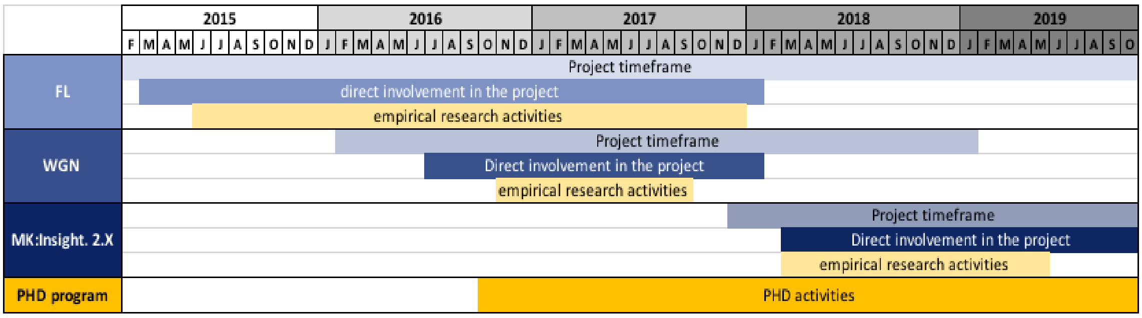


Fig. 6.22 Temporal schema of the three case studies

[13] Note requested at the PhD thematic meeting 2017. Fig 6.22 shows that the data collection activities for the first case study started even before the official starting of my PhD programme (November 2016). This fact could seem unusual, or even problematic, but only if we consider the existence of one only possible PhD path: the one moving from the literature review to the definition of the research questions and, then, to the design of data collection activities that is followed in the majority of cases. Even if I agree that starting the data collection before the definition of the research questions could seem unusual, this had been not problematic in this work for three reasons.

1) My profound interest in city technologies and my personal involvement in the project on which the first case study is based constituted, respectively, the main personal motivation and the opportunity for undertaking a substantial research on the topic, that would have been impossible without the opportunity to work on prototypes of City Mirrors with the appropriate background and experience. On this basis, I independently started my research within my professional activities, and then applied for the PhD programme to continue my research within this educational framework (see section 6.7.1). My purpose of contributing to understand how web technologies could effectively support city activities remained unchanged before and after my enrolment into the PhD programme. What changed then? The progressive formalisation of the problem to be investigated (not its focus) and the specific sub- research questions (not the overall one) in a dynamic evolutive manner that is typical of TD research anyway.

2) This path is consistent with the research setting framing my work: transdisciplinarity, abductive reasoning, an interpretive system of inquiry combined with design and qualitative methods. All of them assume the pre-existent knowledge or experience of the researcher regarding the investigated topic as a fundamental resource to link empirical observations and effective analysis to significant results [Schwartz-Shea & Yanow 2013]. Moreover, my specific background and mindset influenced the choice of research methods such as action research, specifically because they are part of regular toolbox with which I approach new problems in my professional activities as well. By applying specific research methods and techniques in the initial phases of my research before the start of my PhD I was still aware of their boundaries, outputs, outcomes and limitations because already experienced before.

3) Materials and observations made in the period preceding my official enrolment into the PhD programme had been used as valuable resources for orienting the subsequent phases of the research, but they constitute anyway only a small part of all the sources used in this work. In addition, they had been used in the analysis by focusing on pieces of evidence, meanings, facts, dynamics, that are independent from the specific timing of the data collection.

6.6 APPLICATION OF THE RESEARCH METHODS IN THE CASE STUDIES: TACTICS, TECHNIQUES AND TOOLS

After the introduction to the case studies in section 6.5, I explain here how the four research methods presented before in relation to the multi-method approach had been applied in each case study and for the cross-case analysis, by focusing on the hybridisation of techniques, tactics and tools from the domains of urban and informatics disciplines. I am going to present the general elements characterising the individual application of the forum methods. In the next chapters reporting on the development of the three case studies, the description and discussion of the research methods will be detailed in reference to the path for answering the research questions and the activities of data* collection and data*analysis. [see sections 7.3.5, 8.3.4, 9.3.5, respectively in Chapter 7, 8, and 9].

6.6.1 DESIGN RESEARCH

Design Research methods oriented to provide direct inputs for the immediate goals of the design process and platform development in the three case studies had been implemented by relying on an **extensive hybridisation of techniques and tools usually applied in informatics and urban disciplines** [See Fig. 6.23].

- In the **pre-design phase** of the three projects[14] this hybridisation focused on combining the analysis of the needs of the different clusters of intended targets with the in-depth analysis of their operational context from multiple point of view. This entailed revising usual techniques used to conduct user studies in technology design (focus groups, interviews, surveys, ethnography) with systemic approaches more common in urban projects such as stakeholder analysis, context mapping, thematic analysis, historical analysis of the evolution of some phenomena over time.
- In the **design phase**, diversified in the three cases (because oriented to develop a new platform, assemble consolidated tools in a unified platform, or rethinking the concept of a class of technologies), the hybridisation had been implemented by overlapping the different techniques and tools in technology design and urban projects for the engagement of stakeholders and the orientation of design choices. As regarding the engagement of perspective users into the design process:
    - the first case study allowed to experiment a large-scale face-to-face participatory design process as the ones associated with the elaboration of city plans, but oriented to the definition, design-in-use, and testing-the-world of the incremental prototype of a technology platform
    - the second case study provided the opportunity to develop a co-design process based on experimenting the application of typical tools used in service design (e.g. stakeholder mapping, user journey, service blueprint, etc.) to the design of digital services combined with the definition of open and cooperative governance models for city transformations, supported by technology and made tangible and adaptable through their translation into the logic of services.
    - the third case study activated a sort of policy design process intertwined with the conceptualisation and pre-prototyping of technology modules alternative or integrating current solutions for data portals.

[14] As specified earlier, while the focus on the pre-design, design and post-design phase have a different weight in the three case studies, in all of them I have been involved in the entire flow going from the preliminary activities to the ex-post evaluation.

As regarding the orientation of the design choices during the three processes, the design research focused on the in-depth analysis of other platforms and technological solutions facing similar types of challenges and addressing part of the requirements emerging from the development and engagement process. Collateral activities frequently classified as "research for design" activities covered aesthetics and consistency of the platforms' interfaces and interactions, but these activities are not detailed in this thesis because out of the scope of this work.

- In the **post-design phase**, or rather in the evaluation (ex-ante, in-use, and ex-post) of the implemented design choices in the prototypes and solutions for having city mirrors, the hybridisation focused on assessing the usability and effectiveness of the platforms against expectations and needs of the perspective users in combination with the assessment of the appropriateness and appropriability of the platforms by users in their local actions. In other works, the evaluation focused on collectively reflecting with the involved users on the "political soundness" of the city mirror [see also Chapter 3, section 3.6]. Again, reports on the usability evaluation of tools are out of the scope of this work, instead focused on reporting the insights about the constraints for the integration of technologies in multi-stakeholder settings.

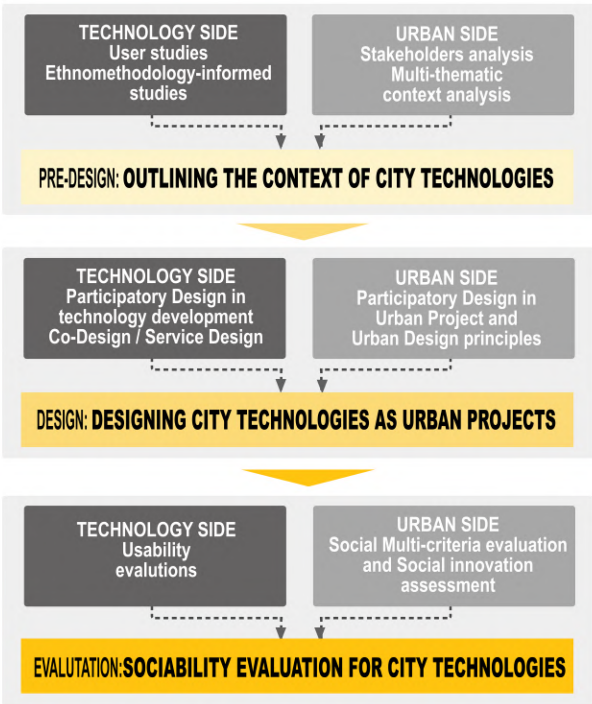


*Fig. 6.23 Hybridisation of design techniques - *to edit for-language consistency*

6.6.2 ACTION RESEARCH

Action Research methods had been applied in the three case studies in association with the engagement process of perspective users in the development of the prototypes of city mirrors. Action research methods have been used to include a variety of perspective in the design process extended even to groups and target usually excluded from user studies and technology development research (such as elders, minority groups, children, and a wide range of organisations and communities). Most importantly, the use of Action research methods allowed to gather thick descriptions of the operational contexts of different classes of stakeholders, acquiring sufficient elements for identifying the structural, discursive and practical elements impacting on the introduction of web-based technologies oriented to support coordinative, cooperative and collaborative practices among multiple actors. The cycles of action research activities, regardless of the time actually spent on the field with each group (from a few hours to more than a year), provided the opportunity to explore and discuss these elements reflecting together with the participants in the activities. As a result, the application of this kind of methods enabled the extraction of requirements and insights difficult to be defined by using traditional requirements elicitation methods detached from the main matters of concern, constraints and everyday activities of perspective users.

Action research methods had been profoundly readapted and innovated in the three case studies. Indeed, action research methods are usually applied to work with one group only, or one group for each case study in research based on multi-case study strategies. In this work, the flow of collective identification of the problem, planning, action, observation and evaluation, and re-planning remained unaltered. But timeframe and forms of involvement had been radically modulated and shaped on the evolutive circumstances of the design processes that research activities were accompanying. The three forms of Action Research experimented in this work can be defined as follows [see Fig. 6.24].

- **Serial Action Research** (first case study), with the AR flow repeated with numerous groups, in parallel or in sequence, for a period ranging from a day to more than one year, implementing from one to five iterations, working on various domains and problems derived by the specific framing of the participants and with the objective of widely exploring different city dynamics.
- **Bilateral Action Research** (second case study), with the AR flow conducted in parallel with two clusters of participants, internally divided in multiple groups. While the common goal was the same for both clusters, the autonomous definition of the problems to be overcome to reach this goal in each cluster followed independent paths, reunited along the process in "realignment occasions" to verify the compatibility of plans and actions developed on both sides. In this case, the process continued for more than one year, with multiple iterations, but remained almost stable in the composition of the participants in the activities.
- **Enacted Action Research** (third case study), with the AR flow developed in a short time frame with multiple groups in parallel, and then a second collective iteration involving all groups at the same time. In this case, an extremely careful preparation of the activities, the design of appropriate tools to be used, and the long and diversified experience gained from the previous two case studies, allowed to build a solid understanding of the users and their context and the challenges to be addressed comparable to other experiences involving longer periods of joint work.

Fig. 6.24 Serial, Bilateral, Enacted Action Research: matrix

6.6.3 RESEARCH THROUGH DESIGN

Research through Design methods had been applied for the systematic investigation of the effects and implications of introducing a multi-stakeholder, multi-scale, and multi-purpose platform in urban settings on the basis of the experiences associated with the three case studies and the prototypes of city-mirrors-in-the-making. More specifically, numerous interviews and fieldwork activities (including workshops and testing with users) had been combined for:

- studying the implications of potential alternatives to the logics of existing web-based technologies with applications in urban context
- understanding users' needs, applicative scenarios and forms of support expected or required from these alternative web-based technologies in city dynamics
- identifying key barriers, issues and constraints in the design process of the city-Mirror-like technologies in the pre-design, design and evaluation phase.

In this sense, the intentional adoption of an RtD approach in the exploration of the City Mirror proposal tried to combine the three forms of design-driven knowledge indicated by Fallmann [2008, in relation to Interaction Design but generalisable) as knowledge about an alternative future (*the possible*), the users' needs *(the true)* and the constraints of the operational context *(the real).* In other words, the role of RtD method in the study of City Mirrors was binding theoretical findings, real phenomena, and design solutions [see Fig. 6.25].

Research through Design methods applied in the study reflect the three **canonical roles of researchers in the practice of RtD** (as defined at least in the domain of HCI or in design more in general):

- *"constructors of the world they desire"* [Zimmerman & Forlizzi 2014]
- scholars engaged in tracing how knowledge is generated by intervening in the context through artefacts [Zimmermann et al. 2007]
- *"glass-boxes"* on the connection between design choices and implications in the applicative context of the artefacts [Jones 1980].

The techniques and tools adopted in the process reflected also other two distinctive characteristics of the RtD: **trying to address wicked problems** and **integrating inputs from a plurality of theories and methods** in different disciplines. Lastly, as recognised to be a current goal in the application of RtD methods, also in the three cases studies of this work RtD methods had been applied to serve the overarching purpose of contributing to the elaboration of a theory systematising the knowledge acquired during the research and design explorations [Zimmerman & Forlizzi 2014].

The novelty of the application of RtD methods proposed in this work relies on the fact of **making possible to intentionally practice RtD on wicked problems, multidisciplinary topics, and with the goal of generating a theory by working on a plurality of small and medium projects, with limited resources, and considering the frequent change of partners and settings as a unique opportunity for exploring the problem under new angles, reflecting the common environment of most of the design and research team.** Indeed, usually the size and scope of studies having these characteristics and adopting RtD methods usually implies the rare coexistence of four conditions: long-term projects, dedicated teams, significant funding, institutions able to overcome the administrative issues related to carrying out the investigation beyond the academic milieu [Zimmerman et al. 2010]. In the absence of these conditions, this work shows that an alternative could be based on coherently and consistently pursue a specific research goal across multiple projects and settings and relying on a set of artefacts instantiating in different forms the design proposal to be investigated.

Other relatively uncommon aspects characterising the application of RtD methods (as made explicit and listed in Andersen et al. 2019) in this work are:

- the use of a conceptual framework (in the form of a design proposal) as **infrastructure for the knowledge** generated during the research process across several small projects and activities in the three case studies
- the development of an **overarching strategy** to systematically study the different aspects of the conceptual framework by using three different web-based technologies instantiating the same design proposal in specific artefacts (due to the abovementioned practical constraints of the study)
- the adoption of **participatory techniques and tools** to carried out the field activities to explore the interaction space defined by these artefacts, actively involving a plurality of local stakeholders in three case studies.

Fig. 6.25 Knowledge about the possible, the true, and the real in City Mirrors explorations

6.6.4 GROUNDED THEORY

Grounded theory methods intended as procedure for the systematic analysis of the collected data* had been applied throughout the development of the three case studies to stratify, iteratively validate and conceptualise the findings emerging from the empirical and applied research activities into an organic theory of the capabilities envisioned for City Mirrors. As showed in Fig. 6.26, the sequence of the three case studies allowed to progressively move the focus of the research from the analysis of the contextual factors impacting on the relationship between web technologies and city dynamics, to the analysis of the processes to be supported, and then to the rules to put in place to make the system work into a complex social environment. Similarly, the object of design expanded from the platform functionalities, to the services and then to the structure of the information ecosystem. Along this process, Grounded Theory methods had been applied to extract relevant elements concerning the mirroring of the city ecosystem on a platform oriented to orchestrate the action of city stakeholders.

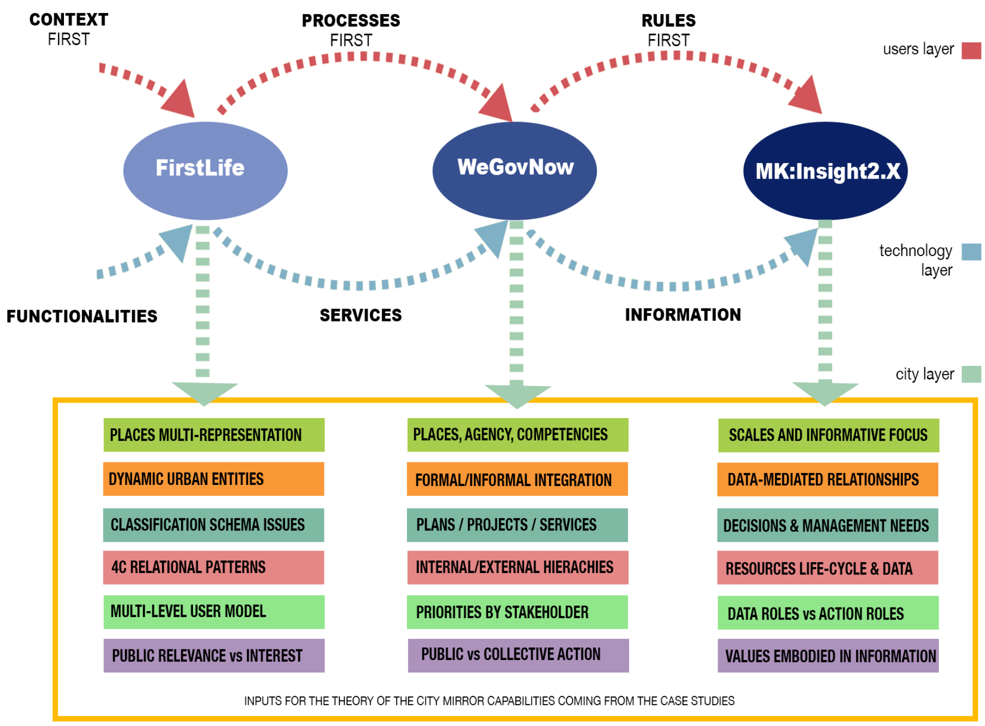


*Fig. 6.26 Case studies and inputs for the grounded theory *to edit for language consistency*

The application of Grounded Theory methods in this work is characterised by the following aspects.

- The **analysis covered heterogeneous types and sources of data***, including notes related to analogic and digital artefacts, the artefacts themselves, notes and transcriptions from a variety of field activities ranging from focus groups to co-design workshops, differently from more common application of GT methods based on interviews, survey, and archival documents.

- The **analysis was based on data* collected in multiple settings and related to different projects,** examined by calibrating the level and scale of the analysis to extract patterns and concepts having generalisable properties, and also used for the triangulation and cross-validation of findings. More commonly, data for building a grounded theory are collected in one specific setting only, especially in purely inductive research.

- The **structure for the analytic process was supported by the knowledge infrastructure represented by the three core models** presented in Chapter 5. This knowledge infrastructure did not limit the generative process of concept definition. Basically, it allowed to develop in parallel three "theory silos" for the interactions among users, city systems and forms of technology support, by offering an orientation on what to focus the attention (in relation to the properties and details of the various components and layers of the core model). Then, the final coding operations recomposed these three strands of the theory into a unified set of concepts. In this way, this work provides an example of application of GT methods deeply rooted in an abductive reasoning process, dynamically and biunivocally connecting the theory in elaboration to consolidated knowledge throughout the analytic process, and not just at the end for confirmation and validation.

- The grounded theory had been constructed on the basis of:
  - the **deep longitudinal analysis of each case study**, accordingly to the three strands of user, city, and technology, as well as in relation to the design aspects and the understanding of city dynamics
  - the **cross-case analysis of the three case studies** to highlight clearly defined patterns and robust concepts, apparently saturated on the basis of the collected data* [see also section 6.5.2].

To this regard, looking also at the three case studies as part of a unique flow of research [see section 6.5.3], the practical application of the Grounded Theory methods proceeded in the following way.

- *First case study.* **Open coding** of all the materials collected in the initial phase of the participatory design process of FirstLife, including about 150 applicative scenarios on over one hundred distinct city practices. Open coding of the issues and constraints associated by different social structures to the use of map-based interfaces, temporal features, specific user profile and other. Starting of the **axial coding** on these materials, progressively integrated by other collected in the subsequent phases of the participatory design process by relying also on a focused sampling of these materials along selected dimensions (such as scale of action, or rime, or involved actors, or domain of intervention) made possible through the multiplication of the experimental silos for the data collections [see the structure of Open Labs in Chapter 7, section 7.3.4]. The extensive and long work conducted during the first case study provided a preliminary basis for defining an initial set of concepts appearing already saturated and for identifying other space for further investigations.

- *Second case study.* **Open coding** of new elements; theorethical sampling of materials covering the aspects remained unconsolidated after the first case study, triangulation and validation of the concepts selected in the first case study, **axial coding** of the new material and concepts to be reformulated under the light of new evidences. Starting of the **selective coding** based on the resulting axial codes.

- *Third case study.* Same flow of the second case study, considering the new codes and concepts from this case study in relation to the previous one for triangulation, reframing, and consolidation in **selective codes**.

- Normalisation, triangulation and final selective coding in the cross-case analysis. After multiple iterations, the hierarchy of codes ended up into six macro-categories of City Mirror capabilities.

6.7 RESEARCH BOUNDARIES

In previous sections, I discussed the critical aspects of a research strategy based on multiple case studies and the research methods applied to carry out this work, specifying the measures implemented to minimize their impact on the robustness of findings. In this section, I made explicit the boundaries of my work for the benefit of the reader, by providing a concise account of the relevant elements for evaluating my research considering its limitations.

6.7.1 PERSONAL STANDPOINTS

An important criterion for assessing the quality of a Transdisciplinary research is the appropriateness of the skills and competences of the researcher to undertake the study (see Chapter 1, section 1.8). At the same time, the choice of adopting design-based and interpretive research methods deeply relies on the Researcher as the essential "tool" for his/her own research because the interchangeability of the researcher is not one of the assumptions considered in these systems of inquiry (see section 6.5 of this chapter). The specific set of research skills, competences, personality, behaviours are instead recognized as valid channels for co-generating the information with the participants in the study, assessing that information, elaborating unique design solutions. It is absolutely vital in this type of research trusting on the critical and heedful attitude of the research toward potential bias that could generate systematic misinterpretation of information. To enable the reader making his/her own judgment on the quality of the research as transdisciplinary and the rigor of the research process, I briefly list a few elements of my personal background relevant for the research, and then I unfold the copy mechanisms adopted to contrast or limit the impact of potential bias in my work.

A. *Personal background*

1. *Education.* I have a background as Architect[15], specialised in Technology of Architecture[16]. As Architec,t I am formally educated in design theory and methods. As a technologist of the built environment, I received an extensive training in studying technological artefacts and the context in which these artefacts are intended to be integrated, by taking into account that every technological artifact in the city is always deeply embedded in a plurality of socio-technical systems. This specific background led me to balance ecological and systematic approaches to the extraction of requirements from complex operational contexts. At the same time, it made me to automatically assume that the aim of the context analysis is never limited to understand the context in itself, but always projected to inform planning, design and management choices concerning the development or use of technology. This way of thinking and approaching technology is resilient to the shift of the research object from building technologies (focus of my formal education) to information technologies (focus of my current research), as proven also by other many architects and urbanists that influenced the theory and evolution of information systems [Steenson 2017]. However, my domain knowledge on cities helped me during this work in pursuing a research on urban actions and social structures combined with the focus on technological artifacts.

[15] My master and postgraduate qualifications were based on "five pillars": Architecture, Urban Planning, Technology, Restauration, Engineering. The formal training, I received covered different aspects, approaches, theories and scales of the built environment, including buildings, urban systems, or infrastructures.

[16] Technology of Architecture, domain ICAR12 in Italy, is the discipline studying the planning, design and management of industrial components, building processes, systems, and projects for the built environment, going from technology products to the territorial scale at which services and systems are organised and produced. Because of its systemic perspective, Technology of Architecture is a discipline considering human (social, cultural, economic, political) and technological elements as intertwined in the definition of planning, design and management choices. [ref. Spadolini>humanist technology, Ceragioli].

On the other side, I have no formal education in Informatics. From 2015 to 2017, while I was working with the "Social Computing Research groups" at the Department of Computer Science of the University of Turin, I learned the fundamentals of sub-domains such as geoinformatics and social computing that were revelevant for the reseach activities of the group. However, at the same time, I started to intensively study urban informatics, IS, CSCW, and HCI literature that seemed to me having more direct connection with my professional activities performed for the on-going case studies and my research interests as PhD students. The background as a technologist made me to get familiar with these new disciplines relatively quickly because of the homogeneity of system of thinking, type of problems, procedures, research methods and so on, as I illustrated also in this chapter. Despite this effort and the affinity between these disciplines and my background, my knowledge of IS, CSCW, HCI so far remain necessarily fragmented. Nevertheless, also domains such as urban planning or design are so vast and diversified that the specialisation on circumscribed topics or domain is a necessity. Therefore, to carried out this work, I focused uniquely on a few theorethical or methodological stances of the above mentioned disciplines, as made explicit in Chapter 2, section 2.3.

2. *Competences.* The research objects of this work are web platforms aimed at supporting local activities. I progressively acquired a certain familiarity with the specificities of web-based technologies by collaborating with web developers and computer scientists since 2008, primarily in non-profit organisations and academia. Over the last 12 years, I always worked with them as analyst and "translator" of the requirements coming from real-world scenarios into web-based services. Therefore, my competences do not include coding or knowledge of programming languages. They cover instead a good understanding of the logics of web-based tools as regarding components, design constraints, and applications, but also glossary and approaches of the various professionals involved in the design and development of such technologies. These competences had been essential to actively collaborate with the development teams of the three case studies and to independently carried out my own empirical research activities.

3. *Skills.* An important aspect of a transdisciplinary research, as well as of conducting action research, is the close relationship with many stakehodlers and the effective facilitation of group meetings, discussions, workshops. Personal interest in participatory practices, professional opportunities, voluntary experiences brought me very frequently into the position of mediating and managing a plurality of stakehodlers in reference to a specific project or initiative since 2005. Nevertheless, to convert these self-learned skills into a solid and versatile toolbox for my research as a PhD candidate and my activities as a practicioner, I undertook a professional training as group facilitator in 2016-2017. This training provided me more solid basis to understand cognitive and behavoiural patterns in group dynamics, distinguishing between person-specific reactions and context-induced behavoiurs. This new knowledge and skills had been incorporated in the preparation and implementation of on field activities related to the three case studies, especially as regarding the relationship with different stakehodlers during the development of the research.

B. Potential bias and copying mechanisms[17]

1. *Context-specific bias/antibias.*

2. *Generation-specific bias/antibias.*

3. *Experience-specific bias/antibias.*

[17] To be completed

4. *Technology-specific bias/antibias.*

5. *Participants bias related to my gender, appearance, affiliation, work, provenance.*

C. Personal involvement

1. *Professional.* Two of the case studies considered in this work had been developed as a result of my independent research activities carried out in parallel to my professional responsibilities as an external researcher (i.e. not subordinated) collaborating with the "Social Computing" Research Group at the Department of Computer Science at the University of Turin from March 2015 to January 2018. Most of my activities in that capacity were autonomously defined while coordinated with the ones of the development team working on the projects of FirstLife and WeGovNow and related sub-projects. This open framing of my professional profile and the convergence between the themes of the projects I was following and my research interests led me to undertake an extensive process of preparation of my activities to serve both the purposes of my group and my research agenda. I also collaborated with the research activities of the Social Computing group on some topics of geoinformatics, but the orientation of my research interests on city technologies was not aligned with the priorities of the group and then indipendently pursued. The third case study had been developed in Milton Keynes as a visiting PhD researcher from February 2018 to May 2020. In this case, no specific professional obligations framed my research activities.

2. *Personal.* While working on the first two case studies, the nature of the continous engagment with the city stakeholders in both formal and informal settings led to extensively involve also my family at large in part of the social activities complementing the moments more focused on co-design and data generation. This elements contributed to build deeper trust-based relationships with some gorups of stakeholders based on my closeness to their social environment.

6.7.2 ETHICS

D. Awareness of involvement by participants in the case studies

1. *First case study.* The participants in the first case study voluntarily decided to be involved in the proposed activities, or even to propose new shared activities on their own. Their engagement was not subjected to any form of monetary compensation, as well as my collaboration with them (partially covered by my contracts with the University and partially self-financed). Participants were aware to be involved in defining the profile of future civic technologies to support the coordination of local actions in city settings, that their involvement entailed also sharing their domain knowledge on their everyday activities and practices, and that the goal was contributing to the development of a non-commercial web platform, implemented in academic context as a prototype projected toward becoming publicly and widely adopted. Even in a late stage of the case study, I oriented my investigation over specific domain or issues, but never directly selecting the participants to be involved. As it will be clarified in Chapter 7, this challenging choice led to also include segment of the populations usually marginal both in urban and technology design participatory processes.

2. *Second case study.* The participants in the main activities of the second case study were determined by the referents of the project for the different partners of WeGovNow. Their participation in the activities

was framed within obligations established by the goals of the project (understanding how to assemble the platform and how to use it), but their level of interests and commitment had been independent modulated by each subject. The co-design activities reported in Chapter 8 were not included in given list of tasks within specific work packages, but the participants were aware of their centrality to expedite the achievement of the project goal. Other secondary participants beyond the projects partners, such as the city stakeholders participating in workshops and presentations and meetings, were not selected because of the public nature of the events by me and voluntarily taking part in these activities because interested in contributing to the project, to the platform, or to the creation of new open and cooperative processes in their city.

3. *Third case study.* The participants in the third case study had been selected from the basin of city stakeholders involved in past data-related projects and currently involved in data-related services in Milton Keynes. They voluntarily decided to be engaged in the proposed activities, aware that their inputs could contribute to rethink the services associated with the city data portal, and more in general improving the local policies or services around Open Data. The strategies, tactics and tools adopted in this case study to establish a meaningful dialogue with the participants in the activities despite the short time had to work together are detailed in Chapter 9.

E. Privacy of participants and personal protocol for data protection

The personal data of the participants in the case studies are never exposed in this thesis and anonymised in all research materials used for its preparation. I always refer to classes of stakeholders and type of organisations to contextualise statements and insights gathered from the participants. The elaborated scenarios to explore potentialities and limitations of city mirrors-like technologies are always rendered to a sufficient level of detail to represent the specific dynamics under study, but preventing the identification of specific people or organisations. In addition, none of the information generated during field activities can be classified as sensitive data or data exposing informants to life and/or social risks and/or threats. The majority of the collected information concerns indeed the descriptions and interpretations of city practices, experiences, contexts, perception of problems, and co-generated proposals.

F. Third parties involved

The third parties involved in the activities included the research groups I worked with in Turin and Milton Keynes. As specified before, even though part of activities I carried out served the double goal of progressing the development of the prototypes and advancing my research, the results of my research do not compromise in any way agenda and legitimate interests of my former research groups or the economic interests of third parties.

6.7.3 RELIABILITY AND TRANSPARENCY

The metrics usually mentioned to evaluate the validity of a research are the **reliability, internal validity and external validity**, respectively intended as:

a) replicability of the same results under the application of the same technique in the same conditions
b) self-evidence of the causal relationships among two or more factors of a phenomenon, excluding dependence from external factors.
c) independence of results from its context implying their transferability.

However, these metrics are usually linked to a research paradigm assuming a positivist epistemology and they are not appropriate to evaluate qualitative research, and even less interpretive or design research as this work is. Systems of inquiry based on these methodological approaches, especially if developed under pragmatic and constructivist epistemology as in this case, are not driven by the objective of making results replicable (considering that the nature of "results" is intrinsically difficult to define, as including also artefacts and reasoning-based outputs), and they openly acknowledge the dependence of the findings from the context and the people involved as researcher and participants in the research. In addition, the co-dependence of multiple factors describing a certain phenomenon is not considered as a problem, but as one of the points of investigation. The transferability of findings, assumed an appropriate level of analysis and abstraction used by the researcher, can be ensured as regarding the principles and concepts, but not necessarily their instantiations.

Methodological literature substantially agrees on alternative criteria for qualitative and interpretive research such as the **transparency of the knowledge generation process**, the **trustworthiness of the findings** and their internal consistency (also defined as dependability), and their **transferability** [see e.g. Glaser & Strauss 1967, Charmaz 2006, Lincoln 2002, Steinke 2004, Schwartz-Shea & Yanow 2013]. As regarding design research other criteria are the **utility, practicability, viability and relevance of the solutions and elaborated concepts** [Kelly 2006, Bakker 2018, Gerber et al. 2018].

Transparency as a quality criterion for research is intended as the commitment of the researcher to communicate clearly and objectively the logical connection between observations, analysis, reflections and findings along the process of knowledge generation, documenting this connection as possible or describing in detail the process itself. The scope of transparency is to enable an external assessment of the consistency of the analysis in relation to the followed process, as well as outlining the conditions for experiencing or retracing the steps of the process.

G. Transparency and repeatability of processes

The design and research processes reported in the three case studies are certainly unique and unrepeatable because of the mix of special circumstances that enabled their development (e.g. highly motivated team living for the project, innovative EU project with unprecedented scope, long-term partnerships in a city projected to innovation by design). However, the design and research processes of the three case studies are presented in this work through a clear systematisation of the structure and goal of each phase, associated with the kind of outputs expected or produced at each step, the discussion of the main criticalities, and the comprehensive account of rationale, constraints, needed resources. The full transparency over the processes is aimed at enabling the potential adaptation of the described processes to:

- other large-scale participatory design processes at the city scale that could benefit from diversified strategies for the engagement of participants belonging to various segment of the population, regardless if the scope of the process is the design of digital technologies or policies or other instruments (see case study 1, chapter 7)
- other projects aimed at combining transformation of institutions and transformation of the role of technology in social and organisational settings (see case study 2, chapter 8)
- other design and research challenges associated with situations in which the disconnection between representations of the reality and real practices make difficult even the correct framing of the problems to be addressed (see case study 3, chapter 9).

These are a few examples of other processes that could benefit of the approach and insights provided by the three case studies.

H. Transparency and repeatability of methods

A structural characteristic of a design system of inquiry is the creative generation of new methods or the hybridisation of existing methods oriented to achieve the goals set by researchers and the designers involved in the process [ref. Nordes 2006]. The assessment of the quality of the methods is strictly related to their efficacy and effectiveness (intended as the best exploitation of the available resources with the maximum results) in relation to the goals of the investigation or creation process. To a certain extent, this vision is quite different from the one oriented to codify and standardise a limited number of methods providing predictable outcomes and type of findings that is more common in pure qualitative research.

Considering that multiple systems of inquiry (design, qualitative and interpretive) are combined in this work by adopting a multi-method approach, I used well-known methods creatively reconfigured and readapted to the contingencies and goals of the research and design processes in which they had been applied. The application of each method and their combination is explained in detail in each case study, specifying the canonical elements kept as stable and the one revised, extended or readapted, as well as the rationale for the choice of readapting consolidated methods to new settings. In this way, the experimented version of the methods, but also techniques and tools used or generated for the study, are potentially reusable by other researchers facing similar geometries of research and design constraints or similar goals.

I. Transparency and repeatability of findings in other processes and with other methods

There is an objective difficulty in tracing the flow of direct and indirect logical connections between the flow of activities largely collective (because carried out by using participatory techniques or in collaboration with some members of the development teams) and the insights for the research organised accordingly to the knowledge infrastructure of the core models guiding this work. Nevertheless, all the insights and findings presented in the case study are contextualised to facilitate their understanding in relation to the design process and the research methods applied for their definition. In this work, the findings are patterns connecting rules and actions in urban settings, nature of the social structures and collective dynamics, the relationships between logic of social interactions in specific settings and the expected/needed/refused interactions mediated by technology. As patters, they can be identified also in other processes and with other methods, and furtherly refined or contextualised or extended.

6.7.4 VALIDITY AND TRUSTWORTHINESS

Trustworthiness as quality criterion for qualitative and interpretive research is intended as the sum of the **credibility of data used for the analysis** (or rather their value of truth), the **consistency of the findings**, their **confirmability** (as neutral or objective or non-bias dependent). This criterion, especially looking also as the quality criteria for design and design-related research, should be integrated by considerations concerning the **originality, resonance and usefulness of the findings**, respectively intended as the effective exploration of new topics or known topics with methods, the deepness and completeness in representing data into a coherent solution or representation of the reality, and their practical implications for the intended target users of the generated knowledge.

J. Robustness of the findings

All findings coming from insights associated with the involvement of local stakeholders in the design and research activities, or emerging from reflections and analysis, had been:

- based on **multiple sources of evidence**

- **triangulated and constantly compared with external sources** (e.g. external to the participants for confirmation or contextualisation)
- integrated into an **abductive research logic** connecting findings coming from empirical and applied research activities to existing consolidated theory covering some aspects of these findings or providing proved explanations for the observed dynamics.

K. Accuracy in the representation of reality

As mentioned earlier, I considered the impact of personal and contingent bias that could interfere with my objectivity in the research process and I proactively contained this kind of risks, keeping as clearly distinct my values, priorities, opinions from the ones emerging from the activities carried out in collaboration with the stakeholders involved in the case studies. The accuracy in the representation of the reality, and thus the confirmability of the findings and patterns, relies on:

- the frequent **decomposition of observations at the three levels of discourse, practice and structure** to separate elements potentially dependent on the informants and permanent constraints of specific dynamics
- the **contextualisation of these information** when needed to support their potential observability in autonomy and in other contexts.

6.7.5 TRANSFERABILITY AND GENERALISATION OF FINDINGS

The quality criterion of the **transferability and generalisability of findings** as metrics for its validity involve the critical assessment of the different components and dimensions to be considered for identifying context, conditions, type of problem, research goal that allows to collect new evidence of the same phenomena to confirm or extend the previous analysis, or to search for the manifestation of the same phenome and patterns in new settings. As highlighted in the discussion of the multi-case study strategy in section 6.3, the transferability of findings does not depend on the data used for the analysis, but on the level of abstraction set by the researcher to develop the analysis.

L. To the design of other technologies

The three prototypes examined in the cases studies had been considered as prototypes of City Mirrors because their intrinsic nature was to be multi-stakeholder, multipurpose, and multi-scale platforms oriented to support multiple forms of collective actions. In addition, these prototypes were all "city technologies" in the sense of platforms looking at the city as a social and political entity, space of actions, interests, competing goals and so on. This profile is still extremely rare or virtually not existent for current web-based technologies. However, as widely discussed in the initial chapter of this work, there is growing interest to move in this direction, but practical examples are not yet available. Thus, the findings of this work have the potential to be transfered in other experimental multi-stakeholder, multipurpose, and multi-scale platforms (even if not focused on the collective activities in the city) or to other attempt of developing "city technologies" (even if focusing on narrow domains or settings).

At the same time, the insights associated with specific solutions (e.g. map-based interface, absence of user profiling mechanisms) and applicative scenarios (e.g. temporary urban activities, fluid hierarchies settings) can potentially serve the purposes of commercial applications, not oriented to support collective actions, local development or city operations in general.

M. To other cities and social settings

The study had been entirely conducted in Italy and the UK, two countries characterised by institutional contexts presenting radical and profound social, cultural, economic, and normative differences. Within these countries, different cities had been considered in the empirical activities (in the UK, London and Milton Keynes, and in Italy, Turin, San Dona' di Piave, but also many other cities at a regional and national scale). This aspect of the work served as a sort of testbed to prove the transferability of most of the findings and their possible generalisation.

However, both the UK and Italy are Western European countries, and further studies are needed to assess the transferability of the findings from these social settings to others where the institutions and norms regulating the relationships among different stakeholders in urban contexts can follow other principles. Also, in this case, the transferability of findings depends on the granularity of the analysis. For instance, the dynamics of groups, organisations, communities and networks had been already recognised as quite stable across different cultures, even though the specific norms of each type of social structure are strictly dependent on the context. Thus, it is plausible to think that a part of the findings related to dynamic patterns only can be generalisable and transferable. At the same time, specific needs or expectations associated with the use of technology or to a particular domain of city activities require a higher level of abstraction.

6.7.6 LIMITATIONS OF THE RESEARCH

The intrinsic limitations of the research are related to the operational framework context of the research process, the obstacles for a more extended data collection, and the necessary selectivity in the data analysis.

N. Related to the operational framework of the research process

The research process carried out to prepare this work had been framed firstly by the **time constraints** of my PhD programme, lasting three years, and forcing for planning fields activities and empirical research accordingly to deadlines internal to the programme. In my specific case, other external time constraints were also set by the rapid progression of the projects in which I had been involved professionally and as a researcher and that I analysed in my case studies. Every project entailed deadlines for conducting participatory activities and, especially in the first case study, the participants themselves set the timing for their collaboration in the research often in relation to their own projects and initiatives [see section 7.3., chapter 7]. Thus, I had to organise data collection activities accordingly to these multiple level of time constraints and proceed in parallel with data analysis activities.

Being this work related exclusively to my PhD research and not directly to funded projects, the **economic resources** available for research activities were quite limited, and most of the engagement process had been carried out voluntarily in a self-financed way, investing time aside strictly professional activities and with limited means. This framework implied also the need of thinking to alternatives to compensation for the participants in the research, such as help and digital training, but not always this ensured a full cooperation on the co-generation of data*.

Other over-determined constraints concerned the **cities for the empirical activities**, determined by personal and professional circumstances. While I specified before that these cities provide interesting settings for the exploration of city dynamics recurring also in other context, they had not been explicitly selected on the basis of these qualities.

Lastly, the three projects of the case studies originated in a **University environment**. While this circumstance offered a high-level of flexibility and freedom, the followed design research processes had been disconnected or under looked the typical constraints of technology design and development in industry. Thus, the **technical and economic feasibility factors had been less central in the evaluation of the solutions**. On the other hand, the university environment did not ensure the conditions for fully implementing and testing the proposed solutions emerging from the design research or determined a significant detachment between research findings and transfer in the prototypes, limiting the chances for in-depth evaluations.

O. Related to the data collection

The collected data* had an intrinsic **low accessibility** because not formalised or usually documented. For instance, the local dynamics impacting on the choice of some stakeholders over others for long-term cooperation in critical domains, or the reasons for internal conflicts among units belonging to the same organisation while distributed at the regional scale. The adoption of Action Research methods combined with the introduction of an external object as trigger for letting to emerge these dynamics, essential to correctly defining the role of technology in these cases, certainly left part of the aspects to be considered underexplored. Thus, the **completeness of data*** is impossible to assess. Nevertheless, preliminary answers to the research questions and a preliminary theory can still rely on a rich and dense corpus of information in line with the goal of this work.

As regarding the "**population**" considered in the data* collection, the three case studies provided a wide range of opportunities to gather perspectives and points of view from a variety of subjects representing almost every age-band, socio-economic group, operating in a variety of sectors and with diversified level of digital literacy. However, the research did not aim to balance the various segments of the population, focusing instead on the analysis of the social structures framing their actions.

Another limitation related to the data*collection concerns the **impossibility to transfer in an explicit form the informational content of human interactions** with the participants in the case studies, the living experiences shared with them and the implicit connections between circumstances, personalities, behaviours and so on. On the other side, also the generation activities strictly related to the design and co-design sessions are particularly difficult to be traced. Along the research process, I tried to keep notes also related to these aspects, but necessarily they are partial and not legible for external assessment without their detailed contextualisation.

P. Related to the data processing

The considerable quantity of data* and materials collected along the research process would open a number of potential options for its analysis, starting from the selection and ordering of the most relevant material or significant examples to illustrate specific practices, dynamics, preferences in the use of the prototypes. Multiple narratives and points of view could be explored by referring to all these materials, but I had to focus my attention of the elements strictly related to the formulation of the research questions. I had also to consider that the processing of these materials had been implemented autonomously.

While the following chapters reporting on the case studies tried to condense at least the most characterising aspects of each projects, certainly they would have deserved more space and a higher level of detail to completely appreciate their value.

6.8 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 6 to the three outcome spaces outlined in Chapter 2, section 2.7, by briefly describing them in the table below.

Table. 6.3 Mapping of the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 6
SYSTEM KNOWLEDGE	THEORETHICAL CONTRIBUTION	
	METHODOLOGICAL CONTRIBUTION	[SECTIONS 6.3, 6.4] Chapter 6 includes an in-depth critical discussion of limits and potentialities of case study research, and in particular design case studies, outlining the possibility to pursue design and research activities (intrinsically linked to contingencies) within a coherent, comprehensive, long-term, contingencies-independent research agenda. Considering the complexity of the problem under study in itself, the circumstances shaping the case studies, and the goals of this work, Chapter 6 also introduces the development of **variants of Action Research and Grounded Theory methods combined with Design Research and Research through Design methods**. These variants, such as for instance, the serial, bilateral and enacted action research, will be furtherly described in association with the case studies in Chapters 7,8,9.
	EMPIRICAL CONTRIBUTION	
TARGET KNOWLEDGE	FOR RESEARCHERS	[SECTIONS 6.1, 6.2, 6.5, 6.6] Chapter 6 highlights **practical aspects and issues concerning the research methods applicable in urban disciplines and informatics to investigate a deep design problem**. These issues start with the linguistic differences in defining components, levels and steps of research methodologies. These issues are also often accentuated along the research process by the adoption of deductive and inductive logics that tend to set the boundaries of investigation within one discipline (providing the theory to be confirmed) or over a limited set of case studies (providing inputs for theorisation). On this background, Chapter 6 proposes to adopt abductive logics to build bridge among disciplines by synthetizing knowledge and methods consolidated in distinct domains to instrumentally orient and optimise empirical and applied research explorations. Then, Chapter 6 provides a **practical example of this hybridisation of methods by explaining and analysing strategy, criteria and choices to build the case studies and readapt research techniques and tools commonly used in urban disciplines and informatics for new purposes.**
	FOR TECHNOLOGY DESIGNERS	
	FOR URBAN PRACTICTIONERS	
	FOR CITY STAKEHOLDERS	
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNWOLEDGE	USERS	
	CITY	
	TECHNOLOGY	

PUBLICATIONS

The following publications and/or presentations include part of the contents or concepts presented in Chapter 6.

- UNDER REVIEW. Lupi, L., ***Design of City Technologies: A Transdisciplinary Methodological Framework*** *[Journal Paper]*

- Lupi L., (2019). ***A transdisciplinary perspective on the design of city technologies: Touchpoints between Informatics and Urban Disciplines.*** AESOP Conference 2019 , July 2019, Venice (IT). Conference Proceedings – ISBN: 978-88-99243-93-7 *[Conference Paper]*

- Lupi L., (2019) ***Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development***, IASDR 2019, Manchester, United Kingdom. *[Long Conference Paper]*

- Lupi L., (2018). ***Mirroring the City. Toward Web-Based Technologies to Support City Stakeholders in Local Development Actions***, Extended abstract at the Swiss Inter- and Transdisciplinarity Day 2018 – Inter- and Transdisciplinarity in a Digital World, Lausanne (CH). *[Extended Abstract, Poster and Conference Presentation].*

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CHAPTER 7.

CRAFTING A
CIVIC SOCIAL NETWORK

CHAPTER 7. OVERVIEW

Chapter 7 reports on the process of **crafting a civic social network**, FirstLife, through the exploration of alternatives for reversing the conventional logics of mass social network toward anti-personalistic purposes and **collective practices in the city context**. This case study provided the opportunity of investigating current social dynamics at the local level and several *"practices-yet-to-come"* in order to experiment how getting web-based technologies closer to the social desiderata of city stakeholders, their actual needs, and the challenges of supporting the orchestration of their activities. In relation to the goals of this work, the FirstLife platform constitutes a first example of ***"City-Mirror-in-the-making"***, intended to address the needs of multiple stakeholders, their different purposes and actions at different scales and in various domains of local development.

Chapter 7 is organised into seven sections, as follows.

- Section 7.1 synthesises the **essential characteristics of the design and development process of FirstLife** considered for the research design and the construction of this case study.
- Section 7.2 provides some key elements to frame the typology of the platform constituted by a civic social network in relation to the research on **civic technologies** and in reference to the model of the City Mirror.
- Section 7.3 explains the **structure and implementation of the design and research process** associated with the case study.
- Section 7.4 analyses the progressive **reframing of the intervention and design space of FirstLife**, in relation to the development of the prototypes and the real-world experimentations associated with the the participatory design process of the platform.
- Section 7.5 describes the **applicative scenarios of the FirstLife platform** and how they informed the design of a platform aimed at supporting a variety of activities and initiatives
- Section 7.6 formulates the preliminary answers to the **research questions** (stated in Chapters 3 and 4) based on the design and research process of the Firstlife platform.
- Section 7.7 summarises the **chapter contributions**, according to the outcome spaces of transdisciplinary research.

Connection with the previous chapters. The case study of FirstLife, as a first and vast case study on the prototyping of a City Mirror provided solid basis to start the investigations about the interconnection among users, city activities, and web technologies in several applicative scenarios. At the same time, it allowed to identify the lines of research explored in the following two case studies reported in Chapters 8 and 9. The core models described in Chapter 5 oriented and informed the analysis of the case study, developed according to the research methods and techniques introduced in Chapter 6.

Connection with the following chapters. The research activities associated with this case study contributed to a preliminary definition of the core concepts about the representation of the physical system of the city, in its spatial and material components, as well as other principles further elaborated in Chapter 10.

CHAPTER 7. DETAILED TABLE OF CONTENTS

7.1 SYNOPSIS OF THE CASE STUDY

The case study about crafting a civic social network presented in this chapter is associated with the development of the FirstLife platform. As introduced in Chapter 6, section 6.5, FirstLife was a platform developed at the Department of Computer Science at the University of Turin (IT) by the "Social Computing" Research Group. The platform had been incrementally refined and expanded across several sub-projects and initiatives held in collaboration with local partners in the city of Turin (IT), but also in the Piedmont Region and in other territories in Italy. The main goal of the platform was defining a new model of online social network aimed at supporting local activities, initiatives and projects connected to social innovation processes.

The framing of FirstLife as a case study of *"City-Mirror-in-the-making"* is outlined in the schema below [Fig. 7.1], summarising how different aspects related to its design and implementation process had been considered in the research design within the overall multi-case study strategy (see Chapter 6, section 6.3).

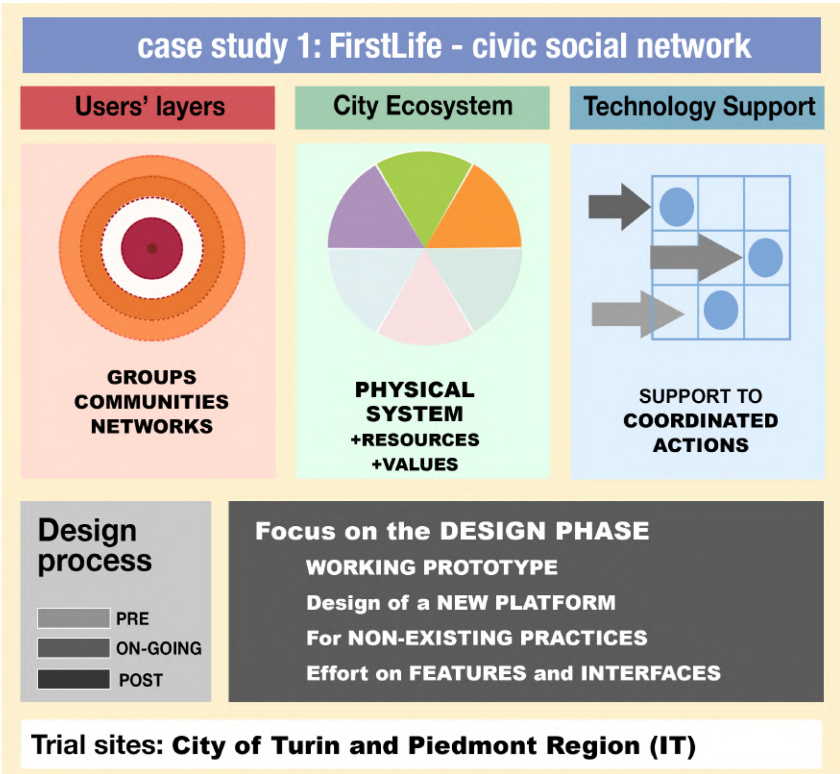

Fig. 7.1 Synopsis case study 1

This first case study provided the opportunity of investigating:

- representation, roles and actions of **groups, communities and local networks**, engaged or promoting local initiatives of public relevance
- interconnections and interdependences between the **physical system** of the city, its resources and the different scales of actions of the various stakeholders operating at the local level
- the role of technology **to support or activate the coordination among local actions and new emerging practices** for consolidating and amplifing their impact on the city
- strategies and protocols to **connect design choices in the platform to their effect on city activities.**

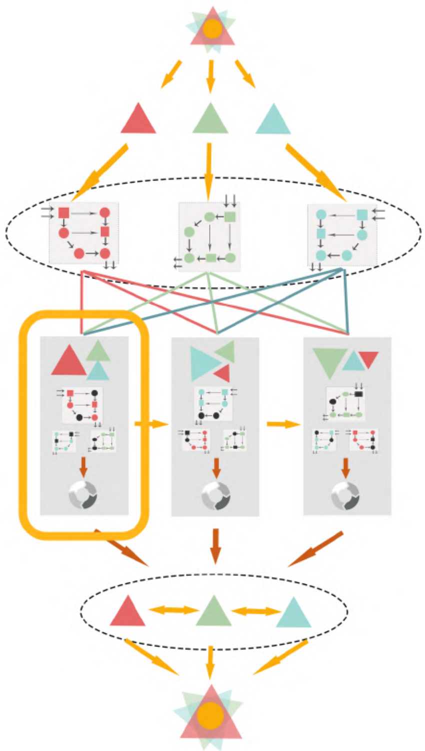

Fig. 7.2 Mapping the first case study in the TIDS protocol

Within the TIDS research protocol (see Chapter 2, section 2.4), this case study constitutes the first instantiation of the core models of the User, City and role of Technology (see Fig. 7.2). The instantiation of the models into a digital artefact is aimed at extending knowledge and understanding on the problem of connecting technologies and local development actions by supporting city stakeholders in their activities and relationships.

7.2 CIVIC DIMENSION, DIGITAL CIVICS, AND CITY MIRRORS

In this section, I am going to provide some background elements to contextualise this case study in relation to the emerging research on civic technologies as support for social innovation and new democratic forms of participation to the public life in cities.

7.2.1 CIVIC DIMENSION AND CITY DYNAMICS

The word *"civic"* is interpreted and used in two very different ways, both when talking about urban initiatives or digital technologies. Indeed, in most of dictionaries[1] in various languages, *"civic"* is translated as:

[1] Examples of the definitions of the word "Civic" limited to the languages I am familiar with.

- English. Oxford Dictionary. "Civic". 1. Relating to a city or town, especially its administration; municipal. 2. Relating to the duties or activities of people in relation to their town, city, or local area. Cambridge Dictionary. "Civic": of a town or city or the people who live in it.
- French. Dictionnaire Larousse. "Civique": relatif au citoyen, à ses droits, à ses devoirs, à son rôle dans la vie politique. In parallel, the alternative term "citoyenneté" indicate both a juridic status as "citizens" and social roles related to the values of "civilité" (respect and tolerance for people), "civisme" (respect of rules and awareness of personal responsibilities

a) the adjective indicating something that is related to the citizenship (i.e. rights and duties of citizens) of **individuals under a common authority**
b) or as something related to what is "of the city", in the sense of **what concerns the city, happens in the city, is done for the city, belongs to the city**.

Both these meanings look at the city as a social and political entity constituted by the people living in the city or acting in the city. While the two meanings of *"civic"* partially overlap in their operational outcomes, the preference attributed to one of the two are based on strong assumptions about the roles of individuals and government in society. This kind of preference has practical implications on the way urban initiatives or digital technologies are framed to support social innovation processes or new forms of participation to the public life in cities. The attention could be either on **improving the relationship between citizens and governmental institutions** or, in alternative, on **supporting the collectivity in its own activities and goals** (independently from local authorities or without a specific focus on civil rights).

An extensive discussion of the historical, religious and socio-cultural reasons influencing the preference for one of the two options is beyond the scope of my work and this section. My purpose is instead to acknowledge the two meanings commonly attributed to the word "civic" to avoid misunderstanding with readers having different sensibilities and personal positions on this matter due to their nationality, living country, standpoints, preferences, knowledge background. I want to clarify that **I use the word "civic" in this work for indicating what is of public relevance in the city, in the sense of happening into the public domain, or of interest for an urban collectivity, or having impact at the society level within the city, or related to the city development.** My choice is not alien in the landscape of urban disciplines.

In planning theory, especially in schools of thoughts embracing complexity principles as lenses for interpreting city dynamics, the concepts of **self-organisation** and **self-governance** are essential to investigate civic initiatives. Indeed, these initiatives are framed primarily as actions that are **independent of government actions and implemented by other stakeholders, possibly collaborating with local authorities**. The key difference between spontaneous self-organisation processes and self-governance processes relies on the fact that in the first case these **processes are not centralised**, while in the second case there must be a sort of **consensus over the goal or the decision to be taken** need to be established for combining the efforts of independent actors [Raws 2016]. In this sense, the characterisation of coordinative dynamics described in Chapter 5, section 5.4.2, is the closest one to render the peculiarities of **civic initiatives** in cities and, at the same time, to reflect on the **forms of support that technology could provide primarily to self-organisation processes and possibly to self-governance experiments.**

In urban studies, the civic dimension of city life and the analysis of its manifestations are strongly connected with their framing as social innovation processes[2]. The peculiarity of **social innovation processes is their positioning beyond State-driven and market-driven development processes** [Jessop et al. 2013]. Especially in recent years, under the pressures of economic crisis, globalisation, and digitalisation, the attention to the

toward society) and "solidarité" (as individual and collective commitment toward fraternity and equality, especially toward vulnerables). [https://www.vie-publique.fr/fiches/23857-quelles-sont-les-valeurs-attachees-la-citoyennete].

- Italian. Dizionario Garzanti. "Civico". 1. Che è proprio dei cittadini, in quanto appartengono a uno stato, sinonimo di "civile". 2. Di città, comunale, municipale.
- Spanish. Diccionario of the Real Academia Española. "Cívico". 1. Related to the city. 2. Related to civism (intended as civic attitude, not as juridic status).
- Arabic. Almaany English Arabic Dictionary. [madaniyy] 1.Relating to, or derived from, a city; related to the adminsitration of a city; relating to an individual as a member of society (as concerning its responsabilities but also sense of belonging).

[2] The literature on social innovation is highly multidisciplinary, covered by domains ranging from political sciences, social sciences, business and economy disciplines, and not only by urban studies, even though the local dimension of social innovation processes and their prevalent contextualisation in city settings.

local dimension of development at the city level (and at lower scales such as neighbourhoods) highlighted the importance of **collective actions to address local needs neglected by current services, policies and institutions**. These collective actions having a strong civic connotation emerged as *"transformers"* of the spatial relations among city stakeholders [Moulaert 2013, 2016]. As a result, social innovation processes *"move the boundaries"* [Moulaert & Mehmood 2011] among these actors leading to **socio-political changes** involving changes in the **communication channels and operational protocols** among different groups in the city, in the **provision of services and distribution of income and wealt**h among new segments of the society, in the modality to shape **new institutions for decision-making and participating in local development** dynamics [Moulaert & MacCallum 2019]. The direct effect of these changes is the slow and unpredictable **shift of powers and responsibilities conventionally attributed** to specific organisations and classes of stakeholders (see also Chapter 5, section 5.4) based on plastic rearrangements of their missions, competencies, and actions.

This background implicitly reveals that the choice of focusing on the civic dimension of city life as the one of fluid arrangements among city stakeholders relies on the assumption that **everyone in the city transforms the city** (to a certain extent) to meet new needs and create new collective visions in self-organised forms and within social innovation processes. City life is the result of the contribution of each social entity to the local development, not limited to public authorities and marginally involving them in most of the cases.

Two examples can clarify this point. When a number of small shopkeepers in a deprived neighbourhood individually decide to move their activities in other neighbourhoods with less criminality and more commercial exposure, they are collectively shaping the life of a city and the local government is not directly involved in their choices. Still they impact on local development at large. When a major bank foundation finances every year over 1200 projects in a city of less than 900.000 residents (1 project every 750-800 people) is not just shaping the life of a city. That stakeholder is also implementing a specific agenda and vision of the city by engaging (and financing) hundreds of local organisations to fulfil that vision year after year, independently from the one that local government could have for the city. Not necessarily a worst or better vision, but definitely concurrent with the one of the government or other actors, even assuming the existence of transversal coalitions of goals and interests among the most powerful stakeholders in the city [see the theories of urban regimes to this regard, Dowding 2001].

These are just two examples extracted from the specific context of this case study, the city of Turin. Exactly as many other examples that will be provided along this chapter, they highlight how **a significant part of local dynamics is not traceable back to the relationship between citizens and government, even though they have a political driver** (while they are not related to politics or political activities) and push for socio-political changes. In their attempt to address local issues and meet new needs, these self-organised operations of some city stakeholders have **a clear impact on the public domain, on the interests of the collectivity, and they change the way a part of city is lived, perceived, and transformed**.

As I tried to explain in Chapter 3 (see section 3.5.), this kind of dynamics is invisible in current web-based technologies for cities. Getting them to emerge requires a digital environment where the mutual relationships among city stakeholders can be configured analogously to the offline dimension, that is the purpose of investigating how to design city mirrors that have the *"political soundness"* as a paramount.

7.2.2 PERSPECTIVES ON CIVIC TECHNOLOGIES

Among the disciplines considered as roots for this study [3], HCI is the domain more invested by a certain interest in civic technologies. Since 2014, research on ***Digital Civics*** (as cross-disciplinary[4] area of research) started to outline the horizon for framing **civic technologies as enablers of new models of organisation, services provision and citizens empowerment** [Vlachokyriakos et al. 2016].

7.2.2.a Main themes in the HCI research on civic technologies

Considering that t**he theme of the empowerment of citizens is frequently recurring in the research on civic technologies**, it is important distinguishing between technologies enabling citizens to act (*power-to*) and technologies aimed at rebalancing their role and capacity to influence institutional and informal decision-making processes (*power-over*) [Schneider et al. 2018]. The boundaries between these two forms of empowerment are quite uncertain at the city level because only the understanding of the *"social geography of local practices"* can lead to design technologies able to generate significant changes for the activities of city groups at the local level [Taylor et al. 2014]. Olivier & Wright [2015] insist indeed on the value of the engagement of communities and local stakeholders to *"truly empower citizens"* in shaping *"a new model of citizen-led service commissioning"* to improve public services. Hansen et al. [2014] mark the role of technology as intermediary (or *"broker")* to connect local needs to the people able to implement collective actions.

Working at a city scale, Boehner & Di Salvo [2016] identified several tensions between issues and opportunities associated with the design of civic technologies (in particular data-centred technologies). They include issues related to the accessibility of information, fragmentation of technology solutions, digital literacy of users, but most important the **need for new guiding metaphors in the design of civic technologies.** The authors point out that these metaphors should be alternative to the one centred on business innovation because civic innovation do not follow the same logic. However, the characteristics of this alternative logic for designing civic technologies are not clear yet, even though other researchers are keep going to investigate and experiment the possible options [e.g. Golsteijn et al. 2016].

Other researches on civic technologies at the local scale insist on the importance of **trust between government and citizens to give civic technologies the chance to possibly work** [Harding et al. 2015, Corbett & Le Dantec 2018]. Public trust is seen indeed as a pre-condition for the use of technology and one of the goals of technology is identified in reinforcing public trust in settings troubled by possibly conflictual relationships. An alternative space of intervention for civic technologies is identified also outside the sphere of mutual trust, as support to forms of activisms and participation to public life organised through informal or "illegitimate" channels [Asad & le Dantec 2015].

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[3] Extensive research and effort are devoted in the domain of Information Systems to the analysis, design and evaluation of e-government technologies. Sometimes, in HCI, the label civic technologies actually indicates e-government technologies, seen from the perspective of end-users [e.g. Corbett & Le Dantec 2019] increasing the confusion around this class of technologies. However, research in Information Systems over topics related to e-gov technologies focuses on the bureaucratic part of the processes aimed at enabling new forms of interactions between citizens and governments, without investing the aspect related to political consideration and to governmental actions (to do not be confused with administrative acts, that are the bureaucratic ones). Bureaucratic aspects can indeed be easily modelled, potentially transferred, and tested in their digital translation. So far to my knowledge, attempts in Information System research to address the civic dimension beyond the technology-mediated relationships between citizens and government are not documented.
In the domain of CSCW, there are a few works introducing the possibility to use the institutional analysis for better understanding civic practices at the city level mediated by technologies intended for collective uses [e.g. Weise et al. 2017], going beyond the ethnographic study of collective practices. Nevertheless, they remain isolated examples.

[4] According to the definition provided in Chapter 2, in this case, we have an interdisciplinary research capitalizing contributes from many disciplines to outline a research agenda in the domain of HCI.

A parallel perspective is taken by researchers promoting instead the **value of co-designing and making visible and tangible objects placed in the city** to make manifest the opportunity for people to see local needs addressed [Fredericks et al. 2016, Foth 2017, Taylor et al. 2018, Fredericks et al. 2019], moving the focus of interactions among different subjects from immaterial aspects (such as mutual trust) to physical signifiers.

Given this general background about the main themes in the research on civic technologies in HCI, I want to point out that the prevalent meaning attribute to the word "civic" in this domain is the one related to the intermediation of the relationships between government and citizens. This element already generates a distance from the perspectives on the civic dimension of local development processes highlighted in the previous section, even though the ideal of contributing to socio-political changes through appropriate technology is actively pursued. I am also forced to make explicit what, in my opinion, is missing in that picture and why. This is essential to outline potential touchpoints between the two radically different visions of the world associated with the word "civic" and an operational bridge between studies focused on self-organisation and social innovation on one side, and the design of civic technologies on the other side.

7.2.2.b Framing of civic technologies and political and legal frameworks

As I stressed already in Chapters 3 and 5, the political and legal frameworks of urban settings and digital technologies determine in substantial ways the operations that can be done in a city, and consequently the ones that could be possibly mediated or supported through technology. On the other hand, I remarked a few times that the design of technologies for cities, in particular those oriented to support collective actions, are not commercial customer-centred tools (as also highlighted for civic technologies by researchers in HCI such as Boehner & Di Salvo). The paramount of the *"political soundness"* (see Chapter 3) for such technologies imposes to keep a broad look at the context in which these technologies should be integrated.

In urban disciplines, primarily planning theory and urban studies, reflections about the practical aspects of the political and normative context in which planners and urban practitioners operate are central to inform and assess design, strategic and policy choices. On the contrary, despite growing interest for the political aspects related to the design and use of technologies is emerging in HCI, it is hard to state that in this domain there is a consolidated political literacy oriented to action and mature enough to codify and connect the purpose of technologies and their instantiations in specific tools with the inputs and implications related to their political and normative context of use. Civic technologies, unfortunately, are the most emblematic example of this gap for the reasons I am going to expose.

Almost the totality of published research on civic technologies is contextualised in Anglo-Saxon countries[5]. These countries, as well as others formally assimilated at a normative level (50 in total over almost 200

[5] It is quite enlightening and extreme the example of the book *"Civic Media: Technology, design, practice"* [Gordon & Mihailidis 2016], intended to provide a comprehensive account over civic technologies from a theorethical and empirical perspective. In that case, 52 authors over 56 studied and/or lived and/or worked in Anglo-Saxon countries (the three conditions combined in most of the cases). Inevitably, the vision of civic technologies emerging from that book reflects a very specific perspective over what is civic, what is the roles and purpose of government, what citizens are supposed to do or aspire to, and so on. This is perfectly fine and extremely interesting. Unfortunately, the point of the book was not to provide an anthropological and cultural account over the Anglo-Saxon perspective on civic media, but outlining what civic technologies are supposed to be (for everyone else). None of the authors self-reflects on the fact that this vision is not universal. The aggregation of authors having a homogeneous background instead mutually reinforces their respective positions in a sort of continuous totalising echo. The value of the presented contributions and the book as a whole is not questioned, but it also exemplifies the shortcoming that could originate from an unconsolidated political literacy consciously linking political and normative context to the framing of technology.
I did not count yet the number of authors from/working in Anglo-Saxon countries writing on civic technologies since 2014 in the major HCI venues such as the CHI conference. However, they are more than the net majority. Again, this is not a problem in itself. It is just an issue for the communication, expression and inclusion of other perspectives that are distant from the common ground of the majority. The appreciation for isolated "exotic" perspectives does not suppose unfortunately constructive understanding and contamination.

countries legally existing), are regulated by the "Common Law"[6]. Never in the research on civic technologies there is any reference to the fact that is carried out in a specific kind of normative framework deeply conditioning at a structural level what is admissible and considered as related to civic matters (and therefore directly informing values and ideas associated with civic technologies). This legal framework does not even cover the majority of people or countries in the world, because for instance other 100 countries are regulated by the "Civil Law"[7] and the remaining ones by traditional law systems combined with common law, civil law or both.

The equivalence between civic technologies and technologies for advocacy, civil rights activism, collective learning, public awareness over environmental and social challenges is the result of contextualising the research on these topics under a Common Law framework. In these technologies, **the emphasis over personal empowerment, the recurrent goal of building a provisional sense of community of place (assumed as existing and central social structure), the importance of amplifying marginal voices to get theirs needs closers to the (political) decision makers clearly reflect the peculiar logic of Common Law systems.**

This characterisation of civic technologies is indeed strictly related to the fact that **Common Law ensures freedom of expression at every level and in every form** (except in the countries where is just formally adopted and not necessarily coupled with democracy). At the same time, **it does not provide certainty over the risks related to act beyond the boundaries of what is established already by conventions**, except than within what is regulated by contracts[8] among two parties, arrangement that can virtually cover any action. On the contrary, **Civil Law systems can be more or less restrictive over the boundaries for the self-expression** of individuals and organised formations[9], and these boundaries change over time under external and internal pressures on the legislative bodies. However, **Civil Law systems provide certainty over what is considered the legitimate interest of non-State actors (privates and organisations), the explicit limitations for the actions to pursue these interests, and the boundaries and procedures for the action of the State over these interests.** The certainty relies on the definition of the principles and protocols for social interactions at higher level, leaving a substantial freedom of action (and interpretation) even when the freedom of expression is not necessarily unrestrained.

In other words, individuals and organisations under Common Law can do what is already allowed and push for a more extensive interpretation of what is included within the sphere of what is allowed, without having any certainty about what is not explicitly allowed and goes beyond the virtually unrestricted freedom of expression. Under Civil Law systems, actions legitimately pursuing the interests of social parties (on the basis of given principles) are protected from third parties and from the State itself even if not explicitly listed or allowed [Merryman 1981, Novakovic 2019]. Of course, both kind of systems are oriented toward similar goals of fully functional (and often democratic) prosper societies, but they outline and implement two different strategies and set of measures in this direction [see Pejovic 2001 for an in-depth comparison]. As a result, the two visions of the space for actions into the public domain and within a civic dimension

[6] The Common Law is the legal system of British derivation in which laws are dynamically defined from custom and judicial precedents rather than being statutory laws. It is considered a bottom-up legal system with vast powers attributed to law professional and citizens, instead than being concentrated in legislative bodies.
[7] The Civil Law is the legal system of Roman derivation in which laws define principles, protections and limitations in the relationships between the State (and its bodies) and individual citizens, among citizens, among public and private institutions, among private institutions. It is a top-down system with vast powers attributed to legislative authorities at the national, regional and local level.
[8] Contracts are regularly used to mitigate uncertainty in the relationships among two parties, considering also that the Common Law do not admit contract benefiting third parties. In Civil Law systems, contracts are required in specific situations, but not necessarily required in informal or evolving arrangements that are anyway framed in the law under the principles related to the legitimate interests of the involved parties.
[9] For instance, consider the differences in the freedom of expression in Netherlands, Spain, France, Italy (that still have historical limitations) and other countries such as Russia or China. All these countries have civil law systems.

significantly differ envisaging different risks, protections and level of certainty for the agents implementing these actions, both offline or online.

The design of civic technologies necessarily has to deal with the critical difference between "safe" and "risky" actions imposing serious reflections on:

a) the context of intervention of technology

b) the awareness of the limitations and opportunities of the normative system in which a certain technology is deployed[10]

c) the ability to prevent by design risks for the users[11].

It is clear that technologies oriented to openly support the self-organisation of people in cities to take over responsibilities usually attributed to the public sector expose to significant risks users operating under Common Law systems, while the same actions are perfectly legitimate under most of the Civil Law systems that ensure the principles of horizontal subsidiarity among social forces. In this last case, there are risks of conflicts because of unplanned and too fast potential shift of power, but not legal and material risks.

Technologies emphasising the supposed impact of advocacy have less chances to be meaningful (and thus widely adopted) in settings where it is much easier to act for direct little changes than mobilising people, even though advocacy is essential in other settings to increase the chances for structural changes reconfiguring the boundaries for legitimate actions. To this regard, the practical implications for the design of civic technologies under those systems also lead to think about instruments for reaching a wide public and make them to publicly support a shared a goal or increase the sense of community, orienting the design choices toward focused digital environment. On the contrary, if the point is supporting a variety of emerging actions of small groups the openness and versatility is more crucial.

A political literacy oriented to action in the design of civic technologies should be based on critically positioning technology solutions and orientation in relation to the boundaries for the actions of individuals and collectivities within the legal framework that could privilege personal expression, political intermediation or emerging transformations.

7.2.2.c Civic technologies and forms of technology support to local development actions

Navigating the literature on civic technologies in HCI, an interesting contribution is the classification of three possible forms of support provided by technology having a civic orientation elaborated by Di Salvo et al. [2016]. They indicate the following three categories:

- *computed civics*, technology that can provide access to informational resources for civic purposes
- *mediated civics,* technology that can also provide a new frame to activities and processes that not

[10] I am not suggesting that researchers in informatics and system designers should become expert in comparative law, but just reflect on the boundaries for users' actions defined by the normative systems in which they act. For instance, urban planners are not usually experts in geology, but their basic understanding of geology is functional to prevent urban development pressures on flooding areas. In urban design, the basic understanding of economy, law, politics, history, philosophy, aesthetics is considered as essential to give a meaningful form to the identities of places and society [Cuthbert 2011], even though there are no expectations that urban designers should be economists or historians or philosophers. I want also to clarify that the lack of attention to the normative framework of actions is a generalised problem. Anglo-Saxon researchers are perhaps overexposed, over-represented, and unquestioned in their perspective while expressing a niche. But it is incorrect to suppose that researchers living in countries under Civil Law are aware of the implications of their direct experience of the norms of their countries over the approaches, goals, and outputs of their research on alternative civic technologies.

[11] The concept of preventing risks for the users by design is not new, especially in borderline domains. Common web-based technologies conceived to support minor crimes or socially illicit actions, such as streaming platforms or some e-commerce portals not preventing the sale of stolen items, minimise the risks for the providers and keep the conditions for a relative safe environment for users by design (e.g. through weak authentication procedures).

necessarily have a "civic" meaning or are of public interest as civic activities and processes
- *proxied civics,* technology that more radically can facilitate different modes and forms of actions by and in between different organisations working together or independently on an issue.

Considering the intrinsic boundaries to civic initiatives determined by the two predominant normative frameworks of action for individual and collective entities mentioned before, the instantiations of *computed* and *mediated* civics will naturally reflect a preference for personal expression and political intermediation. Differently, *proxied civics* aspire to support the experimentation of new social arrangements not necessarily feasible or safely pursuable under Common Law systems.

It must be considered that social innovation processes and civic initiatives intended as local collective actions addressing issues of public relevance are characterised by fluid social arrangements. These arrangements are intrinsically multi-actor and emergent, and most of all they question established conventions and customs. In addition, social innovation processes are ill-defined especially in the early stages of experimentation and consolidation. Their fluidity escape contractualisation because contracts allocate duties and responsibilities in a crystallised way that could actually block innovative city dynamics based on the reconfiguration of roles and power relationships among social forces. Thus, the design of *proxied civics* requires to calibrate the risks and alternatives of an over exposition of these processes against the certainty of the freedom of self-expression or the certainty of pursuing legitimate interests through non-established and non-contractualisation forms of action.

This case study is developed in Italy within a normative context under Civil Law, allowing a deep substantial freedom of experimenting a wide range of fluid social arrangements to rethink public and private services meeting local needs. Considering also the vision of the civic dimension of city life that is part of my research and design practice, the exploration of the potentialities of city mirror-like technologies aimed at supporting the orchestration of local development actions focused on actions that have very little in common with the rituals of the relationships between citizens and governments, advocacy initiatives, awareness campaigns that are commonly central in the current research on civic technologies[12]. I have analysed instead the actions implemented by different city stakeholders to practically and directly take over or possibly share responsibilities and capabilities usually regulated by state or market-driven actions (see section 7.5) for introducing systemic changes into the public domain.

7.2.3 CIVIC SOCIAL NETWORKS AND CITY MIRRORS

The case study of FirstLife is centred on the challenge of defining what a civic social network could be, in a time in which global social networks are flattening their users to the role of personal data providers and advertisement targets. At the same time, these global social networks are increasingly declaring political aspirations and implementing new institutions to govern the online public life in social media platforms. Differently from global social network, FirstLife attempted to design a platform considering users primarily

[12] The clarifications reported in this section are necessary precisely because these is a predominant concept of what is the purpose of civic technologies that reflect a very context-dependent vision of the relationships and interactional mechanisms among social parties that is the one developed in countries regulated by the Common Law. In some ways, this case study provocatively suggests that it could also exist an opposite perspective in which self-expression-centred legal systems are not universal but just a particular case or exception to systems where actions are regulated by principle and not by customs. In that cases, the only legitimate actions are limited to communication acts, ensured by principle. In all the other cases, the range of actions allow diversified and undefined forms of self-organisation, even non-contractualised. This is a crucial point for the design of civic technologies exploring alternative to web-based technologies focused on communication only.

agents of change in their environment and part of social innovation processes. This orientation determined the substantial overlapping between the characteristics of a civic social network and the design proposal of the City Mirror.

- Firstly, a civic social network is aimed at providing an environment enabling the **multiple stakeholders** involved in the City to coexist and potentially augment the impact of their local actions through a better coordination.
- Secondly, a civic social network is intrinsically opened to support **multiple purposes** associated with diverse organisational flows, type of activities, operational domains determining city life and self-organised dynamics
- Thirdly, a civic social network that is also map-based is intended to support **multiscalar** actions in the city, enabling community initiatives at the neighbourhood's scale as well as distributed services all over the urban area.

7.3 DESIGN AND RESEARCH PROCESS

FirstLife is a web platform developed at the Department of Computer Science at the University of Turin by the "Social Computing" Research Group. I collaborated in the FirstLife project from March 2015 to January 2018, by working in the development team as the practitioner in charge of the engagement of city and project stakeholders in the design process of the platform, connecting the development team with civil society organisations, institutions and privates involved at the local level. My research interests were compatible with the development process of the FirstLife platform, framing the process as the prototyping of a City Technology meant to create a multi-stakeholder and multipurpose online environment. Thus, I started reflecting, analysing, and elaborating the outputs and outcomes of the engagement and design process of FirstLife as personal independent line of research associated with my PhD research.

This section presents the analysis and discussion of the activities I carried out during my collaboration in the project from 2015 to 2017 and, in the next sections, the insights and lessons learned from the engagement process intertwined with the design and development of the platform. The contents of this chapter reflect personal insights and my perspective on the project in relation to the research goals of this dissertation[13]. The contents of the chapter do not cover the evolution of the platform after December 2017[14].

The initial idea of the platform, elaborated in 2012, was centred on the proposal of a citizen journalism platform in which crowd-sourced local news at a neighbourhood scale were complemented by augmented reality solutions. This initial framing of the platform was associated with the strong interest in citizen journalism between 2008-2012, attested also by the emergence in those years of platforms such as "Global Voices"[15] and important players such as the "Knight Foundation"[16] supporting innovative journalism initiatives. Despite the initial proposal for FirstLife won a grant of the Italian Ministry of Education in 2012, the development of the platform started only in 2015 (see footnote 22 in this chapter). In a few years, the technological landscape undertook enormous transformations. Moreover, since 2013 the concept of

[13] To know more about other research topics associated with the FirstLife project and other lines of research developed by other researchers directly or indirectly involved, I suggest reading [Antonini et al. 2018], focused on geographical aspects, or [Rapp et al. 2017] connecting FirstLife to technological support for people with autism spectrum disorder.
[14] I suggest visiting the website firstlife.org for updates on the evolution of the project after December 2017.
[15] https://globalvoices.org/ Project started in 2004 and increasingly expanded from 2006-2008. Still active nowadays.
[16] https://knightfoundation.org/. American Foundation promoting Journalism in media and communities.

Civic Technologies raised new issues and opened new research horizons for studying how web platforms could address local needs, beyond the online sharing of local information. Therefore, in 2015 the design and development of the FirstLife platform started on new basis by attempting to define what a map-based social network for civic purposes could achieve in this direction.

According to the meaning given to the word "civic" in this work (see section 7.2.1), the overall goal of the process of crafting a civic social network from my perspective can be condensed in *"getting the City in the room, a piece at the time"*. In other words, the process had been organised as a large-scale open participatory design process on multiple segments of the population, working in different sectors and at different scales, characterised by different sets of constraints, norms, and type of actions.

This attempt to structure the participatory design of FirstLife as a large-scale and open process had been set up on a few key principles that can be summarised in:

- starting from significant goals for each group and class of users corresponding to the different local actors in the city, and not from the goal of developing a new technolological platform
- managing the requirements elicitation and the design of specific features of the platform by looking at the way the stakeholders involved in the project could achieve their goals in a virtual space shared with other city stakeholders
- allowing different level and forms of involvement in the design process, always by considering each individual/potential user in a multidimensional perspective (or rather under his/her professional, territorials and political dimensions, see Chapter 5, section 5.3).

7.3.1 A HYBRIDISED PARTICIPATORY DESIGN APPROACH

The definition of the participatory design strategy and techniques in this work had been influenced by previous direct and indirect experiences concerning a-typical forms of participation in the design of information systems and in the planning domain.

In recent years, Saad-Salonen [2014] already explored the opportunity of combining the peculiar approaches to participation independently developed within these two macro-spheres. In both cases, progressive levels of engagement of participants can be observed in the structuration of the design processes, ranging from "staged forms of participation" to the actual co-design and co-implementation of the interventions, according to the author. On one extreme, the role of participants is limited to task decided by the designers or planners (e.g. consultation or testing), while at the other extreme the participatory process is seen as a way to actively support the self-organisation of the participants but also to design technologies shaped by their use in the context. In her work, Saad-Salonen focused on participatory design processes aimed at developing digital planning tools and she examined primarily the corresponding levels of openness and inclusiveness toward the participants' inputs from a system and planning perspective.

While taking into account her experience and adopting a similar orientation to establish operational correspondences, the challenges posed by the case study of FirstLife required to also consider other experiences. First, experiences not necessarily focused on digital planning tools because I interpret a planning perspective more in strategic terms than procedural, and the aim of a civic social network was distant from the ones commonly associated with urban planning operations. Second, experiences providing inputs on large city-scale participatory processes, potentially conflictual environments and the combination and coexistence of a variety of forms of engagement.

To this regard, the most comprehensive experience I had been able to reflect on (and be inspired by) was the participatory design process implemented for developing the General Plan of Rome (Italy) from 1995 to 2008. Even though this experience is scarcely documented in academic literature, especially in English[17], it constituted a direct continuous evolving case study during my years of university, dissected under very perspective (procedural, normative, social, economic, historical) and used to reflect on radical planning practices and those innovative forms of citizens' involvement advocated for the XXI century [Innes & Booher 2000].

This case of participatory design was an extraordinary experimentation of a large-scale PD process extended to the entire city of Rome (2.8 M residents), involving hundreds of groups over time, from primary-school children to retired clubs, from real estate developers to grass roots organisations, authorities at every level and universities, and so on. The forms of involvement ranged from the collection of needs and inputs, to institutional forums for multi-level decision making, to hand-on interventions. The central idea was that all the feasible transformations that could benefit the life of people in many neighbourhoods had to be concluded even before the approval of the Plan and shape the planning directions themselves (i.e. *"planning-by-doing approach"*). This approach was determined by practical contingencies related to potential political conflicts associated with the approval of the plan and political changes in the city administration, but also by the intent of rethinking the planning process in fluid forms negotiated between professionals and all the interested parties in the city and reactive to local transformations and opportunities. The goal of the process was to formulate the General Plan (i.e. the corpus of strategies, city laws, regulations, and financial instruments for the future development of the city), but the priority along the process had been given to the essential needs and expectations of the groups involved in the participatory activities to ensure that its implementation could become reality, differently from the previous Plan formulated in the 60's and marginally implemented over forty years.

Several choices made in the definition of the participatory design process for FirstLife tried to incorporate the principles and inputs coming from the experience of the General Plan of Rome:

- **openness to different segments of society**
- **coexistence of multiple engagement forms**
- **dynamic balancing of the role of designers and non-designers**
- **focusing on the participants' goals instead than on the development goals to search for small concrete and direct impact of the process on real-world activities** (before than the actual platform could be made largely available).

Clearly, the differences with the Rome's example were substantial in my case study. Extremely limited resources on one side, limitations of an academic-driven project on the other side, and the fact that the design of an information system is way much more abstract and less understandable or engaging for people than interventions visibly changing their living environment.

**** This section is to be integrated here with the reference to PD strands and evolution in system design.

- Utopia and Demos > similarities and differences, aspirational but sectoral (and wanted, plans are not)
- Large scale engagement & system design> Antonella De Angeli, Susanne Bodker
- Issues future participatory design > Wagner > Bardzell and King > polical driver / political camuflage

The challenges of a long-term large-scale participatory process in urban context evolve over the time, but they can be grouped in conceptual, ethical and pragmatic challenges on the basis of the classification presented by Vines et al. [2013]. In this case, the **conceptual challenge** was the relationships between

[17] See the volume 116 of the journal "Urbanistica" for a general description of this experience from the professionals and planners involved. Texts in English and Italian.

platform designers, city stakeholders involved in the process, and the general vision about the platform evolution of its promoter.

The hardest **ethical challenge** tackled during the process was making understandable to participants how their statements, feedbacks and stories could be incorporated into the design process of a digital artefact. One aspect was related to the difficulty for a part of actors involved to clearly distinguish between the participatory design of a digital urban platform and the current practices in participatory design of urban regeneration processes. Because of an overlapping of themes, such as the discussions about urban activities at local level, and the overall goal to support social activation in promoting and taking part to local transformations. Managing the expectations and correcting this misunderstanding impacted on the platform. The second aspect was the informed consent. Every activities had been always clarified in its general aim and objectives, but clearly the level of understanding and awareness was deeper in medium and long term collaboration than in one-time events.

The **pragmatic challenge** in this process was the management of a variety of participants not predetermined by the facilitators and designers, changing over time, and not necessarily fitting the model of the perfect perspective user. The process involved a wide range of city stakeholders, including representatives of public authorities, educational institutions, non-profit organization, small business, professionals; having different expectation in term of formal/informal engagement; wide range of ages, from children at the primary school to seniors over 80; different level of digital literacy, from occasional users to technological enthusiasts; different attitude toward the participation, from an active opposition to the process in itself to an active support in testing and revising the solution in their applicative scenarios. The key concern in the process was not pursuing a representative group of users from a statistic point of view. On the contrary was the possibility of reaching different groups and targets to work with for exploring the challenges of real-world settings. As a result, bout two thirds of meetings and workshops had been organised collaborating with local agencies, organizations and institutions, that invited people in their network. Therefore, facilitators had no chance to select the participants and in most of the meeting were not aware of what kind of participants they would have found at the workshops. I adopted the strategy to prepare from two to three possible schedules of the meeting to be adapted to the characteristics of the group of participants (number, ages, digital literacy, attitude, sector of activity) and to the available facilities (tables, chairs, wi-fi, devices, etc).

Lastly, as regarding the temporal dimension of participation in the city, Saad-Suloneen et al. [2018] identified two main types of temporalities in PD: a "*future-oriented temporality*" and a "*project-based temporality*", respectively aimed to "*imagine and re-imagine the future based on the present*" or defined in relation to the design process in itself, as before, during and after the design. Respect to this macro-classification, the participatory design of **FirstLife was shaped by a future-oriented temporality**. Designers and participants were completely aware of the fact that we were working on a system aimed to potentially support their practices and local cooperation dynamics and that this system was a future option to define together by challenging logics and assumptions of the existing tools. The use of the prototypes was indeed used more as a boundary object than as the concrete instantiation of this vision. The local projects supported during the engagement process were attempts to anticipate this future by experimenting alternative practices through the platform.

The following sections describing the structure and implementation of the participatory design process can be seen as a sort of "annotated portfolio" [see Bowers 2012, Gaver 2012] reporting on the rationale, choices, decision points, milestones, material and conceptual tools, purposes and outputs systematised during and after the process, and here presented in a linear way. The object of design and research in the next sections is the design process itself, instead than the platform to be developed that will be examined after that.

7.3.2 STRUCTURE OF THE PROCESS

The structure of the process for crafting FirstLife as a City Mirror can be represented by a set of three distinct spirals corresponding to three interdependent workstrands: development, engagement, and research (see Fig. 7.3). The design of the platform was the result of the continuous realignment and mutual challenging of these three workstrands, especially in correspondence with the subsequent releases[18] of the platform (indicated in Fig. 7.3 as FLv1, FLv2, FLv3, FLv4, FLv5).

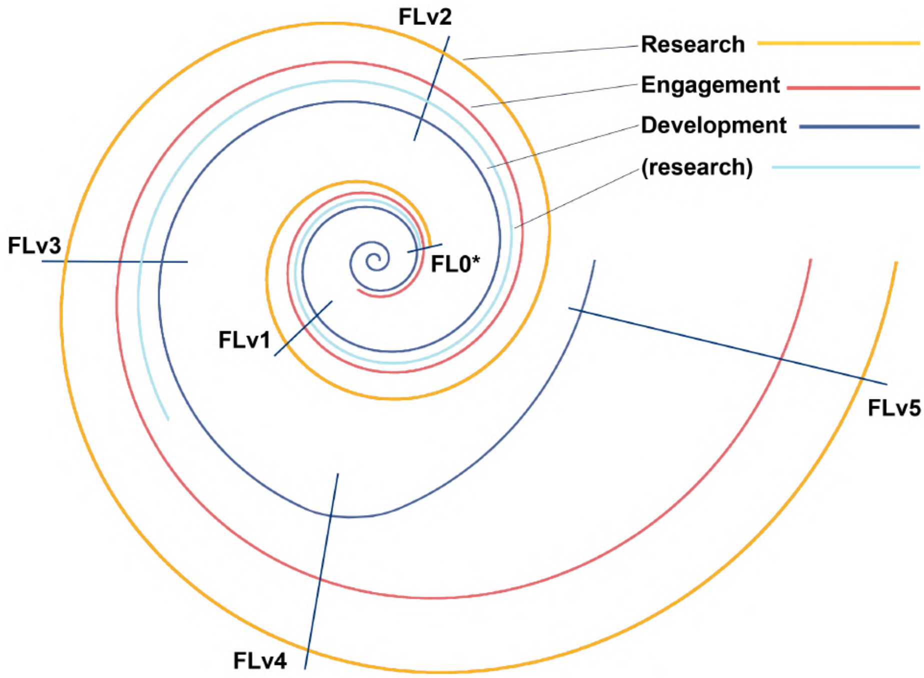

Fig. 7.3 Structure of the crafting process of FirstLife

As indicated above, the making process of FirstLife relied on a large-scale participatory design process in an agile development framework.

- The **Engagement** (red spiral) comprised the participatory design activities, but also other actions oriented to support the FirstLife project.
- The **Development** (blue spiral) enclosed the flow related to the implementation of the main platform, but also the activities related to software development for branch projects and parallel initiatives.
- The **Research** (yellow spiral) can be seen as a path accompanying the Engagement and Development strands. In this work, I focus uniquely on the research activities linked to the exploration of city technologies, and in particular City Mirrors[19].

[18] A release of a software is the version of the platform made available to users, after a period of testing on preliminary and unstable versions (usually called alpha and beta versions).

[19] I independently carried out this strand of research while working in my professional capacity with the development team (see chapter 6, section 6.7.1) and in collaboration with my colleague Dr. Alessio Antonini. The inputs from this strand of research had been integrated in the platform development through the design unit of the team, see Fig. 7.2. This strand of research, while not actively supported by the research group, was accepted because it favoured a higher level of commitment in the engagement and development activities that had a positive impact on the project in itself.

An additional research strand (light blue spiral) focused on topics of geoinformatics and directly fed by the development activities, included in the agenda of the research group incorporating the FirstLife development team[20].

The three spirals schema is however a drastic simplification of the actual structure of each workstrand and its relationships with the other two workstrands. In the next sections, I am going to discuss in detail each workstrand to clarify their components and the type of activities and output related to the investigation on City Mirrors "in-the-making".

A better understanding of the process and the following description of the three workstrands can be facilitated by outlining the composition of the **FirstLife team from 2015 to 2017** (see Fig. 7.4). Indeed, the key challenge of an operational context characterised by the extreme fluidity of engagement and development activities was harmonising the activities of all the people working within the project. In this case, the practical arrangements[21] included:

- **a central unit connecting the inputs coming from the Engagement process to the Development process** through the requirements analysis and the definition of the design solutions to address the emerging needs and applications of the platform. The unit was composed by two people respectively:
    - in charge of the Engagement process and in direct relationship with the city stakeholders involved in the process, covering the functions of Product Owner[22].
    - acting as Development Coordinator[23] and managing the platform technical team as Technical Lead.
- **a technical team composed by the Development Coordinator working also as front-end developer[24], a second front-end developer (working remotely), a back-end developer[25], a system administrator[26], and a data analyst[27].** The technical team had been temporarily integrated by a

[20] I collaborated in part of these research activities as regarding the analysis, design and evaluation of map-based interfaces. However, my personal contribution on this topic is discussed within the main strand of my Research.

[21] The FirstLife project had been developed within a research group in an academic context. Thus, differently from a business environment, the operational roles did not correspond to formal roles or titles or labels, but to the actual practices and decisions chains within the team. The job position of each team member was indeed defined by its formal academic framing by type of contract (PhD student, External Independent researcher, Research Associate, Professor). Academic hierarchy and project arrangements were unrelated, except for the overlapping between the role of Client and scientific coordinator of the research group. Also codified "titles" such as PI, Co-PI, Co-I, research lead, technical lead usually used in Anglo-Saxon contexts are not codified in the University Italian system.

[22] The **product owner** in an Agile team is the person collecting and structuring the requirements expressed by the stakeholders involved in the design and development process. He/She provides information to the development team "on behalf" or by representing the stakeholders needs, helping the development team to prioritise the activities aimed to fulfil the emerging requirements.

[23] The **development coordinator** is the person responsible for the management of the technical implementation of a software project. In this case, the development coordinator covered also the role of software architect, outlining the technological solutions and their combination within the development process.

[24] A **front-end developer** is the professional that develop the interfaces of web-based applications using web technologies and programming languages. A front-end developer works on the "client-side", or rather on the visible part of web-based applications with which users interact and he/she defines the logic of interactions between users and application.

[25] A **back-end developer** is the professional that develop the invisible part of a web-based application, or rather the mechanisms for connecting inputs and data within the application. A back-end developer works on defining the internal logic of an application, the database structure, the rules for the integration of data and the application features, the procedures to connect the different components of an application internally and with external services.

[26] A **system administrator** is the professional managing the IT resources (both hardware and software), in this case of a development team. He/She executes maintenance operations to improve the security and performances of systems, identifies risks and prevents practical problems, periodically supervises data backup and recovery. He/she can work also as technical helpdesk. During the evolution of the FirstLife project, the systemist changed but this role remained covered by one person at the time.

[27] A **data analyst** is the professional managing the data, in this case associated with the project. His/her activities include inspecting, cleansing, and restructuring data, but can also include the elaboration of data extracts, visualisations, analysis and integration of different data sources. In the FirstLife project, the data analyst worked also as a research assistant on location intelligence solutions.

BMP specialist[28] working on a branch project, and 5 students over three years working on their bachelor/master's thesis or training projects.

- **an engagement unit composed by the Engagement coordinator and two facilitators[29] assisting or collaborating in the field activities** (but working in different periods of 2016 and 2017) and by the data analyst of the technical team collaborating on specific projects and initiatives. The two facilitators worked also as internal testers of the platform.
- **the Client or Project Owner[30] managing the project stakeholders external to the development team, both in academia and at the local level,** and interacting mainly with the two people in the central unit. He covered the functions of **Project Manager respect to the economic aspects** of the project and high-level decisions concerning the development. By cooperating with the engagement unit, he partially covered also the role of Product Owner in relation to a part of the project stakeholders in academia.

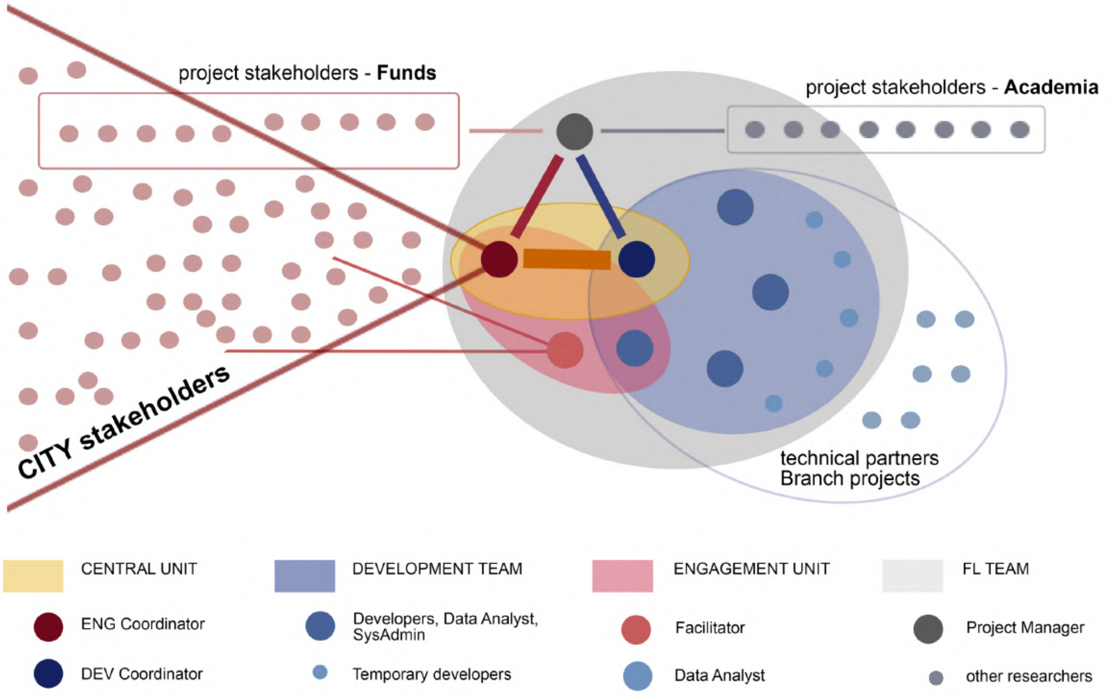

Fig. 7.4 Structure of the FirstLife team 2015-2017

The seven core members of the FL team and the Client worked in close connection for years to face the frequent rescheduling and restructuring of priorities and activities in a highly unpredictable context. Indeed, the ambitious experiment of managing a city-scale open participatory process for the design-in-use of the platform required an extreme adaptability, and both professional and personal versatility. The FirstLife

[28] A **business management process (BPM) specialist** is the professional analysing and engineering processes in business or organisational environments. He/she can act also as a developer of the specific software components aimed to align the needs and actions required in different phases of a process with a subset of features of the platform used to support the process.

[29] The **project owner**, or the Client, is the person financially supporting the project and engaged in the promotion of the project and fundraising operations. He is also the person accountable for the project in front of the project stakeholders and donors, and therefore making the high-level decisions for the future of the project. The project owner and the product owner are usually distinct roles. In this case, they partially overlapped because of the fluid roles attribution in the specific operational setting of the project within university.

project would be practically impossible without these two conditions and the constant full dedication of the team members to the progress of the platform[31].

The following analysis and reflections on the crafting process of FirstLife are aimed to depict strategies and approaches for dealing with the complexity of the city and the development of multi-stakeholder, multi-purpose and multi-scale web-based city technologies. The specific objective of the rest of the chapter is indeed unpacking rationale and criticalities of this experimental process to inform future attempts of designing city mirrors in similar settings.

7.3.3. DEVELOPMENT

The Development workstrand[32] was characterised by a **central flow of iterative cycles** of requirements analysis, design, implementation, testing, deployment, and maintenance of the platform until the next release. This central flow was accompanied by **Research and Development activities** aimed to investigate and assess the technical feasibility of design hypothesis independently from the development flow of the main platform. Then, the **branch projects**[33] provided the opportunity to explore the application of the platform functionalities in different environment and beyond the scope of making a civic social network. The main outputs of the development workstrand consisted in **five releases of the main platform** in less than three years, and **five derived platforms** associated with the branch projects [see Fig. 7.5].

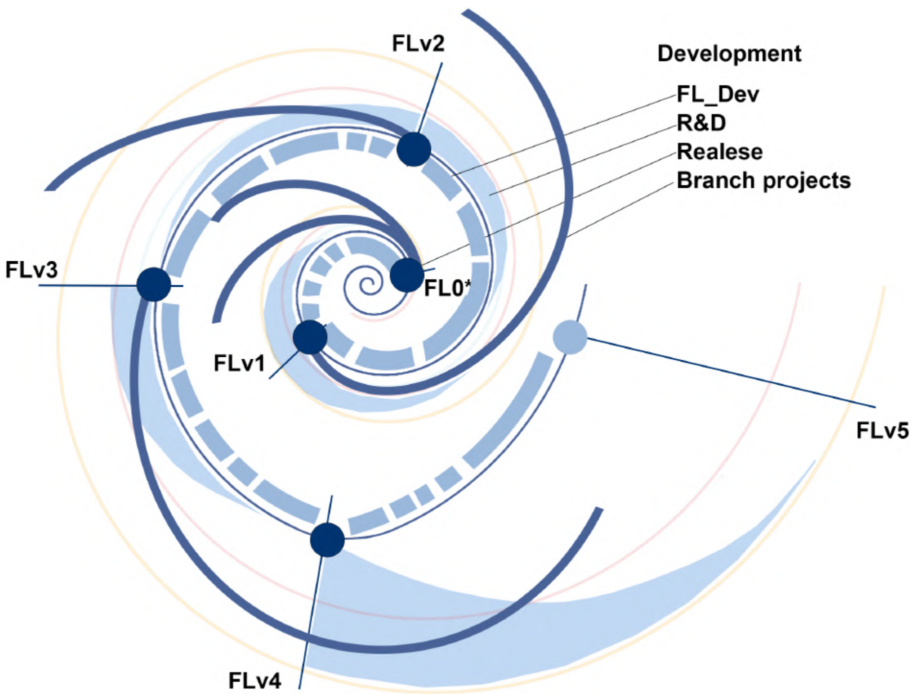

Fig. 7.5 Structure of the development workstrand

[31] The structure, members and organisation of the FirstLife team changed since January 2018. The schema reported in Fig.7.2 is not representative of the arrangements after December 2017.
[32] Another description and analysis of the FirstLife development process in 2015 and 2016 from the perspective of the Development coordinator is available in the PhD Dissertation: **Antonini Alessio, *FirstLife. Building a civic social network for supporting urban networks and institutions cooperation in daily activities*, 2016** (included in the references of this chapter). In that PhD Thesis, the author focused more on the technical aspects of the agile development cycles and their touchpoints with the Participatory Design process. This PhD thesispresents instead the complementary perspective. Considering the type of audience for this work, unnecessary technical details are omitted, and definitions are included in footnotes.
[33] The economic sustainability of FirstLife was determined by the branch projects, and not by funding related to a specific project. This situation ensured a great flexibility and independence in the platform design process, but increased also the development efforts.

7.3.3.a Main development flow

The development of FirstLife evolved by incorporating and trying to harmonise:

- the inputs coming from the heterogeneous classes of users involved in the participatory design process
- the constraints related to the branch projects and their parallel sets of requirements
- the empirical and theoretical research associated with the aim of building a civic social network.

On the other side, other inputs came from emerging technologies, tools, technical frameworks and their potential integration in the development strand. These two macro-groups of contextual and technical inputs were furtherly integrated by the lessons learned step by step testing the prototype into the real world and improving performances and usability to meet users' expectations [Antonini 2016].

This complex set of inputs and project constraints was managed through specific strategies in each phase of the iterative development cycles.

A) The **analysis of the requirements** elicited through the engagement activities usually involved multiple iterations of definition, assessment, conceptualisation and translation in inputs for the design of the platform. The analysis of each new requirement involved the following steps:
   1) **Contextualisation and characterisation of the requirement in the context** (e.g. type of requirement, functional or non-functional; type of users, organisation, or class of stakeholder; purpose of the request; occurrences of the same request by different subjects and in different settings).
   2) **Clustering of similar or intertwined requirements** (e.g. requirements related to the contents moderation or to the interaction with a specific interface component)
   3) **Clustering of the specific use cases and patterns in which a specific requirement should be meet** (e.g. spatial coordination of distributed groups or documentation of local initiatives)
   4) **Comparison among the instances supported by similar requirements across multiple uses cases** to identify the common principle or issue
   5) **Assessment of the generalizability** of the examined requirement in multiple use patterns
   6) **Early identification of risks and conflicts** of addressing a specific requirement (e.g. among different applicative domains or incompatibility with the logic and scope of the platform)
   7) **Pre-assessment and planning of the related development effort** (e.g. technical issues, timing, concurrent deadlines and flows, available human resources).

   Throughout the analysis, each requirement was considered as an *"assemblage"*[34] composed by the user desiderata or need, plus the social, political or operational factors determining this request. **This approach to the requirement analysis can be broadly defined as ethnographically informed and anthropological oriented** based on prolonged filed observations and participatory activities, but also on the study of the "invisible constraints" of people actions and practices in the context. In other words, the analysis was aimed at setting a part personal points of view (of people involved in the process) from the social, cultural, economic and legal factors influencing real social interactions in the urban environment among different stakeholders with specific roles in the city, and consequently also constraints and expectations concerning the interactions mediated by the platform.

[34] The concept of requirement assemblage is inspired by the idea of "data assemblage" elaborated by Kitchin [2014] to clearly explains how each data or information in the city the result of a complex set of social and political choices is made in a specific context to produce that information.

In this phase, the core models of the users' layers and the city systems [see Chapter 5] helped to reduce the complexity of working in multiple parallel settings and decreased the uncertainty related to the interpretation of a certain requirement in the context.

B) The **platform design** was the result of a continuous review of the compatibility and consistency of new features (hypothesised on the basis of the requirements analysis) with:
   - the general framework of the platform as civic social network
   - the potentialities of the technologies (languages, development frameworks, tools, auxiliary web services) used by the development team
   - reflections on previous experiences and tests with the current prototype
   - new research findings.

Accordingly to new emerging needs and opportunities, the design process focused on a specific feature, or on revising the interfaces, or on more substantial actions aimed to refactor the system of interactions within the application or extending and generalizing the supported workflows.

Each design intervention was always assessed against the overall design of the platform. Thus, the main criteria orienting the assessment of the design actions were:
   - the **internal consistency** of the proposed intervention (respect to the type of component or function in the application)
   - the **compatibility** with other implemented or planned design solutions
   - a balanced **trade-off between platform "expressivity[35]" and simplicity** of the design outputs.

C) The **implementation**[36] of the design proposals was a sub-process consisting in:
   1) **engineering the solution** (selection of approaches, technologies and tools, and their application)
   2) **prototyping and developing** the new feature, or interface or workflow
   3) **revising and improving the output** (e.g. by restructuring the code, debugging, solving unforeseen problems).
   4) **consolidating the implemented solution into the platform architecture.**

The developers worked on multiple development spaces where the solutions were progressively stabilized and integrated during the implementation process (i.e. FirstLife Dev, FirstLife Test, FirstLife Production, see Fig. 7.6). Another element characterising the implementation phase was the management of multiple "copies" or "instances" of the main platform, called "verticalisations", and customised for specific purposes [See Fig.7.6, and section 7.4]. The generation of a new verticalisation was a relatively ordinary activity for the development team, even though the integration of new functionalities in all of them was a delicate issue in the deployment phase.

[35] Expressivity is a term used here to indicate the ability of a design solution of serving multiple use cases in an appropriate and rich way.
[36] A detailed account of all the technica aspects related to the implementation of the FirstLife platform is reported in [Antonini 2016] for an audience of software engineers and computer scientists. The intended audience of this work is instead composed by system designers and researchers on one side, and urban practitioners and researchers on the other side. Thus, the focus is on the relationship between city dynamics and a platform modelled as a City Mirror, and not on technical aspects.

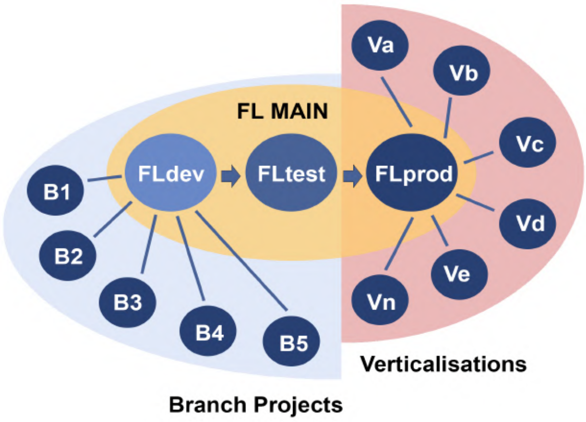

Fig. 7.6 Schema of the implementation environments of FirstLife

The main challenge faced in the FirstLife project had been coordinating and synchronizing development activities with engagement activities, especially as regarding the implementation phase of the development cycles. Indeed, engagement activities have unpredictable outcomes, but very strict time constraints (e.g. dates of workshops and events, deadlines of projects and activities). On the other side, the time required to find, engineer, and implement the technical solutions is not exactly predictable. A joint planning of the two strands of activities by the central unit was based on the reciprocal understanding of the type of effort, contingencies and risks associated with the goals and priorities of implementation and engagement[37].

D) The **testing of the implemented solutions** was decupled into an internal testing and the "test-in-use" of the platform.

The internal testing was functional and technical. The functional testing was routinely performed by at least two team members to check the platform for **unexpected technical issues**. The technical testing was done every time a change was introduced into the system: integration of new features or roll-back, porting or conversion of data between different versions of the platform, opening of new branch projects and verticalisations, propagation of the edits made to the systems across all the instances associated with the general platform.

The external testing of the platform relied on the involvement of perspective users in real working environments. Each update of the platform was tested on the field with local stakeholders, on applicative scenarios and with the target users that the implemented solutions were intended to support. **Testing-in-use protocols were used to identify usability issues and progressively refine the implemented solutions, but most of all to understand the implications of specific design choices on addressing social requirements and concerns**. As expressed by [Antonini 2016], *"Testing outcomes highlights the differences between software testing and real-life testing involving end users"*.

The testing protocol involved at least three meetings or workshops with different sets of stakeholders to evaluate together the new implemented solution and explore how that solution could fit into the current and future practices of their working environment. Issues and problems highlighted in these sessions were discussed primarily with the users in order to transform the testing session in the opportunity for better tailoring the platform on users' needs and expectations, and hypothesizing with

[37] The actual practices to perform these coordination activities had been constructed by the two people in the central unit in years of joint work, before the starting of the FirstLife project. See also Chapter 6, section 6.7.1.

them alternatives and preferential options. Testing sessions were often performed on “testing environments” of the main platform, specifically to assess new functionalities before their complete integration in FirstLife.

In a few occasions, the improvement of some platform components resulted to directly meet the requirements elicited before. In most of the cases, the testing protocol required more than one iteration to find a common ground among divergent perspectives and various uses.

E) The **deployment** consisted in a set of operations to make the new updated versions of the platform openly available to the public through the web, and not only to the users involved in the participatory design process.

The deployment could involve only the main platform, or also a part or all its verticalisations. Indeed, specific features developed to address the needs and requirements of a specific applicative domain in one or more verticalisations, if suitable to be extended to a plurality of scenarios, were tested “globally” in each instance of the prototype.

F) The last phase, corresponding to the **maintenance of the platform** until the subsequent release, was aimed to manage just technical issues reported by users or due to minor hardware or software problems. In this phase, the main platform was stable in its features and performances and actively used within local projects and activities. At the same time, the new version of the platform was under design and implementation. The length of the maintenance step within the development cycles increased from one version to the next one because of the extended time required for progressively refactoring the entire system taking into account the increasing complexity of the platform functionalities.

My contributions to the main flow of the development process were concentrated in the phases of requirements analysis, design and testing-in-use of the platform.

7.3.3.b Research & Development activities

R&D activities within the FirstLife project consisted in experimental paths to explore design and technological solutions for expanding functionalities and expressivity of the main platform. These activities were organised and carried out in parallel to the main development flow and outside the general platform of FirstLife. R&D activities were instantiated into **spikes and proof of concepts**.

A **spike is a provisional software development environment**, that usually is a simplified version of the platform under development. A spike is used in three main ways:

- helping the developers and programmers **to learn** and get familiar with new technological frameworks (tools or languages) before integrating and applying them into the main development flow
- **experimenting** with new technological frameworks to stress their potentialities
- testing and **refining potential technological solutions** to specific issues.

While spikes were usually intended for internal use only, proofs of concept were instead used as showcases. The **proofs of concept** were aimed to **demonstrate the technical feasibility of design solutions** solving theoretical or technological problems. Proofs of concept were also offering new opportunities to overcome social and contextual constraints emerging from the field activities. The four most important proof of concepts[38] elaborated from 2015 and 2017 included:

- the **interactive map-based representation of the food network** in the Piedmont Region (producers and distributors of food products), proposed at the data visualisation contest "Piemonte Visual Contest 2015" and developed by the FirstLife team in collaboration with bachelor students [see screenshots in Antonini 2016, pp. 143-144]
- an **exploration tool** of the data collected in the TeenCarTo project (see below section 7.2.2.c), enabling users to **"walk" through geospatial data** by navigating the city through the map, proposed at the data visualisation contest "Piemonte Visual Contest 2016" and developed by master students in collaboration with the FirstLife team [see screenshots in Antonini 2016, p. 144]
- a **multi-level map of the indoor spaces of a conference center enabling the combined spatial and temporal navigation of the events** included in the conference programme, presented and tested in the demo track at the conference CSCW 2016 [see screenshot in Antonini 2016, p. 141]
- a working **prototype of an area-based clustering system and calendar-based time navigation system** for FirstLife, tested and collaboratively expanded in a mashup event in 2016 [see details of the event in section 7.2.3].

The lessons learned from the development of these proofs of concept and the feedbacks received in their public presentations had been used to carefully assess the technical and practical issues associated with the proposed solutions as regarding their potential replication into the main platform.

My contribution to the R&D activities was limited precisely to the analysis of the outcomes of the proposed solutions against the applicative scenarios and requirements emerging from the engagement activities. Part of these reflections and inputs are discussed in section 7.3 in relation to the progressive reframing of the design space of FirstLife.

Fig. 7.3 highlights also a change in the direction of R&D activities after the fourth release of the platform (from oriented toward the development to oriented toward design and research). In this last phase, R&D activities focused on elaborating the inputs coming from engagement and research activities on city dynamics into feasible technological solutions socially acceptable. Differently from the previous phases, these experimentations had been not integrated into the main development flow for the fifth version of the platform and remained design proposals [see section 7.3].

7.3.3.c Branch projects

The branch projects of FirstLife can be defined as **derived platforms in which the features and interfaces of FirstLife are used to support theoretical and operational frameworks partially or totally different from the ones of a civic social network**.

[38] Unfortunately, the websites of the proof of concepts are no longer available in 2019. Their documentation is limited to the analysis reported in Antonini 2016, internal reports and notes in the project digital archive, and the blogposts at the following links:
https://www.firstlife.org/piemonte-visual-contest-2015/
https://www.firstlife.org/piemonte-visual-contest-2016/
https://www.firstlife.org/firstlife-sbarca-a-san-francisco-per-la-cscw-conference/
[last visit September 2019]

The vision of FirstLife as a civic social network was driven by the idea of creating a shared online environment to support an active citizenship in a complex society in which everyone contributes to the local development through his/her own actions [Lupi et al. 2016]. This vision did not assume a hierarchy among social forces (e.g. public administration and citizens) and the need of separating in parallel closed worlds specific population segments. The "means" experimented to instantiate this vision into a web-based application included, for instance, map-based interfaces, user-generated contents, mediated real-time communication among users, a unified category system to classify spatial entities (described and discussed in the next sections). In the branch projects, the very same components had been used instead to serve and instantiate different visions, not necessarily aligned with the aims of a civic social network.

The branch projects developed from 2015 to 2017 were:

- SeeS@w
- Librare
- TeenCarTo
- Miramap

The project "**Sees@w - Sensing Safety at Work**"[39] was intended to integrate data from wearable and environmental sensors with user-generated contents on an interactive map. The pilot sites were the chemistry and medical laboratories of the University Hospital of Turin. The goal of the project was configuring an active system of risk monitoring and management for lab technicians, university students, and safety managers [Antonini et al. 2016].

In this project, the context of use of the platform was a **specific and closed working environment**, the intended users were **exclusively the workers of the labs** involved in the trial, and the purpose was limited to the **self-management of a subset of safety issues**. This framing is significantly different from the one of a civic social network that is contextualised in an open urban environment with a multiplicity of users covering a variety of roles and performing activities driven by an indefinite number of purposes.

The project "**Librare - Books on the Move**"[40] was aimed at collecting and making accessible geo-localised data about the books contained in informal libraries at local primary and secondary schools (by using books as sensors) and other information about collective reading, book-crossing, educational activities, book-related events in the city of Turin (considered as Open Data). The intended users of the two web-based applications associated with the project were teachers and students, and the main goal was increasing the awareness of educational opportunities connected with digital technologies.

In this case, the **map-based platform had been used only as aggregator and visualisation tool** of data collected from other sources (sensors or other databases). Thus, the active generation of users' contents on the platform was not part of the project, as well as supporting real actions through the platform. As regarding the context of use, the environment envisaged for the application is extended to the city, and not only the schools involved in the project. However, the **city is seen as the background** for the activities of **closed groups corresponding to the various classes participating to the experimentation** [Antonini 2016].

[39] Screenshots and detailed descriptions available at: https://www.firstlife.org/projects/seesaw/ (in Italian) or in Antonini 2016, pp. 185-190 (in English). A general presentation is available at: https://www.smartdatanet.it/ecosistema/bando/progetti-bando/sicurezza/sees-w.html

[40] Screenshots and detailed descriptions available at: https://www.firstlife.org/projects/librare/ (in Italian) or in Antonini 2016, pp. 190-195 (in English). A general presentation is available at: www.librare.org

The project **"TeenCarTo - Mappe della conoscenza territoriale degli adolescenti"** [41] was a municipal initiative in Turin aimed at surveying perceptions, opinions and uses of the urban spaces from the perspective of teenagers through a crowdmapping campaign that involved 600 students in 16 schools. [Pettenati et al. 2019]. The goal of the project was producing evidence for future public policies oriented to support teenagers' needs and activities.

TeenCarto provided the opportunity to use FirstLife as a **map-based crowdsourcing platform for a large data collection**. However, the segment of the population involved in the project was limited to teenagers from 13 to 18 years old, engaged into their school environment. In this sense, the platform created an **environment separated from the real-life urban settings, segregated by age** and not taking into account the various dimensions of teenagers' lives in the city. It is important to also highlight that all the **other stakeholders** of the mapping campaign (e.g. municipality, researchers in geography, school staff, project facilitators) were **not traced** in the platform in any form, even though their actions and decisions **strictly focused purpose and use of the platform** by the teenagers involved into the project. This framing is clearly distant from defining a multi-stakeholder and multi-purpose environment.

The project **"Miramap - Segnala. Collabora. Progetta"** [42] consisted in the development of a reporting platform in the Circoscrizione 10, one of the city districts of Turin. The aim of the project was supporting an active citizenship and collaboration with the district administration in addressing minor issues at the local level. The ultimate goal was creating the conditions to move from reporting local problems to actively proposing possible solutions or citizens initiatives [De Filippi et al. 2016].

Miramap did not set any population restrictions in the use of the platform (not even being resident in the area) but **limited the scale and area of interest** to the perimeter of the Circoscrizione 10, while the main platform was intrinsically multi-scale. As regarding the possibility of using the platform for multiple purposes, the feasibility was limited by the fact that the platform functionalities were modelled on the internal workflow of the city district administration. Thus, the actions aimed to generate and process reports and complains were clearly managed and supported, but the needs of **other types of purposes remained unaddressed**. Lastly, as extensively discussed in Chapter 4, **reporting platforms create fictitious hierarchies**[43] **among users**, public officers and citizens, that do not represent the dynamics of local actions and citizens initiatives and can be hardly framed in a platform based on vertical relationships.

The branch projects had been essential into the design process of FirstLife to reflect on the assumptions and implications of design choices, and their consistency with the aim of creating an open environment for multiple stakeholders and activities in the city [see also Table 7.1]. The lessons learned in these different parallel frameworks provided several insights on topics such as the limitations associated with user's anonymity or the characteristics of groups activities in the city. Most of them will be discussed in section 7.4 in relation to the progressive reframing of the design problems in the evolution of FirstLife. The branch projects contributed also to the implementation of the main platform by providing the opportunity of developing and testing several technical solutions then reintegrated or refactored into the main platform.

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[41] The title translated in English is: "Maps of the city from the perspective of Teenagers". Screenshots and detailed descriptions available at: https://www.firstlife.org/projects/teencarto/ (in Italian) or in Antonini 2016, pp. 195-200).

[42] Screenshots and detailed descriptions available at: https://www.firstlife.org/projects/miramap/ (in Italian) or in Antonini 2016, pp. 200-205.

[43] A hierarchy is given by unbalanced powers among different classes of users. In this case, the public officer can decide what contents will be showed on the platform because he/she are required to approve each content. On the other side, citizens have no rights or opportunity to act on the contents published by public officers.

Table 7.1 Synoptic view of the branch projects and their differences respect to a civic social network

	SeeS@aw	Librare	TeenCarTo	Miramap
City focus	no	yes	yes	yes
User generated contents	yes	no	yes	yes
User's profile	Restricted by working environment, focus on individuals	Restricted by organisation (schools), focus on school communities	Restricted by age band, focus on groups of students	No restrictions for external users, internal users limited to district authorities
Purpose	Risk management, no multipurpose	Multipurpose, exploration and awareness	Mapping campaign, no multipurpose	Issues reporting, multipurpose as desiderata
Scale	Indoor spaces, no multiscale	Multiscale	Multiscale	City District 10, no multiscale

An additional branch project was related to the inclusion of FirstLife into the WeGovNow project, that will be discussed in detail in Chapter 8. In this case, the radical difference respect to the development of the main platform was given by the need of integrating FirstLife with other seven web-based applications into a new platform. The scope of this new platform was consistent with the vision of FirstLife as a civic social network, but the technological environment to instantiate this vision was drastically different.

7.3.4 ENGAGEMENT

The general conceptualisation and explanation of the development workstrand presented in the previous section helps in contextualising the activities of the engagement workstrand within the FirstLife development team. These activities indeed required to be constantly coordinated with the work of the developers implementing the platform and fitting within the time and technological constraints of the platform evolution. On the other side, the engagement activities were driven and based on the needs and opportunities coming from the collaboration with heterogenous sets of city stakeholders. Thus, the **approaches, methods and techniques to carry out the engagement activities were adapted case by case, taking into account interests and availability of the participants in the activities, their priorities, projects and preferred level of collaboration in the definition of the FirstLife platform**.

Differently from projects aimed to develop a technological system by using participatory design approaches, the development of the FirstLife platform as **technological project was intertwined with several local projects having their own goals, visions, and dynamics**. Moreover, the role played by the platform could substantially be reinterpreted in different ways in each local project.

Differently from projects aimed to involve citizens in urban transformations, the exploration of alternatives and potential actions supported by the platform in the city context was linked to the **operational constraints of the actual development of a technological platform.**

Differently from non-research projects (such as institutional or business initiatives), the process of engagement was also conditioned by the need of investigating and understanding new dynamics emerging

from field activities, and **dedicating less resources to contexts, domains, social segments already deeply analysed before**[44].
As a result of these three clusters of **fluid constraints and settings**, I planned and designed the activities in the engagement workstrand by adopting a **plastic approach** based on:

- **low-level schemas regarding the proactive or reactive use of specific techniques** in different situations (e.g. open interviews, contextual enquiries, co-design workshops, group discussions, focus groups)
- **medium-level operational protocols to organise short, medium, and long-term collaborations** with city stakeholders
- a **high-level framework to orient strategic decisions** to achieve specific design and research goals.

In the next two subsections, I am going to describe:

- the forms of engagement characterising the FirstLife participatory design process (and including the operational protocols of the activities and the applied techniques, low level and medium level components of the plastic approach)
- the two cycles of engagement carried out from 2015 to 2017 (in relation to the design and research goals, high-level framing of the plastic approach).

7.3.4.a Forms of engagement

The description of the forms of engagement characterising the FirstLife participatory design process is based on the "*Framework for Organizing the Tools and Techniques of Participatory Design*" conceptualised by Sanders, Brandt and Binder [Sanders et al. 2010]. The key elements of that framework are the form of actions, and the purpose and context of actions. The form of actions defines the specific kind of users' engagement in the process as oriented to *"making, telling and /or enacting"*. The four purposes of the tools and techniques are probing the user, get the user familiar with the project or system ("priming"), understanding the user, or generating new solutions and scenarios. The context is referred to the size, compositions and relationships of the groups involved in the process and the venue of activities.

These specifications assume the intent of pursuing a user-centred design process and require a light adjustment to serve also a systemic design process that is basically stakeholder-centred (as in this case). For instance, the type of actions can be oriented to make, tell and enact responses **beyond the individual level**. Similarly, the purposes of tools become:

- **probing a certain setting or domain or practice** by using the users as insiders and representative of the world they know and experience
- **get the user as representative of a class of stakeholder or type of organisation familiar with the project and the system** to envision the potential application of a new proposal in their context
- **understanding a certain social and functional component of the city system** and its relationships with others
- **generating new solutions to change the practices or addresses specific issues at different levels of various social structures**.

[44] However, the social relationships activated through the engagement activities supposed my personal commitment, closeness and perceived sense of responsibility toward the various groups involved in the process. These relationships were beyond research purposes and could not be simply interrupted because of a shift in research interests. This is a well-known issue in immersive experiences of participatory design, even if not commonly documented in academic literature.

The context necessarily requires to be defined in relation to the **scale of action**, but also in relation to the **positioning of the social structures** in which the participants are embedded and their domain of actions in the city.

The forms of engagement in a *"dialogic design process"* [Sanders 2008, Manzini 2016] are also deeply influenced by **contingencies and directions driven by the participants in the process**. As mentioned before, the intention of not focusing on preferential segments of the population or on specific domains implied the openness to every class of potential users, from elders to children, from social assistants to entrepreneurs, from the small neighborhood association to huge cooperatives with hundreds of associates, from district officers to regional authorities. Significant differences characterised also the level of literacy and digital literacy of participants, their willingness and level of interest in the project, their availability to cooperate in practical ways or playing just as "informants". All these contingencies required flexibility and adaptation of design&research techniques and tools to the needs, priorities and skills of the participants in the process, but also to their role and active involvement in local development actions.

Lastly, the **temporality of the different forms of engagement** within the design process and the **temporality of the design as a whole** played a central role in defining tools and techniques for the activities. The engagement activities accompanying the design process of FirstLife have been perfomed by embracing a *"long-term perspective"* as the main temporal lens on the outputs and outcomes of the participatory activities [Saad-Suloneen et al. 2018]. This perspective not only allowed the project team to structure the platform evolution according to different temporal scales (e.g. major changes on the long term and minor improvements as a daily or weekly endeavours), but also it contributed to deeply incorporate the inputs coming from city stakeholders along the process (even when they could not be timely addressed in a specific phase of the project).

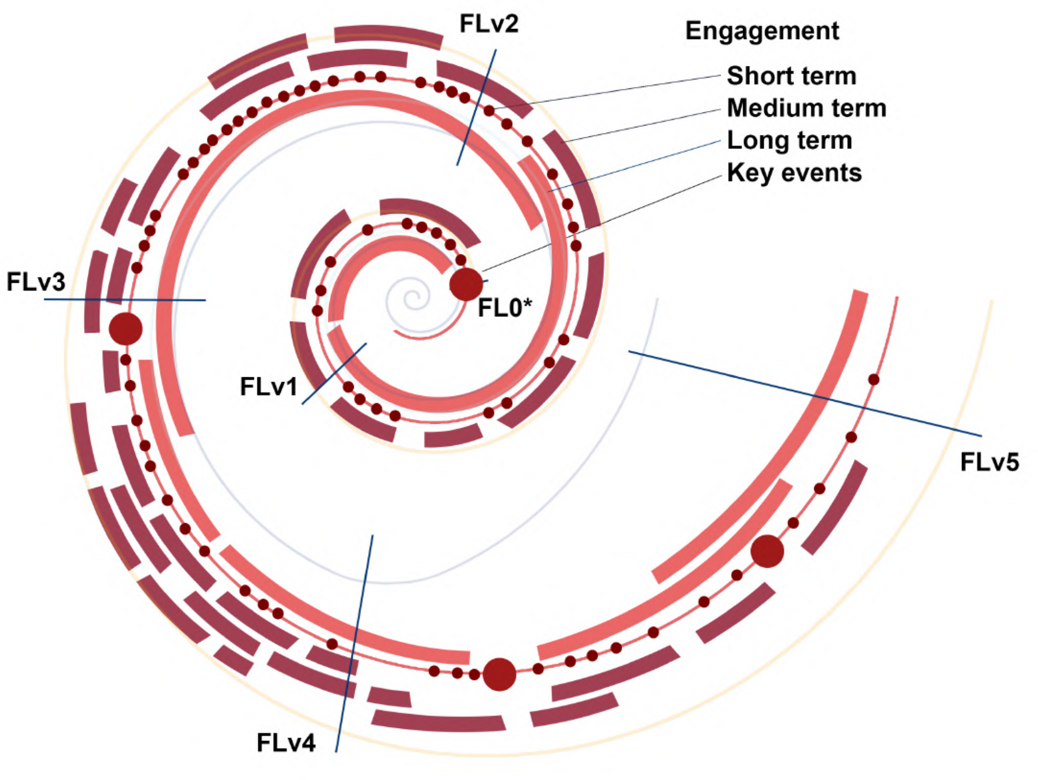

Fig. 7.7 Structure of the engagement workstrand

By considering this temporality and the operational constraints mentioned before, the engagement activities for FirstLife can be classified into:

A. **Key events**
B. **Short-term high-intensity**
C. **Short-term low-intensity**
D. **Medium-term high-intensity**
E. **Medium-term low-intensity**
F. **Long-term high-intensity**
G. **Long-term low-intensity**

These different forms of engagement [see also Fig. 7.7] are described below by considering types, purposes and context of action introduced at the beginning of this section.

A) Key events

Four major events from 2015 to 2017 had been organised[45] in correspondence with crucial moments for the development of the platform. The first two-days' workshop held in **June 2015 (WS1**) constituted the founding stone of the participatory design process. The second workshop held in **May 2016 (WS2)** marked the end of the first cycle of participatory design (see section 7.2.3.b) and the announcement of the second one. The third two-days' workshop at the end of **January 2017 (WS3)** had been set up as a general gathering of all groups and organisations participating into the design process on distinct projects and local initiatives. The last event in **July 2017 (WS4)**, a one-day workshop, attested the existence of a consolidated working prototype to address the challenges and issues of technology adoption to better prepare the fifth release.

WS1 had been organised before any version of the FirstLife platform was available. The goal of the event was two-fold:

- involving participants in **sharing and reflecting on their own practices in the city** in relation to other stakeholders operating in the same domain or area (*understanding city dynamics*)
- envisioning **how a civic platform would support these practices** and relationships (*generating new solutions*).

The 95 participants worked both days in 5 mixed groups of 8-10 people each, including at least one or two representatives of each class of city stakeholder operating at different scales: public administration and local authorities, business, non-profit, academia, donors. This group composition was aimed at building rich, complex scenarios[46] by taking into account perspectives, competences, roles, and needs of other organisations and groups, as well as the real constraints for actions (for the internal and contextual validation of the scenarios)[47]. The groups worked on five macro-topics:

- **services accessibility**
- **group coordination**
- **local promotion**
- **events management**
- **documentation of local activities and projects**.

[45] I contributed to the events by organising the workshops, designing activities and tools used during the events, training other facilitators, facilitating the workshop sessions and coordinating other facilitators, preparing the post-event reports and materials.
[46] The term **scenario** is used in information systems design and interaction design to indicate a rich and detailed description of the interaction between users and a system. The same term in other domains, especially urban and policy domains, is used to indicate the representation of a context and the actions of multiple subjects within this context for a determined purpose. In this dissertation, the word scenario is always used to indicate the **settings and flows of a multiplicity of users implementing a certain action, in which are also highlighted the moments and types of interactions with the system under development**.
[47] A detailed account of the WS1 activities is available at the following link: vghvdfnbgvjnh

The technique used in WS1 was inspired by the *"Open Space Technology"*, a facilitation technique aimed to support large groups constructively working on problems, actions plans, visions [Owen 2008]. This technique in this setting had been applied for *"enacting"* [Sanders et al. 2010] microcosmos in the city and discuss alternative dynamics and interactions with technology. The WS1 outputs consisted in **108 preliminary applicative scenarios** (and high-level functional and non-functional requirements) that informed the following development of the platform for its first and second release (see sections 7.3 and 7.4). The major outcome of WS1 had been connecting with many groups and organisations that started medium and long-term collaborations with the project after the event.

Fig. 7.8 Photo from WS1

WS2 had been structured as a *"mash-up"*[48] event to get together developers, programmers and "techy people" on one side, and "social innovators" operating in various sectors and domains on the other side (35 participants), to mix their different sets of skills and experiences[49]. The activities had been structured as a sort of *"social hackathon"* in which 5 mixed groups of 4-6 people (developers plus social innovators) worked together on joint challenges.

These challenges combined:

a) **outlining a new civic project at the local level**

b) **developing new potential solutions to integrate the FL platform** (at its second release) to provide technology support for addressing the civic projects needs.

On this occasion, an open development environment had been set up to enable external developers crafting and testing new technological solutions concerning interfaces, data visualisations, and other platform functionalities. The making activities had been followed by two rounds of groups discussions, while the focus remained on techniques *"for making"* [Sanders et al. 2010]. The outputs of WS3 (**4 proof of concepts and 23 applicative scenarios**) had been determinants for the key design choices on the temporal management of the platform contents and the classification schema of entities and contents (see section 7.3). Differently from WS1, WS2 focused more on individuals in their context of action than on organisations or classes of city stakeholders, and the actions had a generative intent more than understanding the context.

[48] Mash-up is an expression indicating the act of combining different elements in new forms. A mash-up meeting often indicates an event in which the participants are called to mix tools, materials or other elements to generate something new. In this case, the participants had been called to mix their different set of skills and experiences, in particular technical and non-technical.

[49] A detailed account of the WS2 activities is available at the following link: vghvdfnbgvjnh

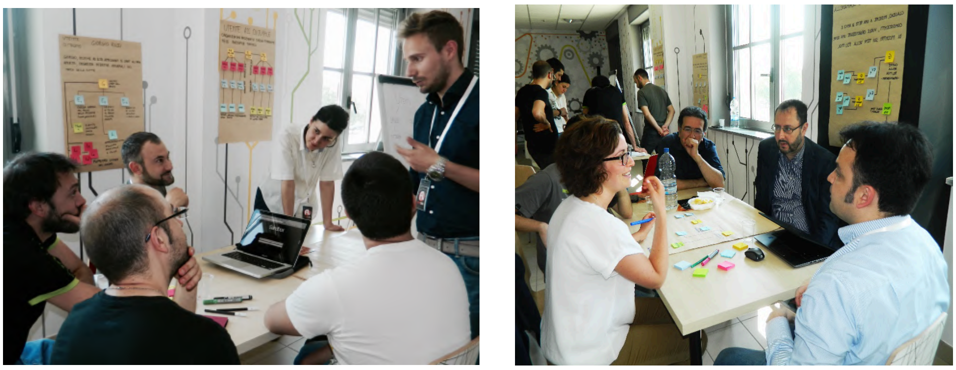

Fig. 7.9 Photos from WS2

WS3 followed principles and approach of the ***"European Awareness Scenario Workshop"*** (EASW), a technique largely applied in urban participatory processes since '90s. This technique is used to **structure debate and discussions aimed at outlining processes and responsibilities to achieve common goals of public interest**[50]. WS3 involved 114 participants, almost all familiar with the FirstLife project and with the use of the platform because already involved in other engagement activities. In this occasion, they had been called to discuss on transversal topics emerged from the various collaborations developed in the previous two years and on potential synergies in local actions. The EASW technique had been used as a **technique *"for telling"*** [Sanders et al. 2010]. While the participants could be divided into eight homogeneous groups by their domains of activities in the city (according to the standard procedure in EASW), the plenary discussion of these eight groups facilitated a broader cross-domain understanding of the main instances, criticalities, projections of each group regarding sharing the same virtual working environment of a civic social network[51]. The goal of WS3 was **understanding how local stakeholders were expecting to address common issues at different scales and in different social and organisational settings.** The focus remained on organisations, communities, and classes of stakeholders, instead than individual users.

Fig. 7.10 Photo from WS3

[50] Description and details of the key principles of EASW method is available at: http://www.monitorappalti.it/sites/default/files/pamiers_en.doc.pdf

[51] A detailed account of the WS3 activities is available at the following link: vghvdfnbgvjnh

WS4 involved representatives of several organisations working in the domains of cultural services, heritage, sustainable economy, professional services, and related fields, operating in the entire Piedmont Region (for a total of 112 participants)[52]. The technique used in WS4 was inspired by the principles and approach of the *"appreciative inquiry"*, a technique aimed at involving organisations or stakeholders to self-determine positive changes in their context of action or working environment, starting with acknowledging positive elements and aspects that could be furtherly improved [Cooperrider et al. 2003]. In this case, a set of probes had been used to support the process and the discussion on the practices in the environments of museums, libraries, consortia and networks for local promotion, non-profit organisations, culture and tourism-oriented businesses, departments and public authorities with mandate on culture policies. **The probes were visual artefacts decomposing and reassembling the components of the platform in abstract or evocative images representing a few aspects of the organisational practices of the participants** [see Fig.7.8]. In this way the discussion focused on the practices and on the forms of technological support that the platform could provide to these practices, overcoming the obstacle of the participants' unfamiliarity with the platform. The goal of WS4 was **outlining action plans** (both for the organisations involved and the development team) to concretely integrate the platform in present practices, or more precisely to **design uses and practices of a civic social network within existing practices**.

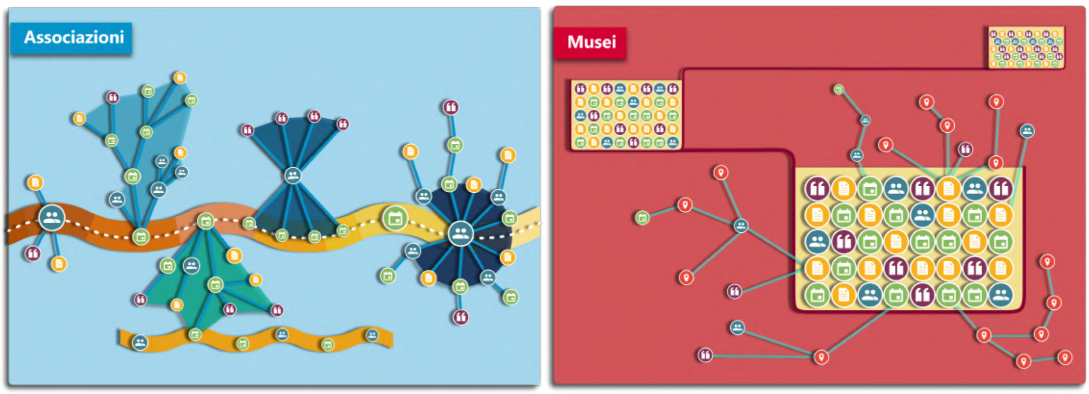

Fig. 7.11 Examples of probes used in WS4, cultural associations (left) and museums (right).

The common characteristics of these four events can be summarised in:

- **creating a dialogue space among different types of users**, usually operating in different sectors or silos of city activities
- **working on concrete scenarios and problems** to find a common ground and possibly shared paths of actions (and design) within the constraints (social, organisational, economic, legal, environmental)
- **framing the collective contributions as boundaries and contents of the intervention space** for technology in supporting local actions
- **presenting and reasoning on technology as a fluid common information space** adaptable to people relationships, instead than focusing on its functionalities and technical aspects.

These four events constituted moments of *"staged participation"* into the participatory design process, or rather activities driven by designers and researchers, framing the participation in relation to their own objectives related to the platform to be developed [Saad-Salunen 2014].

[52] A detailed account of the WS4 activities is available at the following link: vghvdfnbgvjnh

B) Short-term high-intensity

The short-term high-intensity engagement protocol included the participation in **one or two workshops, lasting between 2 and 6 hours, opened to everyone was interested in the themes related to the design of a digital urban platform in relation to specific initiatives or local activities**. In most of the cases, these workshops were organised in partnership with local organisations having capacity and contacts to gather representatives of other non-profit organisations, local businesses, public and private institutions. Rarely these workshops were independently organised only by the FL engagement unit by issuing direct invitations. This kind of arrangement allowed to **reach a quite diverse range of city stakeholders**, even subjects reluctant to be involved in university projects, opening the exploration to as many city dynamics as possible in a comprehensive and resource-efficient way[53]. On the other hand, **not deciding who would be involved in the process** also implied to enter in the room (e.g. district council hall, a café, a garden, a school, a community space, and so on) without knowing who would be there (e.g. disposition, domain, profile, digital skills) and having limited agency on the available resources (e.g. devices, internet connection, furniture).

This operational uncertainty led to adopt a flexible and reactive attitude on the field. The workshop always included a short presentation of the platform in its conceptual (and also aspirational) aspects and often a demo to get the participant aware of the type of tool and try its main functionalities, if the setting was appropriate and not risking to push away participants uncomfortable with hand-on sessions. However, the core of these workshops was **discussing with the participants high-level topics linked to the social constraints in using the kind of technology such a civic social network within the organisational and operational context of their everyday activities**. Other topics concerned the difference between public information and public interest and the expectations associated with the platform, forms of support to collective activities provided by current technologies and their limitations, different framing of the role of web-based technologies by different actors.

The management of interventions by the facilitator[54] was based on focus-group and Open Space Technology techniques and the data collection based on field notes and internal reports, complemented by video and audio recordings when authorised. This protocol had been applied in 30 workshops involving on average of 12-15 participants, always considered as representatives of local groups, organisations, or communities, mainly coming from the districts 2,4,7, and 10 of the City of Turin. In total, I meet during these workshops about **400 people representing 56 organisations**.

The key outputs were the definition of **non-functional requirements**[55] from a wide range of perspectives, and the collection of emblematic user stories and insights to identify the **obstacles to be considered in the perspective technology adoption**. In this sense, the main form of actions for the participants was "*telling*" me about their microcosmos allowing me to better understand their practices, but also to probe them forcing to imagine what could happen if they had an instrument such as a civic social network to support or transform their practices.

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[53] One person, maximum two, without dedicated budget for the recruitment of payed participants.

[54] I covered the role of facilitator in over the 90% of these workshops. I was present and collaborating with the main facilitator in the remaining ones.

[55] Non-functional requirements include all those properties attributed to a software that do not correspond to specific features or functionalities, but are associated with higher level expectations or assumptions about technologies, as well as with the output and outcome of a tool as a whole. For instance: reliability, fairness, accuracy, etc. [See also Gross and Yu 2001]. In urban design, the same kind of properties corresponds, for instance, to "integration in the context" that is not related to a specific aspect of the project, but could be achieved by intervening on multiple design choice with this "requirement" in mind.

Fig. 7.12 Photo of a workshop carried out by using focus group techniques

C) Short-term low-intensity

The short-term low-intensity engagement protocol included **contextual inquiries and groups' meetings in the working environments of several city stakeholders** available to voluntarily collaborate with the research group, for a total of about 13 contextual inquiries, 46 meetings and 200 persons involved.

Contextual inquiries are immersive sessions (from 4 to 8 hours) in the context of prospective users to understand in detail the nature of their practices and gather inputs for the design of systems supposed to support these activities. [Holtzblatt & Bever 2014, Keren & Sandra 2017]. They had been implemented by visiting the workplaces or the areas of intervention of sectors of the public administration, public agencies, private institutions, and local businesses. During these visits, direct observations and open-handed interviews to key persons in the organisations were driven by the intent of:

- outlining the **exchanges** (information and actions) **among internal and external stakeholders**, their nature, the factors impacting on them
- understanding **whether these exchanges were mediated by web-based technologies**, and by what kind of technologies
- discussing with the participants the **role perceived or attributed to these technologies** (and as the context itself communicate or not that role) and the major issues they were addressing in the use of technology to manage internal and external activities and connection
- reasoning together about the **kind of alternatives that they would like to have**, whether the key functionalities or some aspects of the FL prototypes could match their vision of these alternatives, and the limitations or new problems they could see from replacing some of the tools already used with a new platform.

In this setting, the **FL prototype was strictly used as boundary object** to easy connect with the participants about: a social network not focused on the visibility of individuals, but instead on the one of local actions, places, events; a social network primarily based on a map instead than a newsfeed wall; a social network where users were free to choose what to visualise without platforms automatic pre-filters based on users' profiling.

Group meetings had similar structure and reduced length (2-3 hours), except for the fact that the interviews and discussion were handled with 3 to 5 persons at the time, catching multiple perspectives on the very same practices of the same organisation. Meeting groups usually required more than one iteration to consolidate the overall picture, in particular as regarding the differences between formal and informal aspects in the management of activities, information exchange, real use of technology, specific fears and perceived risks.

While the attention to the non-functional requirements was still high as in the case of short-term high intensity workshops, the key outputs of contextual inquiries and groups meetings were a set of **organisational constraints** to be taken into account in the design the platform to ensure its social and organisational acceptability at the same time. The major point of undertaking several contextual inquiries and group meetings was identifying not so much what constraints were specific of a certain organisation, but instead the ones **recurring across organisations of the same type or different, trying to interpret the causes of similarities and differences**. In the phase of analysis, these constraints were processed basically searching for "needs coalitions", relevant to define a multi-stakeholder environment (see also Sections 7.4, 7.5).

D) Medium-term high-intensity

The medium-term high-intensity engagement protocol concerned the **collaboration with one or few city stakeholders in joint initiatives** aimed at pursuing the mission and objectives of the involved organisations and groups and, at the same time, providing the opportunity to pushing forward the design and development of the platform, and testing the design choices in real operational settings. In this case, the joint activities were implemented in a **definite period of time (usually 3 to 5 months**) and adapted on the schedule of our partners (e.g. based on deadlines for specific events).

The activities in the medium-term high-intensity protocol included:

- **demo and training sessions** to get the partners **familiar with the prototypes**, its functionalities, but also its limitations
- **prototyping sessions**[56] aimed at outlining comprehensive and **coherent applicative scenarios of the platform** in relation to the nature of the initiatives to be supported, the kind of envisaged social interactions with internal and external stakeholders, the limitation and potentialities of the interaction with the platform in specific circumstances
- **co-design sessions** focused on identifying the specific integrations and changes required to better support the joint initiatives, but also the need for new features and functionalities
- **evaluation and refinement sessions** to assess the correspondence between design outputs and needs
- joint preparation and management of the **launch of the customised platform or its updated version** on the basis of the inputs coming from the previous activities and the progresses made by the development team
- **testing "in the wild"** with third parties involved in the initiatives (e.g. general public, other partners) during, for instance, major events or in correspondence with milestones in the activity programme of our partners.

From 2015 to 2017, about 15 collaborations had been activated by following this kind of protocol. Among them, the most important included the following initiatives:

- *UniCarTO*, promoted by the department of social sciences of the University of Turin to collect and support the **needs of university students** as regarding housing, health, dedicated services, sociality, integration in local communities (January to April 2016)

[56] In this case, the prototyping is technically closer to the prototyping of digital services than the one of interfaces, but the use of the icons and symbols of the interfaces components to build the flows of interactions was actually a way to conceptually manipulate the platform interfaces. [See examples of the prototyping sessions outputs in section 7.5].

- *SmartTrams*, a cultural project organised by the association KLUG to promote the accessibility of **art and music events** by setting them on public transports crossing the city (February to April 2016)
- *Tedaca'- ACTI,* the experimentation of two innovative theatre companies (Tedaca' and ACTI) operating in disadvantages neighbourhoods to connect events and characters in the theatre pieces with the related real-life experiences of the public, beyond the timeframe of the spectacles (May 2016 to November 2016)
- *In progress*, a series of **public debates** about critical and/or contested urban transformations in the city of Turin organised by the "UCM - Metropolitan Urban Centre" (October 2016 to April 2017)
- *Festival della Cultura dal Basso*[57], an **urban regeneration** project combining the temporary activation of unused or non-cultural places (such as grocery stores) through cultural and artistic events, with the attention to the integration of minority communities called to host or to organise the events, promoted by the organisation "Babelica" *(*November 2016 to May 2017)
- *Cultura e Turismo Regione Piemonte*[58], promoted by one of the divisions of the Piedmong Region Government to facilitate synergies among **creative industries** and public institutions (December 2016 to July 2017)
- *Biennale della Prossimità*[59], a programme to connect all the different stakeholders working on **welfare services and social innovation processes** across Italy, promoted by a consortium including some of the major Italian networks of social enterprises and non-profit sector (January to June 2017)
- *Torino Living Lab*, a project promoted by the City administration in collaboration with national companies, local start-ups and entrepreneurs to **test about 40 smart city solutions** aimed at improving the quality of life at the local level (March to July 2017).

Fig. 7.13 Photos from various engagement activities

[57] http://www.babelica.it/fcb/
[58] https://culturaturismo.firstlife.org/
[59] http://prossimita.net/programma-bologna2017/

E) Medium-term low-intensity

Medium-term low intensity engagement protocols had been usually activated after than an organisation attended one of the key-events (A) or other single workshops (B), familiarising with the scope and vision of the FirstLife Project and self-identifying initiatives we could work on together.

This form of engagement always included a **hand-on training session** to learn how to independently use the platform, but also **contextual inquiries** to create a deeper connection and mutual understanding between the involved stakeholders and the FL researchers/designers. However, differently from the medium-term high-intensity and the short-term low intensity protocols, these two types of activities are the starting point for a collaboration path managed quite autonomously by the involved organisations with periodical assessment meetings with the FL engagement unit.

The main technique used in this case can be defined as ***"participatory co-adaptation"*** and it is inspired by the principles of the *"participatory ergonomics"* [Wilson et al. 2005], calling workers (as experts of their problems, resources, and constraints) to autonomously identify what changes can be done in their workplace to improve their productivity and reduce risks for health, accidents, safety, and so on. Participatory ergonomics programmes always focused on transformations of the physical environment, while in the design of digital systems the focus is on the manipulation of information and interactions. Moving from the physical to the cognitive ergonomics, Chapter 3 mentioned that concerns about the cognitive ergonomics of web-based technologies in city applications should be considered as marginal because of the advanced standardisation of design solutions for these platforms. Instead, the major relevance of organisational, political, legal, economic, cultural constraints over the simple usability of the available tools should project the design of city technologies toward their *"political soundness"* [see Chapter 3, section 3.5]. Exactly for that reason, **I considered the groups involved in the medium-term low intensity protocol as the experts with the appropriate knowledge to identify what changes should be done to make a tools "sound" considered all the constraints of a specific organisation or domain of activities.**

The "participatory co-adaptation" entailed the use of the platform by the participants in their ordinary activities. These initial experimentations were lasting from a few days to a few weeks, and usually extended to a small group within an organisation. Their purpose was **testing the platform against procedural and social issues** that could be associated, for instance, with open contents, information management solutions, or specific features. At the same time, **the platform was "reinterpreted" as a toolkit by the participants and its use independently readapted to the kind of challenges and unaddressed needs they could have**. In the process, the participants became experts of the potential integration of the platform in their working environment.

Building on this direct knowledge and a common ground on the platform and the domain of activities shared between participants and facilitators, the **periodical assessment meetings were aimed at reflecting together on the kind of changes the prototype should undertake to overcome the main issues**. During the meetings, the feasibility of these changes was also discussed to make the participants understanding the implications of each proposal on the general outline of the platform. In addition, the proposed changes were also examined under the light of **recurrent needs and operational framework of other organisations having similar characteristics** (e.g. other city districts, other departments, other cooperatives) and the potential impact on the relationships with their usual partners (e.g. municipality, local businesses, schools).

Further **follow up meetings and cycles of testing** were carried out after the development of the platform progressed in the direction of the proposed changes by each group.

This engagement protocol had been followed with several types organisations, including: a formal cooperation with the District 4 of the City of Turin and its technical and administrative offices; some cooperatives involved in the provision of social, health or educational services; non-ICT local businesses and enterprises associations; an informal network for job placement support to youth, adults and disables; one of the neighbourhood welfare agencies. The outputs of these collaboration were not only new requirements or the development of details applicative scenarios, but also new perspectives on entire domain of activities leading to collectively imagine new solutions to improve the effectiveness of certain local actions.

F) Long-term high-intensity

The long-term high-intensity engagement protocol was similar to its medium-term equivalent, while extended in time (lasting for at least **one year or two**) and **framed in a more formal way** (within a project or externally associated with a project) as regarding competences, roles, and partner's resources. However, the kind of participatory activities, outputs and outcome of the process remained the same, just iterated three to four times. The long-term high-intensity engagement protocol had been put in place in two projects: "Riscopri Risorse" (July 2016 to October 2017) and "Co-City" (starting in November 2016 and personally followed until October 2017).

Riscopri Risorse[60] was a project managed by the non-profit organisation "Laqup". It involved teachers and students (from 3 to 18 years old) in six cities within the Province of Turin (Avigliana, Bruino, Carmagnal, Chieri, Luserna, Rivalta), collaborating with the technical staff of the Municipalities and the students' families. The project goal was to identify a public space in each city to be collaboratively regenerated and hosting new functions designed for children and teenagers. The platform was intended to gather different perspectives on the everyday public spaces in each city and facilitate comparison among the activities carried out in the six cities.

Co-City[61] was a three-year EU project in the framework of Urban Innovative Action. It involved the Urban Regeneration Office in the Municipality of Turin, the Neighbourhoods Houses (public community centres), and the University of Turin for the local activities of supporting citizens proposals for the co-management of commons. The project included a vast range of activities ranging from organisational meetings, outreach events, institutional calls, surveys, visits, academic seminars, in addition to all the activities directly related to the projects carried out by civic associations and citizens groups in public buildings and open spaces recognised as commons. In the initial phase of the project, the platform had been considered as a public interactive archive to document spatially and temporally what is going on in the project from the perspective of all involved parties.

Besides these two projects, the **branch projects** described in the section 7.3.3.c constituted another atypical long-term high-intensity form of engagement, even though they were external to the flow of the participatory design activities related to the development of the main platform. An mentioned before, they included: **Sees@w** (October 2014 to July 2015), **Librare** (April to October 2015), **TeenCarTo** (March 2015 to March 2016), and **MiraMap** (September 2016 to April 2016) [see also Antonini 2016 for more details]. All of them had been implmented before the start of Riscopri Risorse and Co-City, providing a basis to set the temrs of collaboration in the latest cases.

[60] Websites of the project (http://www.riscopririsorse.it/) and the association Laqup (https://www.laqup.it/).
[61] Webpage of the Co-City project in the UIA portal: https://www.uia-initiative.eu/en/uia-cities/turin

G) Long-term low-intensity

The long-term low-intensity engagement protocol describes continuative collaborations with organisations or cluster of organisations constituting local hubs in different areas of the city of Turin. These collaborations, lasting over than one or two years, were developed as an **informal partnership on the territory to create synergies between the efforts related to the development and application of the FL platform on one side, and actively supporting social innovation initiatives and civic programmes**. They included the collaborations with:

- *Mirafiori Social Green*, a consortium of cooperatives and non-profit organisations engaged in implementing new sustainable practices at the community level

- *UCM – Metropolitan Urban Centre*, an independent public agency working as the observatory of the urban transformation in the city of Turin

- *Ecoborgo Campidoglio*, a group of non-profit organisations and local business working for the economic and social regeneration of the historical neighbourhood of BorgoVecchio-Campidoglio through art, culture, and entrepreneurial initiatives

- *The Gate*, the local development agency working in one of the central areas of the city for over twenty years, and operating to support hundreds of retailers in the biggest market square in Europe.

In these cases, the activities had been implemented by following most of the techniques metioned before, going from hand-on sessions, groups meetings and interviews, scenarios prototyping, participatory co-adaptation, co-design sessions and even co-organisation and management of joint initiatives to reach wider targets and groups. However, the value of these collaborations for the participatory design process of FirstLife relied on the opportunity of having a sort of "control groups" that tested every version and update of the platform, by being familiar with the tools and able to critically reflect with the FL engagement unit about the directions taken in the design and development process from their perspective. Moreover, these collaborations worked also as a sort of "windows" on the city, allowing the access to a deep knowledge of local dynamics (in terms of stakeholders mapping, organisational protocols in different sectors, socio-cultural aspects to be considered) that helped to clarify the implications of specific applicative scenarios and design choices in the context of Turin, as well as their transferability in other settings.

The structuring of these forms of engagement in terms of clarity of means, objectives, reference frameworks, and identification of the nature of relevant outputs and outcomes on the side of researchers and designers had been essential to carry out a completely open-ended and users-driven participatory design process. To this regard, systematically outlining the architecture of the strategic design and management of the participatory design process of FirstLife[62] wanted to highlight that it required not less planning and research

[62] The systematic overview of the process can be daunting and possibly misinterpreted by those mythologising spontaneity. It should be underlined the difference between being professionally prepared to the unknown in uncertain circumstances, and regimenting the forms of engagement to simplify and limit fieldwork to what can be planned or known in advance or handled by inexperienced facilitators. Being prepared does not mean losing the spontaneity of human interactions in participatory activities. On the contrary, it allows to better empathise with people by keeping distinct the personal priorities of researchers and designers from the priorities of the involved people in the participatory design. Usually, these people devote time, energies, and resources to voluntary collaborate in a project of which they share vision or objectives, even without having immediate direct benefits. While with them in the same room, listening and working together is the priority to acknowledge the value and meaningfulness of their involvement. Catching the richness of the microcosmos those people bring to our attention is invaluable, even if unexpected or complicated to codify. The priorities become those of researchers and designers after the participatory activities, during the processing of the collected information and the analysis of the outputs. Research and design priorities are indeed "safeguarded" anyway, regardless

that the design and development of the platform itself. Indeed, as stressed in Chapter 4, the design process itself constitutes an object of research for prototyping web-based technologies reflecting the City Mirror proposal [see also section 7.6].

Table 7.2 Synoptic view of the forms of engagement applied in the Participatory Design of FirstLife

Forms	Purpose	Context	Tools/activities
KEY EVENTS	Understanding, probing practices, generating new solutions	City scale Individuals/organisations/groups	Workshops (OST, Mash-up, EASW, appreciative enquiry)
SHORT-TERM HIGH INTENSITY	Probing users	District/neighborhood scale Individuals/organisations/groups	Workshops (focus groups, OST, demo and hand-on sessions)
SHORT-TERM LOW INTENSITY	Understanding context and users	Neighborhood/building scale Organisations/groups	Contextual inquiries, group meetings
MEDIUM-TERM HIGH INTENSITY	Get users familiar with the prototype, generating new solutions and new practices	National to neighborhood scale Networks/organisations/communities	Demo and training, co-design sessions, prototyping of the system of interactions, testing in the wild, co-management of joint initiatives
MEDIUM-TERM LOW INTENSITY	Get users familiar with the prototype, understanding users and context, probing existing practices	City to neighborhood scale Organisations/communities/groups	Demo and training, contextual inquiries, participatory co-adaptation, assessment and co-design sessions
LONG-TERM HIGH INTENSITY	Get users familiar with the prototype, generating new solutions and new practices	Region to City scale Organisations/communities	Demo and training, co-design workshops, prototyping of the system of interactions, testing in the wild
LONG-TERM LOW INTENSITY	Get users familiar with the prototype, understanding users and context, probing existing practices	City to district scale Organisations/networks	Demo and training, contextual inquiries, participatory co-adaptation, assessment and co-design sessions, co-management of joint initiatives, iterative testing.

of what happened during the activities, with the correct preparation and planning. On the contrary, the priorities of the participants require extra attention to be interpreted and put at the centre of the process. Of course, not everything absorbed from the field can be incorporated and translated in findings and design choices, but much more than keeping pre-established points of observation only. Different order of priorities can coexist in the same process, assumed that they are appropriately and timely handled. In my opinion, the lack of organisation in participatory design processes is not a value or useful or not even respectful for the participants and the institutions supporting the process. As C.J.Jones clearly states in his fundamental book on design methods and approaches, only non-professional designers are not aware of what they are doing [C.J.Jones 1992], the others know what they are doing even when they are improvising to react to unexpected situations.

7.3.4.b Engagement and Participatory Design Cycles

The forms of engagement described in the previous section had been organised in two main cycles of Participatory Design[63] identified by a high-level framing of the strategies implemented across the activities. The first cycle had been implemented from April 2015 to May 2016 and the second Cycle from June 2016 to October 2017.

1. **First Cycle: The Platform Outline**

The strategy for the First Cycle of PD had been driven by:
- the collection of inputs and insights to orient the design and development process at a general level
- the definition of the specific requirements of a new web application, based on map interfaces and crowdsourced contents, intended to support local actions and civic initiatives
- the continuous verification of our design choices against the conceptual framing of the platform (as open platform with civic purposes) and the applicative scenarios constructed with the participation of several stakeholders.

An event such as WS1 (see section 7.3.4.a – A) provided the team a solid initial basis of over 115 applicative scenarios[64] **depicting gaps of current technologies to addresses the needs of public and private actors** (associations, local authorities, university, companies and professionals), but also to better understand their priorities concerning the integration of web-based technologies in their practices. Then, short, medium and long-term engagement activities (see section 7.3.4.a – B to G) provided additional real applicative scenarios, but also the opportunity to **refine the preliminary framing of the platform, test new functionalities, and stress the prototype with out-of-the-lab experimentations.** Every minimal improvement of the interfaces or platform performances or functionalities was immediately tested against the world to identify criticalities, both functional and for its adoption. During the first cycle, the FirstLife prototype was indeed rapidly changing, sometimes resulting in a quite unstable platform.

Testing operations looked at the usability of the platform, but mostly at assessing the social acceptability of our design choices over specific features from the perspective of the applicative scenarios of each stakeholder. For instance, I will discuss in the following sections (7.4 and 7.5) the issues related to apparently simple matters such as the names attributed to places, or the position of comments, or the role of tags, or even the visualisation of contents on the maps. All of them brought tensions more or less accentuated on the basis of different design choices, and I had the chance to widely test many different options along the engagement activities, learning in the process their practical implications over real actions.

Another transversal element of the first cycle of participatory design was the attention to **align the interaction with/on the platform with the social and functional interaction of different actors in the city**. We considered both:

a) **homogeneous segments of stakeholders characterised by similar objectives** and ways of acting in a public dimension (local authorities, private actors, non-profit organizations) irrespectively from their operational area
b) **heterogeneus segments of stakeholders** linked by acting on the same neighbourhood or city area.

During most of the engagement activities, participants were usually invited to thinking themselves:

[63] The Third Cycle of Participatory Design had been planned and designed, but never implemented because of changes in the orientation, vision and management of the project at the end of 2017.
[64] Many of them had been furtherly developed and refined in subsequent activities.

- **in the space** (of their neighbourhood or city)
- **over time** according to their local actions (and their permanence, transiency, continuity, discontinuity)
- **in a public dimension** in relation to other stakeholders (also considering conflicts, coalitions, partnerships).

Then, they were helped in critically reflecting on misalignments and touchpoints between these representations and their actual use of available web-based technologies or the FirstLife Prototype (according to the users' familiarity with different tools). This type of exercise associated with other activities was aimed at establishing together with users the boundaries for the intervention space of technology in their actions and relationships with other city stakeholders.

In the last months of the first cycle, the efforts of the engagement focused also on **activating the most motivate participants in the design process**. The role of these *"territorial agents"* was to amplify our reach in their personal, professional, and civic network, but also to bring the prototype and our engagement activities at the core of new ongoing or planned projects in the city, as pursued in the second cycle of participatory design.

The first cycle of participatory design concluded with the mash-up event (WS2) corresponding to the second release of a stable version of the prototype providing the complete outline of the platform.

2. Second Cycle: OpenLabs

The second cycle of participatory design moved its focus from the design of interfaces and features to the definition of integrated forms of platform support for recurrent use patterns. The approach of involving prospective users in the *"design-in-use"* [Saad-Salunonen 2014] of the platform started already in the first cycle. In the second cycle of participatory design, this approach had been applied in a more radical way working in the direction of **reciprocity between FirstLife prototype and participants**: involving city stakeholders to shape and orient the design choices for the prototype day by day, but also being involved in shaping their projects and co-design joint future initiatives on the basis of our on-going collaboration.

In this cycle, the participatory process for the development, testing and iterative progressive transformation of FirstLife had been implemented by relying on eight parallel online environments, branches of the general platform, open to experimentations and adjustment in real-world settings. These eight spaces had been associated with parallel flows of collaboration clusters with local stakeholders in "Open Labs".

Learning from the first cycle, I proposed a hybrid alternative to work with homogeneous segments of stakeholders characterised by similar objectives or heterogenous segments of stakeholders operating in the same area. Indeed, common visions and operational frameworks (and related needs) emerged across heterogenous segments of stakeholders working in different areas and at different scales. As a result, the structure of an Open Lab was based on the following steps.

1. The **clustering of local stakeholders** in groups sharing compatible point-of-views and goals (known from previous engagement activities) in order to work with them in a common platform branch
2. The **definition of a joint work plan with each stakeholder** in one of the Open Labs. The plan included the list of activities and commitments related to a micro-project chosen or proposed by the participants. A micro-project is an initiative to experiment the introduction of the platform in one of the stakeholders' actions. The implementation of micro-projects required to stakeholders to shift their engagement from participation in external activities to

temporarily transform their internal activities allocating resources (human resources, spaces, time) to sustain the collaboration.

3. The **participation in seminars** (2-3) to get familiar with the prototypes and reflecting on the integration of the platform in the stakeholder context
4. The **implementation of the micro-project activities** (~6 months) supported by the platform helpdesk, and customisation and development efforts
5. The attendance of **monitoring meetings** (2-3) during the project's activities, sometimes also oriented to explore together the experiences of other micro-projects implemented in the same branch platform
6. The joint organisation of a **co-design workshop** to define the main use patterns emerging from the micro-project and to rethink/extend/revise the platform features under the light of the project experiences
7. Once a new collaboration with the same stakeholder or with new actors, the pre-assessment of the joint plan is used to associate the new micro-project to a specific Open Lab.

The goal of each Open Lab was identifying the common ground across a variety of real applicative scenarios for a civic social network. Studying the microprojects developed in the same Open Lab by heterogenous segments of local actors helped to better understand how they may have similar needs and may benefit of working in the same digital environment, bridging online and offline dimensions, but also facilitating the generation of synergies among compatible or complementary actions. Following the details of the eight Open Labs [see table 7.3].

Table 7.3. Open Labs, clusters of stakeholders and segment of compatible activities.

Open Lab	Stakeholders' cluster	Envisaged/Pursued Actions
Citytelling	**Creative industry sector and cultural institutions** (e.g. theatre companies, cultural hubs and centres) and individuals (**residents, tourists**, but especially **knowledge professionals** such as artists, writers, architects, historians).	▪ Creating a **collector of narratives about the city**, rendering the places lived every day or experienced once only from several perspectives at the same time. ▪ **Sharing experiences** connected with public spaces, or buildings or parts of the city ▪ Providing a common space for the numerous **community mapping initiatives** aimed at improving the knowledge about local resources to improve their sustainability (e.g. avoiding replications, easily extending successful initiatives) ▪ **Experimenting new cultural formats** to connect digital and analogic experiences, but also to extend the "life" of events and performances.
Resources	Local **producers, retail and distribution**; **professional associations** (industry and crafts); organisations and agencies working on commercial promotion and business development; customers organisations and research groups working on supply chain and sustainability issues. – Excluded GDO/LSRT (Large-scale trade retail).	▪ **Collective corporate storytelling** to enhance the local commercial, artisanal and productive ecosystem ▪ **Self-organisation of shared services** among small independent business activities, such as distributed customer care and home delivery ▪ **Normalisation of informal services** ▪ **Introduction and experimentation of new services** ▪ **Making visible the impact of local activities** on the territory (social impact included) through the valorisation of the role of historical companies and innovative start-ups.

Regeneration	**Neighbourhood committees**, formal and informal **community groups**, **public agencies** and institutions supporting regeneration programmes, **non-profit organisations** engaged in social and educational programmes in deprived areas.	▪ **Documenting projects** and initiatives to activate citizens in taking care of public spaces and community structures ▪ **Supporting the self-organisation of bottom-up initiatives** ranging from informal co-housing to preparation of public art works ▪ **Facilitating the participation** in urban regeneration programmes led by public and non-profit organisations ▪ **Supporting the transition from managed to unmanaged projects** and their outputs (e.g. new green area, playground, after school music class, food waste recovery chain, periodic local events) ▪ **Connecting distinct projects and initiatives** to reinforce their impact and sustainability through formal and informal partnerships
Communities	Cooperatives, benefit corporations and **social services providers**; **community associations** providing auxiliary welfare services; social broker institutions; donors; **health and social care institutions; proximity administrations** (e.g. district councils).	▪ Internal coordination in companies/associations/organisation working with **distributed units of service providers** (social and care services) ▪ External coordination within **networks of families/ beneficiaries/ clients or institutions/companies/associations working in the same field** ▪ **Co-production of services** between service providers and customers ▪ Connecting with other service providers or associations working on **similar initiatives in other territories** ▪ **Reinforcing the accessibility to services and support networks** intervening on the information silos
Trasformation	**Public administrations** at the regional, city and district level; **design, planning and engineering companies**; **construction industry**; public **engagement agencies**; local **committees** pro/against urban transformations; funders and **capital holders**.	▪ **Management of information** provided to different groups of project stakeholders involved in urban transformations ▪ **Enabling different groups of project stakeholders to publicly provide their feedbacks** on specific aspects of future interventions and openly discuss them with other groups ▪ **Experimenting combined forms of participation online and offline** ▪ **Visualisation of plans and interventions at multiple scale** ▪ **Visualisation of the evolution of projects** over time according to the outcome of the participatory processes ▪ **Follow up** on the decision-making process related to urban transformations and related measures
WeGovernment	**Public administrations** at the regional, city and district level; **public agencies and local private institutions** involved in ordinary city management (e.g. services sub-contractors).	▪ Supporting the **co-management of minor works** in community spaces, over urban furniture and local infrastructures ▪ Facilitating the **inclusiveness of policy-making processes** on local issues ▪ Helping the **identification of local needs** and priorities to be collectively addressed ▪ Enabling a better **coordination between public and private** interventions on sectors and domains relevant for public services and programmes ▪ Providing a tool to **experiments alternative governance models**

NewMedia	**Local media** (paper and digital); neighbourhood **social hubs**; **residents**; small businesses.	▪ Facilitating the **collection and dissemination of news** at the neighbourhood scale from residents, social centres and local entities ▪ Improving **the access to local information** usually fragmented across a multitude of websites ▪ Supporting **public discussion on topics of local relevance** outside conventional venues ▪ Extending the **lifetime of news and journalistic work** produced by local media
EduLife	**Schools** and educational /cultural institutions; **school staff**; **students**; **students' families**; **external organisations** working in school or bridging the school to the city.	▪ Publicly documenting **initiatives and projects developed by schools or groups of classes**, involving students and teachers in a shared transdisciplinary educational path or in territorial project (usually lost year after year) ▪ Supporting the **internal coordination among classes** involved in different projects in the same school ▪ Enabling schools to share projects and building new **thematic-based networks across levels** ▪ Improving the **mutual understanding between school staff, students, families and local organisations** collaborating in the provision of educational services ▪ Mapping the **connections between educational institutions and community resources** dedicated to children and teenagers. ▪ Facilitating the **transition school to work** or the access to training\integrative educational opportunities and **apprenticeship** in local companies, especially traditional professions ▪ Providing a civic-oriented online environment for **web education**

In relation to typical while radical planning practices, the participatory design strategy implemented through the Open Labs in the FirstLife project is quite similar (but at a lower scale) to the one pursued in the preparation of urban plans in complex (and conflictual and negotiation-driven) settings such as the one mentioned about the new Plan for Rome [see section 7.3.1]. As in that case, the participatory design process had been planned by operating a **functional segmentation of all the targets needed to have a comprehensive account of the city needs, and then connecting the different experiences in a common reference framework.** In that way complexity can be managed without flattening differences or let the resources completely absorbed in conflict resolution operations ("*conflicts of interests*" and "*conflicts of representation*", see also Chapter 5, section 5.4.2).

In the second cycle, the **benefits for the participants** coming from the engagement in the Open Labs were tangible (even if not monetary) and directly related to their projects (e.g. achieving more with less resources). At the same time, an applied research strategy such as the Open Labs collimates with the so-called "third mission of the University" (in Italy at least), that is actively **transferring knowledge from academia to local development.**

7.3.5 RESEARCH

The Research workstrand within the design process of FirstLife can be described in relation to the research methods selected for the study and explained in Chapter 6, sections 6.4 and 6.6[65].
The three main components of the Research workstrand were:

1. Research activities oriented to provide direct inputs for the immediate goals of the design process and platform development (Research for Design)

2. Research activities driven by the engagement of local stakeholders into the design process and their real problems to be potentially addressed by the platform (based on Action Research methods and Participatory Design techniques)

3. Research activities aimed to progressively elaborate the implications of introducing a multi-stakeholder, multi-scale, and multi-purpose platform in urban settings (Research through Design to inform both design and engagement process, and Grounded Theory for the theory on the capabilities of City Mirrors).

Research for Design activities included the in-depth analysis of other platforms and technological solutions facing similar types of challenges and addressing part of the requirements emerging from the development and engagement process of FirstLife. This kind of activities has been then furtherly elaborated in the classification reported in Chapter 4, because the analysis of these platforms then moved beyond the contingent goals of the case study. Other research for design activities that remained anchored to the development of FirstLife included the study of 1) spatial and temporal interaction with digital maps, 2) cooperative interactions over contents in the platform, 3) options for avoiding users' information overload in the absence of a recommender system. Lastly, collateral activities usually classified as research for design activities covered aesthetics and consistency of the platform interfaces to improve its usability, but these activities are not relevant for the scope of this dissertation.

The extensive engagement process accompanying the design and development of FirstLife allowed me to carry out multiple actions research processes with different segments of city stakeholders. Indeed, in this case study, I used Action Research methods in the form of a **Serial Action Research** (see Chapter 6, section 6.5). In other words, the starting point of every engagement protocols was the self-definition of the problem to be addressed or that constitute a priority for the organisations involved in the design and research process associated with the development of FirstLife. Then, the partnership researchers-participants continued with the progressive elaboration of solutions and actions plans, partially technology-supported by the prototype and other available tools. In several cases, these plans had been implemented and the solutions tested in real working environments. In other cases, an in-depth collaborative analysis allowed to anticipate anyway issues and implications of the plans and hypothesised solutions. Lastly, every action research cycle concluded by reflecting on the lesson learned about the organisation itself and the potential integration of a specific tool such a civic social network in everyday practices and future projects. Depending on the duration and form of collaboration in place, the action research cycle was reiterated two or more times, or not. In the case of FirstLife, differently from the mainstream application of action research methods, **the same flow of problem identification, planning, implementation, reflection had been repeated with several segments of stakeholders.**

[65] In this chapter, I refer exclusively to the research activities related to my PhD thesis and the study of the characteristics of City Mirrors. I have not included the parallel research activities concerning geoinformatics topics investigated by the FL group.

The Research though Design activities had been supported by the incremental development of the three core models presented in Chapter 5.

- The **conceptualisation of the different dimensions and layers of the users' representation** (User Model), developed at the beginning of the process, helped in clearly distinguishing the scope of a public platform from commercial applications.

- A common schema to classify the **type of local actions** and the related forms of technology support expected by type (Tech model) facilitated the navigation, comparison and analysis of a wide range of applicative scenarios and related requirements.

- The **interactional model of the city** slowly emerged from iterative attempts of converting the complexity of the dynamics observed in the engagement process in forms that could support an active dialogue with professionals coming from "non-urban domains" and called to produce city technologies. Indeed, since the beginning of this first case study, it became evident the urgent need of creating an operational meta-language to talk about the city across disciplines in accessible terms (City model). The variety of cases examined in the first case study worked as a continuos testbed for the City model. On the other hand, the model provided a practical lens to identify patterns, variations, strong and weak connections among urban activities, local stakeholders and their scale of action.

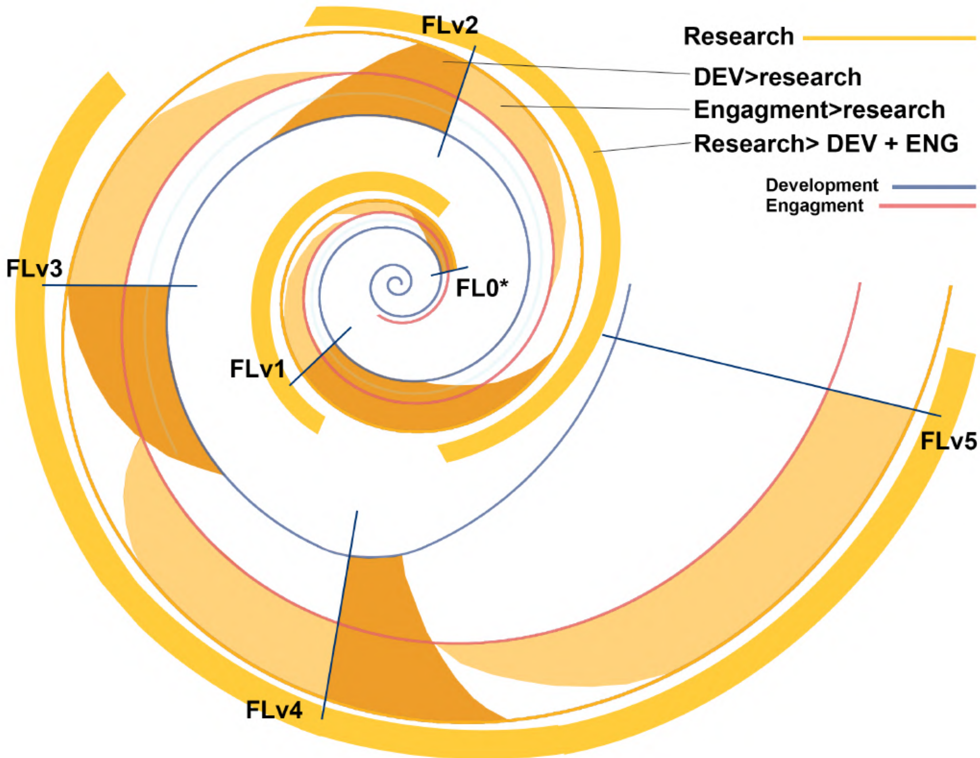

Fig. 7.14 Schema of the Research workstrand within the design process of FirstLife

The three groups of research activities had been tightly intertwined with the Development and Engagement workstrands throughout the entire design process. Figure 7.15 shows the research activities driven by design goals and engagement on the internal side of the Research spiral, and the research activities informed by reflections, study, literature and analysis of evidence from the field on the external side of the Research spiral. As made evident in the illustration, the Research strand had progressively distanced from the Development strand, while remaining aligned with the Engagement process. This also reflects the progressive distance of the design from the actual implementation of new solutions in the version in use of the platform (see section 7.4).

At the beginning of the first phase of the process, the project constraints set the direction of research activities because the priority was understanding targets, perception and domains of a map-based social network. The activation of the engagement process (with the kick-off event, the initial collaborations and branch projects) started to provide also inputs to the research on the framing of digital technologies in different city dynamics. Even though the requirements of the branch projects had deeply conditioned the first release of the platform, the lessons learned from the first round of engagement activities informed the design activities in the second phase. In this first phase, the research activities were focused on understanding the essential differences between the type of platform under development and other existing tools, both at a theoretical and practical level (addressing RQ3)

After the second and third release of the platform, development-driven research activities focused on understanding how different configurations and options in interfaces and functionalities could support specific uses. The goal was supporting the refactoring and evolution of design and technological solutions of the platform by taking into account multiple sets of requirements, sometimes in conflict. In parallel, other design research activities focused on analysing other platforms and their design patterns, elaborating new hypothesis and solutions, and experimenting their integration into the development process for the next release. At the same time, after the stabilisation of the platform, the engagement activities helped in collecting and stratifying several applicative scenarios potentially addressed by the platform, but also a rich picture of the social and contextual constraints facilitating or hindering the integration of a civic social network in different types of city activities. In the second and third phase, the core of research activities was indeed oriented to understand the conditions for the social acceptability of the platform and the correspondence between technology support and stakeholder expectations (addressing RQ1, RQ4, RQ6)

These insights informed several design choices reflected in the fourth release of the platform and helped in outlining a set of solutions for the fifth release (see section 7.5). In the fourth and fifth phase of the process, the focus of the research for design was on the expressivity of the platform, or rather its capacity to appropriately serve multiple purposes and needs with a limited manageable set of components. In these two last phases, the correspondence between engagement and research activities increased by focusing the goals of the participatory design on the ideation of new services and projects centred on the use of the platform in local development actions. The dichotomy specificity of local actions/generality of the platform constituted the main point of investigation in the fourth and fifth phase (addressing RQ2, RQ5).

7.3.5.a. DATA Sources*

The materials documenting this process and directly related to my activities correspond to:

- a corpus of 23 personal notebooks of average 200 pages each of field notes taken during and immediately after the activities for the purposes of my study
- digital notes taken on different applications (e.g. google drive, google keep) sometimes used in alternative to my notebooks
- personal notes taken after audio or video recordings of some events, meetings or interviews

- reports and documents related to the collaborations with local stakeholders that I have personally produced to support the management and self-analysis and reflection on my activities
- photos taken during part of the meetings or events
- photos of graphic materials and paper artefacts produced during workshops and meetings
- graphic or communication materials created by me to support specific engagement activities
- personal notes of the feedbacks received in different occasions in which I was in the position of observer[66].

I focused the examination of these materials on **synthetically structuring my observations and analysis on the most significant aspects and outputs of the process** in relation to the goals of this thesisand the theoretical and methodological frameworks adopted for its elaboration.

My personal involvement in the design and execution of the engagement process, in the requirements analysis and design of the related solutions, and in the evaluation of these solutions in different cases and contexts allowed me to easily navigate the vast amount of collected materials and effectively use them as a support for the analysis of the case study. My direct involvement had been determinant to also be aware of the connections among the data sources and the corresponding actions done within the design process. Indeed, these connections are untraced in the documents, as well as most of the lessons learned step by step by the people directly involved in the project and rationalised in ex-post reflections. In other words, my experience provided to me the big picture in which all the fragments of information are placed and contextualised, but also a detailed image of the low-level relationships among different pieces of information. Nevertheless, I decided to analyse this case study not by focusing on my subjective perspective, but on the constraints emerged during the design process that led to iteratively reframe the problem of designing a City Mirror and the insights on local dynamics from the perspective of city stakeholders (see Research Epistemology, Chapter 6, section 6.5.).

I have not considered the contents collected through the platform all over its development as direct sources for my analysis of the case study[67]. Firstly, because the detailed analysis of the platform data is out of the scope of my methods and the purpose of this case study in the dissertation. Secondly, my notes on each experimentation and collaboration already covered the type of shared information on the platform, but most important why that specific type of information had been shared, by whom, how, and for what purpose. These elements indeed have always been made explicit in building the applicative scenarios with people and organisations involved into the engagement process[68] [see also section 7.5].

[66] As already specified in Chapter 6 (Section 6.7.3, Research ethics), I did not use data or materials belonging to third parties. I used uniquely materials personally produced as part of my independent research activities aimed at analysing and conceptualising the elements emerging from the experience matured within the FirstLife project. Indeed, this work can be considered as a practice-based research and not as a work-based research. More explicitly, I was not required to develop a research on the role of web-based technologies in city dynamics as part of my professional duties, and the results of the research independently developed are not meant to address needs and practices of my previous workplace. I suggest the following references for an extended explanation of the difference between practice-based and work-based research. Candy [2006] and Biggs & Büchler [2007] detailed characteristics, process, output and outcomes of practice-based research. Costley et al. [2010] instead detailed the characteristics of work-based research. However, this is not the central aspect of this dissertation. It is just a functional distinction required because PhD studies in urban disciplines dealing with the developing of actual artefacts as a strategy of inquiry are still infrequent.

[67] Other sources not considered in this study concern materials of projects and initiatives related to FirstLife, but independently prepared by units and people outside of the development team of the FirstLife platform. Anyway, they constitute a marginal part of the set of initiatives associated with the platform and they are not related to the exploration of city dynamics through the platform.

[68] Other practical considerations have been driven by the fact that I interrupted my collaboration with the FirstLife project in January 2018, and I developed my analysis to write this chapter after that date. The contents on the FirstLife platform are covered by CC license and therefore allowing not commercial uses, but I decided anyway to focus on my own materials because completer and more appropriate for the purposes of my study.

As specified in Chapter 6, section 6.4.2, it is quite incorrect and reductive to refer to these materials as "data". Indeed, notes, reports, documents, artefacts are the traces of stories, concepts, ideas, experiences, understanding of phenomena and facts, projections of a desired future, chains of actions contextualised in space, time and organisational structures, and other complex articulations of thoughts and human expressions. According to the DIKW pyramid outlined by Ackoff [1989], these expressions correspond to information in some rare cases, and more frequently to "knowledge" and "wisdom". These sources had been used to generate knowledge (organised and structured information, e.g. the understanding of the decisional protocols of the district council) and wisdom (applied knowledge, e.g. ability to assess the conditions to put in place a risk management plan in a multi-actor partnerships). The expression used in this work to refer to the collected materials is DATA*, to comply with the conventional and flattening use of the word "data", but also trying to underline that we actually deal with something different from "data".

7.3.5.b. DATA generation activities*

The research accompanying the design process of FirstLife had been a practice-based research [Candy 2006, Biggs & Büchler 2007]. Thus, most of the data* generation activities had been associated with specific activities done in collaboration with or for the development team or as part of the engagement programme that I carried out for the design and development of the FirstLife prototype [69].

The **types of activities leading to the generation of data*** included: workshops, participatory design sessions, meetings, group meetings, local events, events organised by the project team, websites preparation, interviews, work sessions, contextual enquiries, public demos, documents gathering, testing sessions.

The **techniques and tools applied for the generation and co-creation of data*** included: interviews, focus groups, sketches, questionnaires, participants observations, workshops facilitation techniques, paper prototypes and toolkits, probes, in addition of the use of the platform in itself as a boundary object (see Chapter 2, section 2.4).

The **types of data*** included: fields notes, notes from test-in-use sessions and experimentations on the platform, notes from recording, minutes from meetings, reports of the engagement activities, materials used to support the engagement activities, power point presentations, posters, photos, project/collaboration documents, e-mails, screenshots, photos, post-its, written feedbacks, drawings, graphical representations of applicative scenarios, additional materials illustrating the projects and activities of the stakeholders involved in the process.

The **participants to the activities** from which data* have been generated included representatives of different organisations and groups classified by type of stakeholder, type of organisation, their role at the meeting, their role in the scenarios built with them or in the practices analysed with them. To preserve the anonymity of participants, their names are never mentioned in the following analysis. Their organisations are identified by type (e.g. voluntary groups or charity, under the class "non-profit organisation"), or by name exclusively in the cases in which there was an official partnership and specific initiatives jointly implemented.

[69] A detailed overview of the data* generation activities undertaken throughout the design process of the platform is available at the following link: link (full anonymisation in progress).

7.3.5.c. DATA analysis cycles*

I analysed the data collected after each workshop, meeting or interview, often in collaboration with my colleague in the design unit, acting also as development coordinator[70]. In this first round of analysis, the focus was on distinguishing between information relevant for the design of the platform and other information. The information relevant for the design of the platform were also regularly discussed with the development team, or with the specific members of the team carrying out activities directly related to the topic under discussion.

I was used to furtherly analyse the data considered not immediately relevant for the design of the platform to plan and organise the next engagement activities, but also to reflect and compare the inputs from the field with the inputs coming from the literature and other experiences (*abductive reasoning*, see section 6.2.). I revised the collected materials every time I needed to support specific project activities, restructure my research plan and reorganise my reflections on the on-going process.

Later, I analysed again the collected materials twice to prepare this thesis: a longitudinal analysis on FirstLife for Chapter 7, and a transversal analysis on FirstLife and the two following case studies for Chapter 10. In the first round of this last phase, a systematic analysis of the materials had been facilitated by the deep familiarity with the collected material, the distance from on-going activities, the reflections matured on the closed process, and the finalisation of the core models.

The analysis focused on:

- Making legible and communicable the various components of the **FL design process** (reported in this section) through meta-design reasoning and visual thinking

- Reviewing and critically examining the **evolution of the platform** under the light of the constraints defining the design problem space at each phase of the process, in relation to key requirements coming from particiaptory design activities, the project agenda, and the technical challenges to be adressed (see section 7.4)

- Surveying, grouping, classifying, comparing the **applicative scenarios** generated during the process and their essential caractheristics by using thematic analysis techniques (see section 7.5)

- Organising and structuring the lessons learned from the field and the insights deepened through **concetualisation according to the main components of the core models** by applying grounded theory procedures (see Chapter 10).

[70] During the periods in which other persons were assisting in the engagement activities, a preliminary analysis of data* was also done in collaboration with them to fill gaps and integrate multiple perspectives, understanding, impressions on the performed activities. Although this preliminary analysis was not aimed to support research activities, but operational arrangements.
Daily or weekly debriefings including the key insights from the engagement activities were also prepared for the client and presented in face-to-face meetings or in written forms (reports, e-mails, other documents). These debriefings had the function to keep the client informed on progresses or consulted on specific actions as part of my professional activities.

7.4 THE PLATFORM EVOLUTION

The systematic overview of the design and research process that accompanied the development of FirstLife highlighted that the prototype advancements happened in cycles, alternating radical changes corresponding to the progressive releases of the platform and small incremental changes continuously implemented to react and address the various needs and constraints coming from the engagement activities. At the same time, the forms and structure of the engagement activities allowed testing the design choices against a high number of applicative scenarios, settings, social structures. Therefore, it is quite difficult to separate the account of the evolution of the platform from the evolution of the participatory process. Ideally, those two paths should be presented in parallel. As this is not possible in a linear text, in this dissertation, I decided to discuss first the evolution of the platform to make understandable its functionalities and capabilities over time [in this section, 7.4.], and then addressing the analysis of a set of representative scenarios exposing the central issues and potentialities of a civic social network in self-organised collective actions [see section 7.5.].

In this section, I am going to structure the discussion on the evolution of the platform in relation to the milestones corresponding to the releases of new version of the prototypes to the public. Consistently with the third core model in Chapter 5, I focused on the elements to study city-mirror-like technologies in their context of use, in relation to **coordinative and cooperative dynamics**, as well as on **the interactions with city resources mediated by technology** and the **interactions with the main components of the platform** (including user accounts, map-based interfaces, temporal features, contents manipulation, and so on). I highlight the underlying **design metaphors adopted along the process, the kind of new design problems addressed one release after another, and the key issues associated with alternative design choices concerning one or more platform components**.

I would not discuss or address strictly technological matters related to the development of the platform, because beyond my domains of expertise, not appropriate for the intended audience and not aligned with the goals of this dissertation. The architecture of the FirstLife platform, the software solutions used for its implementation, the specific technical challenges posed by the agile development framework associated with a large-scale participatory design are discussed instead in the PhD thesisof the development coordinator of FirstLife [Antonini 2016]. Respectively covering the two roles of development coordinator and engagement coordinator, we matured two complementary perspectives on the evolution of the platform from 2015 to 2017[71], enriched anyway by our joint work for a long time. I present the perspective more focused on the relationship between the platform capabilities and the articulation of collective city dynamics.

7.4.1 FIRST RELEASE: FL_V1

FirstLife, since the starting of its design and development process, was conceived as a urban data platform, aimed at supporting activities, initiatives and local projects by improving the coordination among city stakeholders to contribute in social innovation processes. The platform was designed to offer a geo-

[71] After December 2017, the Firstlife project continued its development with a new team, goals, and directions. As stated at the beginning of this chapter, I invite the reader to refer directly to the webpage of the project and other informational materials to discover updates and more recent releases produced after December 2017.

referenced representation of open and crowdsourced data, by using a map-based interface where users can add places, events, news and stories about their neighbourhoods and the areas in which they live and work, creating and sharing public information. The timeline, integrated later, was meant to allow users viewing and organising contents from the past, current events or activities planned by choosing a specific period. Through these features, the platform goal was to support the management of the transformation of the city through time, from a social, functional and physical point of views.

Starting from the main idea to create a map-based social network formulated by the Client (the scientific coordinator of the project), the definition of the platform evolved over time following the inputs of the engagement process, collateral projects and development resources. **FirstLife version One (FL-V1) was a mapping tool for crowdsourced data** based on that idea and the intent of enhancing the relationship among users based on spatial proximity and sharing of information about common needs related to the places where they live.

7.4.1.a User model

The initial user model was based on individuals acting as single operators in the city. Consequently, there was only a registration option, as single users associated with a username and an e-mail address. In addition, the main choice related to the registration of users was to keep it simple and coherent with the main aim to define a civic social network, avoiding asking for personal information commonly required for user profiling, such as gender, birth date, residence address, and list of interests, etc. This framework was acceptable for citizens without a role in public administration or in public and private organisations, and positively evaluate as a positive alternative to the invasive approach of main social networks. On the contrary, a light identification of users was an obstacle to the potential use of the platform by public officers because of the responsibility that each public officer had over contents published on behalf of local authorities, confirming the preference of public sectors organisations for strong authentication systems in platforms meant to support their activities, as also seen in Chapter 4.

7.4.1.b City entities

At this early stage, the platform could be used to share static information about Point of interests (POIs) described by two type of entities, places and events.

- **Places** included facilities hosting public services and utilities, buildings or spaces used for open events and community activities, areas chosen by associations, organizations and companies to implement new territorial projects, points of interest from a socio-cultural perspective, etc. As a civic social network, the mapping of private and residential places was excluded, but we promoted an active involvement of commercial and productive activities (usually considered as private entities) in relation to their contribution for the local development.
- **Events** were intended as public events of any type and scale, which included public gatherings such as concerts, exhibitions, festivals, but also micro-events and spontaneous initiatives at the neighborhood scale, that usually do not leave any trace on newspapers and classic communication channels. By enabling every user to create a new public event, the platform wanted to support bottom-up activities and an active citizenship.
- In a short time, the participatory design process led to integrate these two entities with other two: **news** and **stories.** Their purpose was to have a specific entry point for fast and punctual information to be directly visible on the map and an incremental open access archive to share information about past events, memories, project' reports regarding places ad people.

- Then, the last entity integrated in list in subsequent versions was the entity "**Group**", intended in two ways:
    a) as a first form of aggregation of the previous entities to represent past, on-going and planned activities corresponding to multiple events, places, stories and news distributed on the map and in an interval of time.
    b) as a set of people collaborating at local level in ordinary activities or initiatives.

In following steps of the development, the main challenge became precisely representing complex urban entities on a crowdsourcing platform by keeping their number limited to these and working on their structure, to simplify their construction on the basis of modularity and incrementality principles.

The entities on the platform were initially subjected to the same common categorisation system based on thematic categories such as Sports, Culture, or Food, and a mono-category clustering mechanism. Over several meetings and workshop this classification system resulted to be too rigid and reaching a consensus over the labelling of the categories was impossible. Indeed, the richness and expressivity of these physical and social objects to which the platform entities were corresponding highlighted the impossibility of using a common vocabulary across different domains or segments of users.

7.4.1.c Interactions on the platform

The interaction with entities was limited to the creation of new entities or the filtering of existing ones, by using the action buttons on the bottom right corner of the main interface. Each user could create new entities, select a category and add a description of which he/she is the only author. Moderation over contents was avoided do not providing the possibility to comment entities entered by other users. On one side, this choice defined a protected environment for users to share their points of view and knowledge about local resources in a common information space. On the other side, this limited the possibility to interact with other user through the prototype and activating new relationships based on proximity.

7.4.1.d Indirect relationships among users

The preliminary form of coordination enabled by the FL-V1 was linked to the reciprocal visibility of entities shared by different users on the map, representing places or activities carried out in a specific place on a wide range of topics organized by the category system. The reciprocal visibility of contents added by all users on the platform facilitated the mutual awareness among users operating in the same area (e.g. groups engaged in mapping campaigns proceeding in a distributed way) and create a common space for the sharing of information. Indeed, this basic model addressed the need of aggregating heterogeneous information on a geographical basis, overcoming the limitations of the text search engines of web browsers that make very difficult to find not high-ranking local information and the current fragmentation of news and updates about local activities spread among institutional portals, organizations websites, Facebook pages, etc.

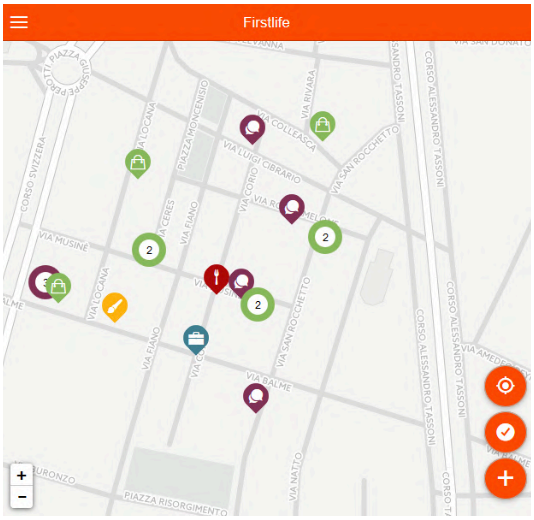

Fig. 7.15 Screenshot of the V1 of the FirstLife platform. Source: Antonini 2016, pag.139. Authorised reuse.

7.4.2 SECOND RELEASE: FL_V2

To go beyond the creation of a common information space and basic forms of implicit coordination enabled by the platform (but not mediated or proactively supported), the design and development process focused on implementing new features to enable users reciprocally interacting among them by interacting with the platform entities. **FirstLife Version Two (FL-V2) became a platform for the cooperative construction of shared entities describing local actions.**

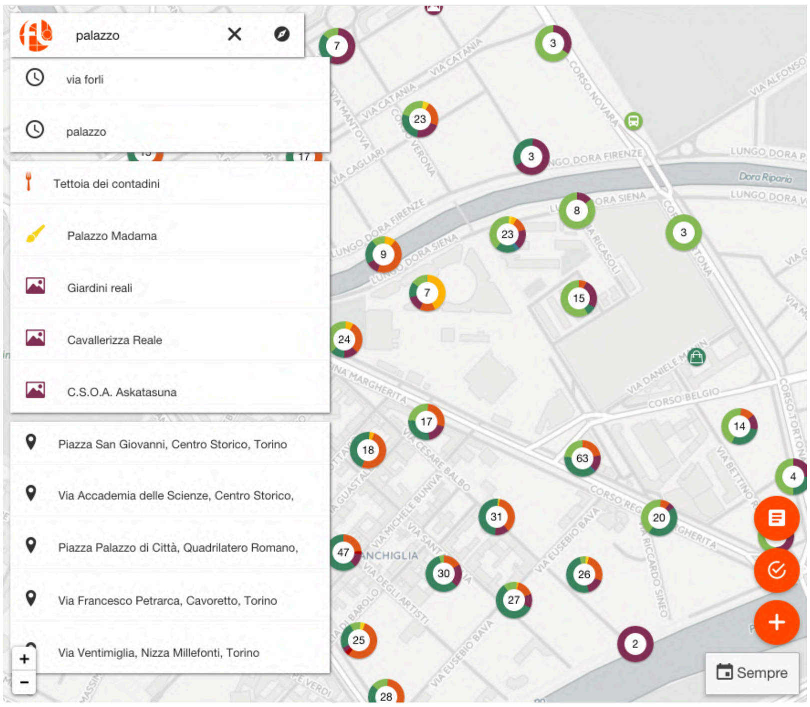

Fig. 7.16 Screenshot of the V2 of the FirstLife platform. Source: Antonini 2016, pag.140. Authorised reuse.

7.4.2.a Cooperation over contents and nested entities

The cooperation on shared entities had been enabled by creating "nested entities" or rather the possibility for users to building together complex entities constituted by a primary entity (place or event) and subsequent nested entities (sub-places and sub-events). The first author could add a POI on the map, defining its title, categories and a description, while following contributors could add photos, comments to the main entity or a new sub-entity linked by a parent-relation. Even though the model of users as individuals remained temporary unchanged, this structure of entities implicitly introduced the two roles of "the initiator" and "the contributor", transferring the concept of the hierarchical structure of entities to an implicit hierarchy among users. Both, **roles of users and internal hierarchy of entities** were both problematic from the perspective of users because, while existing on the platform only, they were easily projected as representation of the external reality of city dynamics and real relationships.

In the end, they resulted completely unacceptable from a social perspective because arising two main issues:

1) The legitimacy of the initiator in adding a new POI, classifying and describing it, and maintaining the ownership and the moderation rights and burdens.
2) The subordinate role of authors of sub-entities compared with the initiator stimulate competitive attitude instead than cooperation.

To clarify the first issue it is helpful to consider an emblematic example extracted by one of the workshops: the mapping of a school in in the neighborhood. Who is legitimate to describe the school? The dean, the school board, school employees, teachers, students' parents, former or current students? The school board and the dean can describe the school in term of educational vision and methods, or syllabus and training paths; employees are qualified to write about the public services offered by the school; students and parents can share their experience lived in the school environment. What if the school is hosted in an historical building? What is more prominent? The historical or the educational aspects? Therefore, who is legitimate to describe the historical aspects? Historians, architects, local experts, students, neighborhood inhabitants, cultural heritage authorities, or local administrations? The local administration can motivate the change of destination of a monumental place to a public facility in order to revitalize the local area. Historians can describe the significance of that building in the city history. Architects and local experts can describe stylistic and technical characteristics and why the building is worth to be preserved. The cultural heritage authority can place the building into the local cultural assets. For the inhabitants is a focal point in the neighborhood over the time.The example can become even more complex. What if the school gym is used by sport organisations for their activities? What if the school is managed by a religious organisation? An urban entity apparently simple as a neighborhood school is actually a complex urban entity that lends itself to be represented by a multiplicity of descriptions, all fitting a specific aspect of the reality, with different forms and levels of legitimacy.

Even though the essence of a crowdsourcing platform is that every user can add information about everything, this logic conflicts with the ownership commonly attribute to places. Most important, it conflicts with the perceived "right" to write about a place or an event, determining uncertainty about what could be added or not on the platform by each user.

In term of social constraints, if the platform should be intended just as a citizens mapping tool, this prevented institutions to use it as an informative tool because of the issue of distinguishing between official and informal information. On the contrary, if the platform should be intended as an institutional portal, citizens were not motivated to share their own points of view and share initiatives and useful information for local groups and peers. Shifting to private activities, such as companies offices or shops, the problem remained the same. Does a customer have the right to describe a commercial activity or only the owner can initiate the entity for its activity? The legitimacy problem find an initial solution in the following version of the platform, setting a dual model of users, in individuals and structured organisations such as associations, institutions, local authorities, business, etc.

In this way, the platform shifted from the simple non-anonymity of users (a key principle in a civic social network) to the implicit identification of their positions in relation to shared contents. The evaluation of legitimacy and value of shared information remained left to users, assumed as able to make their own evaluation about the relevance of the contribution shared on the platform considering the authors' name (personal name or institutional/company mane), context and theme.

As regarding the second issue, the most significant manifestation of the competition dynamics triggered by the transfer netween entity hierarchies and social hierarchies was observed and definitely confirmed (after many other engagement activities) in an experimental project that involved about 700 students in mapping the city of Turin in the branch project TeenCarTo [see section 7.3.4]. In that case, the competition over the representation of shared urban entities on the platform led users to:

- create new entities for POIs already existing openly refusing a possible relation of subordination among peers
- or creating sub-entities to add a new description and classification to the same place in conflict with the main one.

In both cases, the result was a wrong representation of reality. For example, the platform collected dozens of markers pointing to the same museum without adding any useful information to its description, or the entity "museum" containing the same entity "museum" as sub-entity more than once.

Despite these issues, the schema of nested entities resulted to be effective in representing urban entities, such as buildings hosting multiple services or big events like festivals constituted by a series of sub-events, relying on the patters: place-sub-places, event-sub-events, place-events, event-places. But still not socially acceptable.

7.4.3.b Comments-related issues at the neighborhood and urban scale

The content cards corresponding to the entities Places and Events in FL-V2 has been enriched with the possibility to add comments and photos by the initial author or following contributors. This first step to allow a direct dialogue among users based on geo-referenced entities brought out the problem of the moderation over contents in case of unwanted comments because of their potential impact on the author reputation in real life.

Indeed, a large majority of participants involved into the engagement activities stressed that a location-based social network implies a greater user exposure compared to global social networks, and call for the compliance with behavioral codes usually respected in real life also on the online environment. Many called for a sort of enforcement to be "civil" on a "civic" social network, and this element remained critical along the development of the platform until the introduction of an internal reporting system.

On one side, widespread unethical conducts on global social networks affected the attitude of potential users toward a new tool, especially considering that offensive or inappropriate contents are perceived as more serious and impacting if published by someone sharing the same living environment or partners in city activities. On the other hand, community guidelines oriented to limit inappropriate behaviors were perceived as diminished the appeal of the platform because seen as restriction in a "space of freedom" as web platforms. The non-anonymity of users as prerequisite in a civic social network partially compensate these issues, but it has not solved the problems of fear and distrust toward third parties essential to facilitate the adoption of the platform by public and private organizations.

7.4.2.c Viewer and socialization of maps

FL_V2 introduced the first social networking functionalities to implement the vision of an open tool connected to other communication channels. The first step consisted in activating a “viewer mode” for the platform (to visualise contents, but not editing them or adding new contributes externally) and the sharing of contents outside the platform, by sending a link through other communication channels or embedding the map in external websites. The possibility to show the work produced on FirstLife incorporating the map into a personal website resulted to be a strong reward mechanism for perspective users, but the impossibility to share automatically contents produced on other social network within FirstLife augmented the perception of an extra effort in using the platform.

7.4.2.d Multi-dimensional category system

The closed mono-category system used in FL_V1 resulted to be very critical and extremely conflictual in a generalist platform intended to be shared by different stakeholder in a series of complex environments. Thus, it had been rejected because difficult to be applied on real complex entities or descriptive enough to compensate the abstraction effort by the user.

FirstLife Version Two (FL-V2) introduced a **multi-dimensional category system**, allowing the definition of multiple categorisation for each type of entity in the general platform and in each branch project, overcoming the limits and stringent constraint of attributing only one category to entities that perhaps does not fit with the objectives and the requirements of specific actions and domains. Each category space across the main platform and other branch platform was mapped in a common tag space, enabling the shift of data from a branch project to the main platform. This technical solution was the first seed to customize the category sets for different stakeholders, creating multiple parallel working environments but one final collector of shared information, as envisaged in FL_V5 and subsequent design concepts.

In particular, the FL-V2 integrated two category spaces for places (type of space and functions) and three for events (type of event, costs, target audience). The initial result was a long list of categories within which it was necessary to select a category for each category space to classify a new entity. The low level of usability, especially on mobile devices, led us to a modal redesign to organize the list in multiple wizard pages moving from FL_V2 to FL_V3.

The introduction of multiple spaces of categories allowed to **automatically create multiple map themes**, providing users the opportunity of exploring the same contents from different perspectives or to swipe from a map to another. In subsequent versions, FL_V3 and FL_V4, these options had been extended to the visualisation of aggregated data corresponding to the user map (containing all contents generated by the user), the group map (all contents of a group generated by its members).

The negotiation of category names for each dimensional space attempted in a series of focus groups to reach a common language and understanding on the definition of certain attributes of entities, despite a progressive refinement, remained uncertain. As an alternative and in parallel to the classification by categories, a set of **tag-based features** had been introduced moving from FL_V2 to FL_V3. They were ranging from search options to the visualisation of a tag map, or rather the map generated by all entities sharing the same tag. In this way, tags helped in extending the semantic of closed categories, defining a set of internal categories being used as hashtags by groups collaborating at the same time on a topic, and linking entities in a light way to highlighted them by a textual filter. In addition, tags were also often used as an alternative to the descriptions to express synthetically the key characteristics of an entity.

Later improvements of the navigation of the multidimensional category system for different entities in FL_V4 also included the shift from list of categories to tree maps [see Fig 7.20]. The tree maps made easier to interact with a multi-dimensional category system on two levels of depth, managing the selection of theming and list of categories, and avoiding scrolling a long list of items to get an idea of the classification system and interact with it to filter map entities. Despite that, tree maps resulted to be generally not intuitive for a large majority of users at their first use of the platform, while showing at steady learning path (i.e. one understood the principles, they became easy to be used).

In particular, the FL-V2 integrated two category spaces for places (type of space and functions) and three for events (type of event, costs, target audience). The initial result was a long list of categories within which it was necessary to select a category for each category space to classify a new entity. The low level of usability, especially on mobile devices, led us to a modal redesign to organize the list in multiple wizard pages.

7.4.3 THIRD RELEASE: FL_V3

Lessons learned from the experimentation and evaluation of the first two versions of the platform led to rethink the social model of users and the dynamics of their interactions on entities. In FirstLife Version Three (FL-V3), individual and collective users had been enabled to interact over space and time in building complex urban entities representing dynamic objects from multiple perspectives.

7.4.3.a. Citizens and Organisations

While in FL_V1 and FL_V2 the user model remained focused on individuals only, this model had been doubled in FL_V, introducing the distinction between **users acting on the platform as individuals and users representing a collective body** by sharing content on behalf of municipality offices, local institutions, companies, charities, etc. The labels attributed to these two groups were “Citizen” and “Organization”, with an authentication requiring a VAT number or an Identification code for the second one (to start overcoming the limits of the light registration). The legitimacy problem found an initial solution in setting this dual model of users. The evaluation of legitimacy and value of shared information remained left to users, which can make their own evaluation about the relevance of the contribution shared on the platform considering the authors’ name (personal name or institutional/company mane), context and theme.

The main pros of this solution was a representation of stakeholders acting in the urban context more compliant with the reality, partially overcoming the problem of assigning by design a level of reliability of information easier to evaluate in relation to the users’ experience and goals. For example, information about a variation in opening hours of a public service have intuitively a higher degree of certainty if they are published directly by the competent office staff.

However, issues highlighted by the participants in the research and design process were still many:

- Difficult management of the account credentials in large organisations (one account and one password is unsafe in numerous groups, although it is very practical in small ones)

- Responsibility over contents remains impossible to attribute to a specific user using a shared account, and this is critical in institutional and business contexts
- Lack of transparency for readers of organisational contents due to the absence of the author's name, hidden by the organisational name
- Need of multiple registrations for users using the platform as member of one or more organization and as citizen interested to what is happening in the city.

This last point also implied the multiplication of the same user on multiple accounts, mixing user identity (one) and roles (multiple).

The main weakness of this model was its inefficacy in representing size and structure of different organisations, but most importantly their real influence and sphere of action at an urban level. Not having an internal differentiation among organisations, for example, a small association of 5-10 people was considerable on the platform as equivalent to a large charity counting thousands of people. Again, as highlighted for the transfer between hierarchy of entities to hierarchy in the city, also this aspect resulted widely problematic because not differentiating opportunities, capabilities, and type of relationships among local organisations and across different classes of stakeholders.

7.4.3.b. Complex entities for a multi-perspective representation of reality

Leaving the initiation of an entity to the initiative of a single users, even if legitimate and potentially contributing on behalf of a collectivity, still was problematic. First of all, it was necessary to avoid one single user monopolising an entity (as it could happen for real spaces in cities, virtually transformed from public in private spaces) for several reasons:

- Lack of perspective(s) over the representation of urban entities and impossibility to render single entities and their relations in their social context
- Variation in the commitment of users to 'take care" of virtual entities, as well in their involvement in real settings
- Excess of responsibility over other organisations and groups, and overexposure of initiator and moderators potentially imapcting on their offline reputation.

To deal with the issues related to the concept of "ownership" applied to content added on the map and in particular to avoid the practical and semantic overlapping between "initiator" and "owner", **the action of mapping had been split from the action of describing an entity.**

Technically speaking, two different order of entities had been introduced on the platform, while remaining stable the type of entities (Places, Events, Stories, News, and then Groups):

- **First Order entities** had an hidden initiator (and they were corresponding to the first entity added on the map in the scheme of nested entities)
- **Second Order Entities** were all the possible entities associated horizontally to a first order entity, with their related contents composed by multiple coexisitng desription of the same entities, enriched by comments and images.

Hiding the name of the initiator in First Order entities was intended to avoid multiple entries for the same entity related to the logic of competition and the refuse of subordinated roles in the cooperation over contents. In addition, properties to be set at the creation time had been kept minimal and objective as possible: title, valid time interval, categories, tags, external URL, coordinates (latitude and longitude). On the contrary, in Second Order entities, the names of contributors were associated to their specific point of view expressed by contributing with one of the multiple parallel descriptions for entities to attribute and enhance the individual users contribute.

In this way, the cooperative construction of complex urban entities representing multiple perspectives of different authors from a shared entry point on the map implemented a model opposite to the one of collaborative platform such as Wikipedia, where the goal is to reach an agreement among contributors on an objective description of a subject. The goal of FirstLife was actually to represent the contemporary coexistence of heterogeneous perspectives in urban environments characterised by multiple stakeholders and a plurality of social structures. In this way, moderation responsibilities had been dropped down from first level entities to second level entities, to diminish power and burden of initiators.

Going back to the example of the neighbourhood school, a generic user can add a point on the map indicating the school (simply attributing to that entity a position and basic metadata). Then, every kind of user, from the dean to the parents association, from former students to sport groups using the gym on the evening, can share relevant and public information on the school from their points of view in relation to their experiences and activities carried out in that place. Contents belong to the same entity, the school that is one also in the real world, even though it is lived and used in a different way by different users. All the contributors can decide to cooperate by sharing new information and assess by themselves the relevance of other contents on the basis of the signature associated to a description, without being influenced by the fictitious role of initiator of the entity.

7.4.3.c. Categorisation fallacy

A critical aspect of the solution related to First and Second Order entities was the classification system of entities, even in a multi-dimensional space of categories. Indeed, categories associated to an entity change according to the author's point of view and cannot really be considered objective even in the cases in which the correct attribution seems obvious.

The most extreme example of this point came out from a set of engagement activities in which users classified even a "supermarket" as "a restaurant" because in relation to their goals and activities that place was the one where they buy food for lunch. While the fact that a supermarket is a supermarket and can be consider objective, it is also real that its perception changes in relation to the user's goal. Several other examples of most conflictual places indicated that the correct positioning for a choice about categories should be brought at the level of the description of each second order entities, to avoid that the first contributor can still impact on defining the visibility of an entity in filtering, search results, etc.

On the other hand, the problem of the categorisation fallacy had been addressed also dividing between functional categories (exposed to interpretation and autonomous assessment) and properties that resulted to be usually assigned in an objective way from the analysis of the autonomous use of the platform by users. For instance, classifying an event as cultural or entertainment is subjective, while indicating if it requires a registration is objective. Indeed, categories could not be eliminated because essential for the navigation and filtering of contents on a platform based on the principle that the users should choose what contents they are interested in, without being profiles or exposed to automatic recommendations s it happens on the majority of other web-based social networks. Allowing the high-level definition of the same entity in contradictory ways was problematic as well for the consistency of the virtual representation with reality (e.g. a restaurant is not a supermarket, a supermarket can contain a restaurant tough, or a restaurant can have a shopping corner inside).

7.4.3.d. Toward a modular and incremental structure of entities

FL_V3 relied on:

- **four type of first level entities** (Places, Events, News, Stories/Extra),
- **vertical arrangements of nested entities that could reach an undefined depth** (e.g Places within places – Auditorium at the University, Events within a place within another place – Concert in the auditorium of the University – News associated with an Events within a place within another place – tickets sold out for the concert, etc.)
- **horizontal arrangements of contents of Second Order entities to multiply the perspectives** over the representations and experiences associated to the same entity

This configuration greatly increased the number of use patterns to represent everyday activities in the city and to enable coordinative dynamics in the city, beyond the cooperation in the construction of shared urban entities on the platform. While simple content structures such as Place-Stories or Event-News could already support projects oriented to collect community memories or to document an event with its day-by-day updates, more articulated structures proved to be a good fit in complex situations described in section 7.5 based on the modular and incremental organisation of digital contents.

However, the main issue derived from this system was the need to decide in advance the hierarchy of entities requiring an abstraction and planning effort very strong for the user and the definition of a top-down use pattern. The system was too rigid for an everyday use of the platform or too abstract for new users or untrained ones. This issue had been addressed by introducing bottom-up relations among entities in FL_V4.

Interestingly, the possibility to share multiple parallel perspective on urban entities had the drawback of making comments mostly unused both in relation to first order entities even for asking questions or pointing errors. So, also comments had been moved down to second order entities and used maily in relation to images and descriptions.

7.4.3.e. Timeline for analysis, coordination and planning activities

FirstLife as coordination tool has been improved in the third version replacing the data picker integrated in the previous versions with a timelime to retrieve information associated to any time interval in the past, present, and future in a specific area of interest. This feature implemented a new model of coordination oriented to create an elementary shared decision support system based on the possibility to gather information about past events, list of news and transformation of places on an interactive map accessible by institutional actors, privates and citizens. Moreover, real-time updates associated to the entity "News" or to new descriptions and sub-entities added to existing entities improved the opportunity for better coordination and planning at multiple scale and at different time intervals: neighbourhood, district, city, and hours, days, weeks, months.

This timeline was working as time filtering control and as exploration tool for temporalized entities such as events and news. And it was a continuous timeline ranging from centuries to seconds, giving to users total control in defining the period of interest. Two issues emerged:

- the phenomenon of the events stickiness: events and other timed entities tend to stick together in the central part of the day and the timeline is not used in its extend [Fig. 7.18].
- the difficulties for users to understand the connection between map and timeline and effectively use teir combination for a rapid navigation of contents.

These issues had been later addressed in FL_V4 and furtherly elaborated in FL_V5.

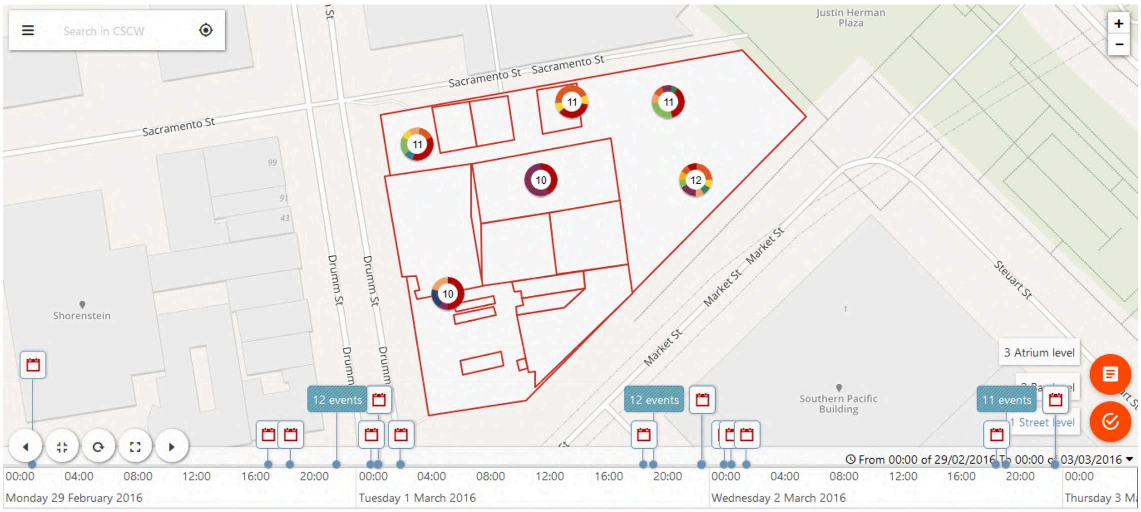

Fig. 7.18 Screenshot of the V3 of the FirstLife platform, verticalisation built as demo for the conference CSCW2016. Source: Antonini 2016, pag.141. Authorised reuse.

7.4.4 FORTH RELEASE: FL_V4

7.4.4.a. Groups and group dynamics

In the fourth version of the platform (FL-V4), we introduced Groups as a new type of entity. Defining groups as entities, the platform was intended to address specifically coordination and cooperation practices of a well-defined list of people (and organizations) working together for a limited period and for a specific goal. However, this choice resulted to be ambiguous because users tended to identify groups as static entities corresponding only to a list of people, equivalent to the organisations. Later the macro-categorization of groups divided them in coordination groups, project groups, and discussion groups.

Offline activities to engage perspective users in experimenting the platform as a support tools in one or more of their activities helped to validate the applicative scenarios to use the entity group as operational units to extend the participation of groups members in organizing and communicating on-going activities. The added value of groups with multiple second level entities has been identified in the opportunity to collect the perspective on everyday activities by different stakeholders involved in a process such as providing a service. At the same time, the perspective of having this kind of distributed communication resulted also challenging for traditional organisations where external communications are handled in a centralised way.

The relational model implemented by the entity "group" was horizontal as regarding the online actions allowed to members of the group, and it was open and inclusive because of the public visibility of content and the light mode of access into the group. The constraints posed by the relations "to be part of" defined by the entity group resulted to be not acceptable only in contexts with latent conflicts, where real-life relationships among were unclear and could not be therefore formalised or crystallised in a virtual environment.

7.4.4.b. Groups and Initiatives, bounding and light weighed forms of collective actions

In parallel to the refinement of features and properties of groups, we started to experiment on the platform another open collaboration model on online contents based on the relationship among entities labelled as "initiative". The difference was that groups were entities, with the same structure described before, while initiatives were relations aggregating entities.

The collaboration in groups is delimited in space and time and requires a direct engagement of users in building the common entities on the platform and in implanting real-world actions at the local level. Groups were indeed conceived as entities created for a specific goal (such organising an event, discussing a topic or communicating a project) and by a specific group of users (listed in one of the sections of the card). As mentioned before, a group on FirstLife was designed as having open access, with a complete visibility of content also for not members, but with the possibility to contribute in adding first level and second level entities in the group only after joining it. Groups were also intended as multi-stakeholder environment. For instance, a group dedicated to the after-school activities in community center can include educators, parents, children, volunteers, organized in homogeneous sub-groups or on the basis of shared projects.

On the contrary, the collaboration through "initiatives" is light, flexible and open to different levels of engagement in real and virtual environment. In particular, the possibility to associate an existing entity without creating an ad-hoc entity in a group make easier to activate new connections at the local level within informal networks. Indeed, the same entity could be shared by different initiatives, and therefore included in multiple groups and organisations. This solution allows an active participation of stakeholders directly involved in the organization of the initiative in representing it, but also a support or endorsement by indirect stakeholder that can associate their entities to the initiative. For instance, organizers, the public and schools can share information about a distributed reading festival. They create new entities such as local groups, news and events associated to the initiative, while the staff of the municipal library can connect the place representing the library to support the festival.

In this sense, initiatives can be used also to represent the map of collaboration among stakeholders if intended as the feature to represent independent actions made by different stakeholders toward a shared goal, that can be know from the beginning or aligned later.

In addition, initiatives did not demand for a predetermination of the vertical order of entities describing services, projects and local activities, but emerging bottom-up from an optional attribution of single entities in parallel of what had been defined for the user model in next section. Basically, the feature "Initiative" allowed users to connect entities that were pre-existing, not collocated, on distant times, etc.

This mechanism had been furtherly enhanced by open folksonomy of multiple tags associated also with second level entities, introduced in this version of the platform to overcome the limits of multi-dimensional closed categories system and tagging limited to first order entities as in FL_V3. The filtering mechanism based on initiatives, from the perspective of users, was equivalent to the mechanisms of content filtering based on tags selection, resulting intuitive and familiar.

7.4.4.c. Bottom-up definition of organisations

The user model based on the citizens-organisations dichotomy has been reviewed in FL_V4 to take into account the limits of this setting and the context of use of FirstLife as coordination tool is multi-stakeholder applicative scenarios.

Going back to the model of users as individuals, the model introduced the "signature" of users as affiliated to structured collective entities that could be the association organising an event in the neighborhood, the department of the municipal administration publishing a new call for proposal, a small business or a large company seeking to promote its activities, the school as community of students, teachers, parents, etc. This interpretation of the applicative domains of a civic social network was oriented to reinforce the responsibility over content from the author's perspective and the transparency and accountability from the reader's perspective, by having a user's signature not limited only to his/her name, but also to the main affiliation relevant in the context of use of the platform.

As empirical evidence, everyone is part of a local network or a group when we consider only actions having an impact on the public sphere and based on transversal relations in the urban environment, as the case of a civic social network. Moreover, the feature designed to implement this model provided also a solution to define an organisation as a bottom-up network constituted by real people activated on its behalf, instead than having an institutional account not representative of the people involved in the organisation itself. In other words, an organization became existing on FirstLife if there are users associated to it and sharing content on the platform.

The main limits of this solution were:

a) a static representation of the relation between individual users and organization over time, until the signature had been made dynamic on the following version

b) the impossibility to represent the multiple networks to which people are involved in.

In addition, a fixed signature was critical because an affiliation is often temporary. To address these issues, in FL_V5, users' signatures had been made dynamics, multiple, while not retrospectively changing on contents previously published under another signature

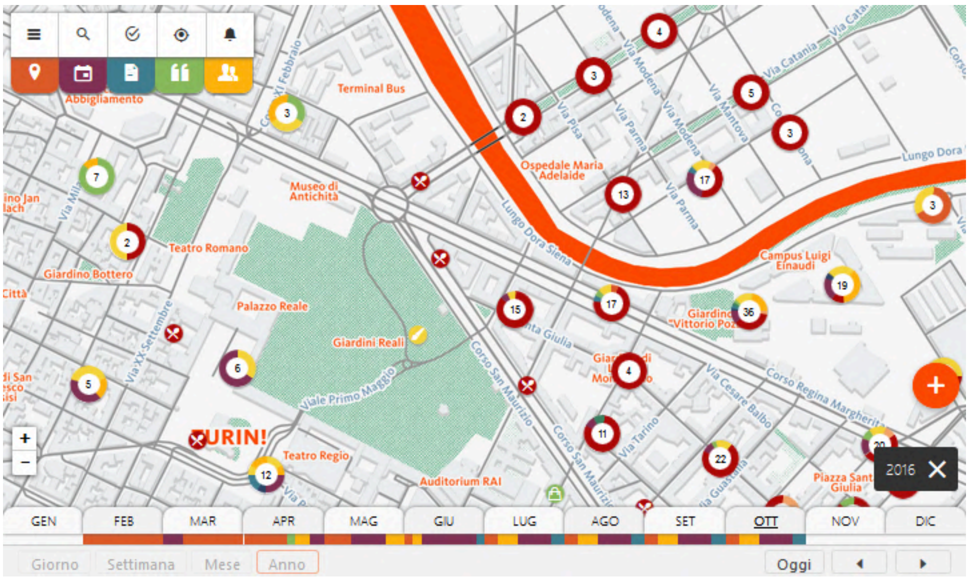

Fig. 7.19 Screenshot of the V4 of the FirstLife platform. Source: Antonini 2016, pag.142. Authorised reuse.

7.4.4.d. Global calendar at the local scale

To address the issues associated with the continuous timeline of FL_V3 we relied on a few principles emerged from the intense work in real-world experimentations. These principles included:

- It is not possible to access to entity through the timeline
- The timeline needs to provide a qualitative (entity type) and qualitative (ratio) evaluation of what is currently visualised on the map;
- The timeline should support human interpretation of the contents on the map.

In order to support user's interpretation of the contents, the timeline had been articulated in discrete units: year, months, weeks, days, night, morning, afternoon and evening. Each unit was enriched with a qualitative and quantitative bar displaying the ration of timed entities for each entity type, avoiding any direct reference to the single entities [see Fig. 7.19]. With this new setup, users found much more intuitive interacting with the timeline clicking on a step to zoom in and focus the map on the timeframe they wanted.

As a result, the new time features were oriented to filter and aggregate entities through:

- a global calendar based on a temporal index at fixed granularities, connected to multiple geographical scales, to represent information included in a geographical unit (city block, neighborhood, district, etc.) and in a specific time interval (day, week, month, year) selected by the user;
- an implicit continuous timeline associated to the time properties of the entities set by their valid time at the moment of their creation.

The difference is that, in the first case, the time intervals are fixed, while in the second case are the results of the start and end time of entities. For example, an event such a Festival lasting from the 27 of March to the 11 of April, on the calendar will be indexed at the month granularity in March and April, while in the timeline will be described by a time interval of 16 days at the granularity of days. By using the calendar as a filter for the entities on the map, they will be visible in part in March and in part in April. By using the feature "initiative" as filter, the festival will be entirely visible in the associated timeline, with its entities and sub-entities.

7.4.4.e. Aggregation mechanisms of entities

As a result of the new features introduced in FL_V4, the aggregation of entities was based on four bottom-up mechanisms:

- Initiatives: aggregation of first level entities associated by a relation indicating a common element (e.g., to be part of the same project)
- Organisation wall: aggregation of entities shared by all members of one organisation
- Area-based cluster: aggregation of entities in a topological indexing system taking into account different geographical units, ranging from the indoor scale to the urban level.
- Global calendar: aggregation of entities related to the same time interval of a day, week, month, year.

These four mechanisms combined together were aimed at letting the user in control of choosing what to see, avoiding overload of information or platform-driven recommendation mechanisms based on the profiling of users.

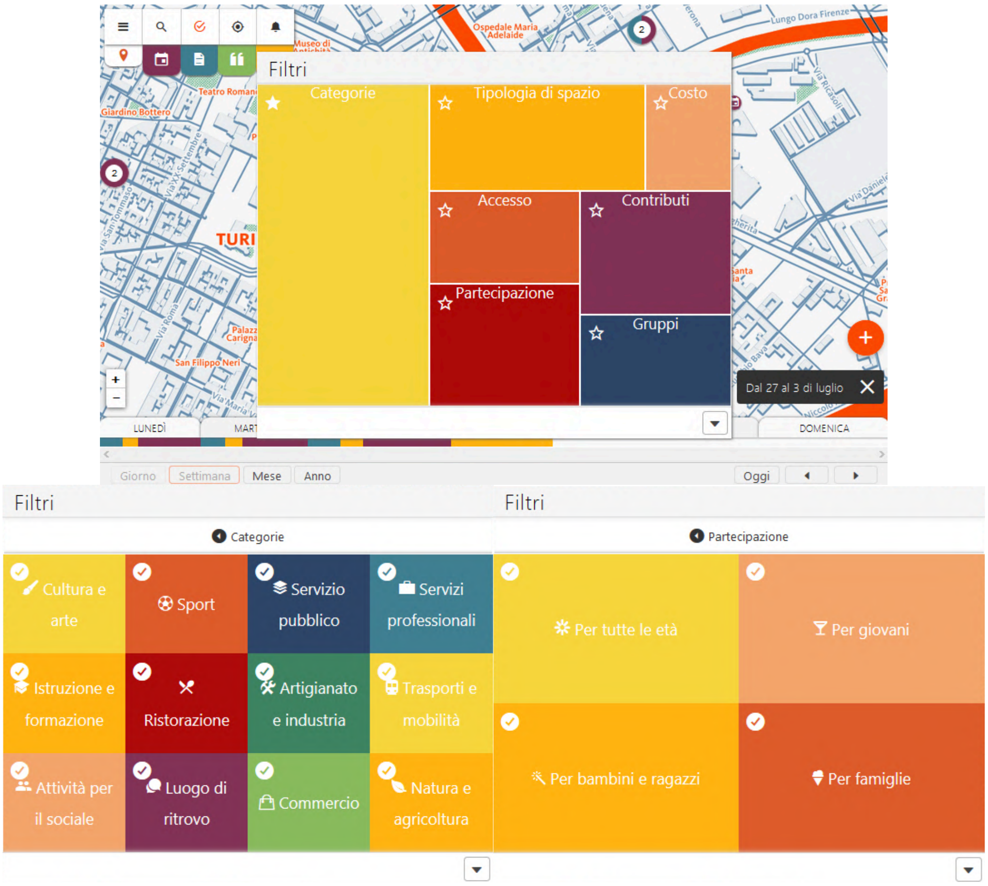

Fig. 7.20 Screenshot of the FL_V4, tree maps. Source: Antonini 2016, pag.159. Authorised reuse.

7.4.5 FIFTH RELEASE: FL_V5 AND INPUTS FOR THE FUTURE OF THE PLATFORM

7.4.5.a Users and dynamic multiple roles

In the latest version of the platform, users had the opportunity to have multiple signatures associated to the different roles played in multiple contexts and within different social structures including groups, communities, organisations and professional or territorial networks. An example of this model is a user who owns a shop, that is an advisor at a local citizens' committee and that is a member of a local sports association.

Users also had the possibility to edit their roles on the platform, when their roles in groups, organisations and communities change. While considering roles as transitory, the signature on the entities shared on the platform while exercising a previous role remained unaltered to offer a correct interpretative context to other users. For example, information published by a user that was member of a local committee is still valid as such in a past time interval, even though the user is no longer a member of that committee.

The validation process of this solution in territorial projects and workshops provided evidence that this kind of solution complied with the needs and constraints of both public and private sector actors, small and large organizations, operating as compact vertical structures or distributed horizontal ones. Indeed, a clear attribution of responsibilities over contents ensures the minimization of the moderation burden that is a crucial factor in determining the potential adoption of the platform by the majority of stakeholders. At the same time, an explicit authorship had been considered as motivating for active users, even in a platform not focused on personal visibility.

7.4.5.b Fram markers to areas

A long period of research and development had been spent on the structure of a scale-based indexing system for contents, or rather a way to associate contents to a certain scale of action, as defined in Chapter 5, and not to a point on the map [see publications list at the end of the chapter].

FL_V5 started the shift from contents associated to points on the map to contents associated at a specific scale of action at the moment of the creation of entities [see Fig. 7.21]. Planned solutions for the visualisations of contents by highlighting their area of interest remained not integrated in that version as regarding their visualisation ex-post, but explored with users during engagement activities. This created a double experience for the contributors called to reflect to the scale of action of the entity, and the "readers" visualising the same entity only a marker on the map [see Fig. 7.22].

Fig. 7.21 Schema of the scales of action to be chosen in the creation of a new entity (Source: Tutorial booklet, authors: Lucia Lupi, Elena Lucia

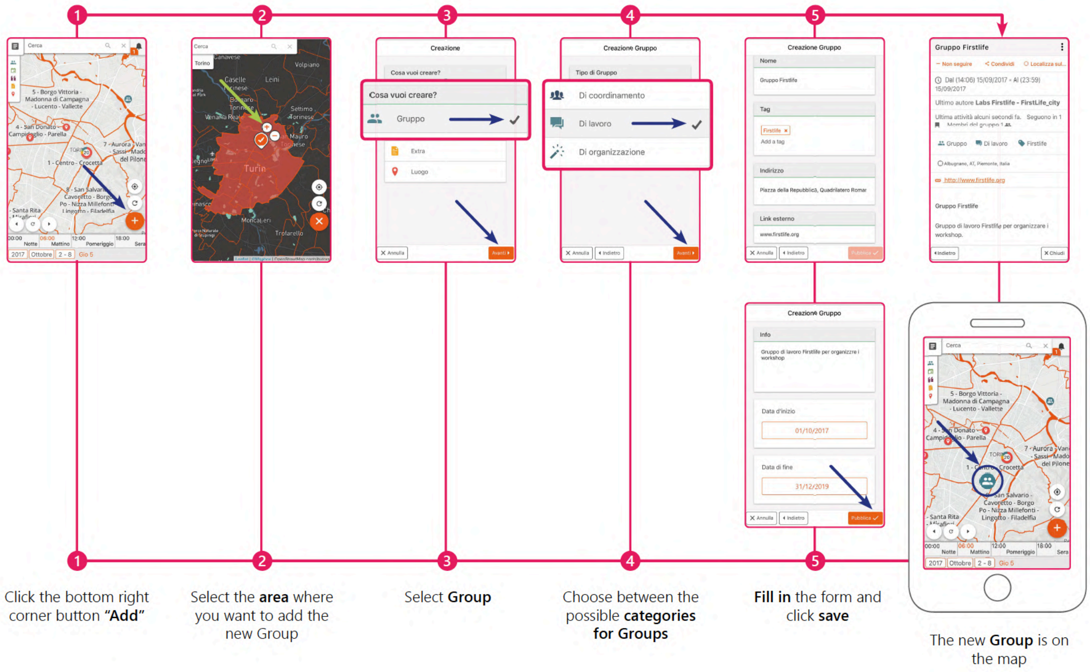

Fig. 7.22 Schema of the different visualisation of contents geographical association by contributors and readers (Source: Tutorial booklet, authors: Lucia Lupi, Elena Lucia)

The goal for the evolution of the platform was to overcome the limits of the bi-dimensionality of digital maps pointing toward the introduction of the "vertical dimension" of the scale of action to consistently represent most of the applicative scenarios developed with numerous groups, as will be discussed in section 7.5.

In parallel, FL_V5 deeply restructured the "bulletin board" or "wall of entity", component present on the platform since the beginning, but less interesting as regarding the dynamics related to the use of a map-based platform as visual media to communicate in multi-stakeholder context. The entity wall, working in combination with the map and allowing an alternative fruition of the contents, contained a list and previous of all the entities included in the frame of the map selected by the user or determined by the application window on the used devise. In other words, focusing on a specific area, the wall showed only the contents geo-referenced within that area.

Several other features of the platform not particularly significant for the investigation of the mirroring of city dynamics had not been addressed in this section. They include, for instance, the notification system, the subscription of entities and initiatives as contents of interests explicitly selected by the user and linked to notification, the features to report abuses and misuse of the platform, or to claim the attribution of a certain first order entity for its management and editing. Most of these features are described instead in the user's guide of FL_V5 that I prepared with a colleague and available at the following link: *link*

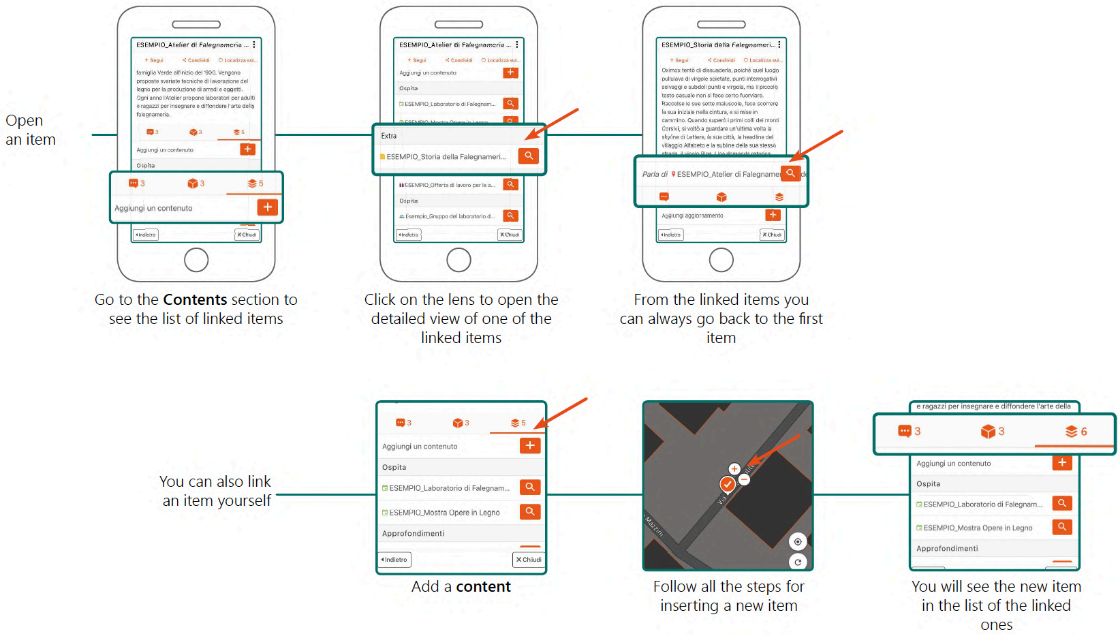

Fig. 7.23 Schema of the exploration and contribution to entities (Source: Tutorial booklet, authors: Lucia Lupi, Elena Lucia)

7.4.5.c Inputs for future implementations

As specified earlier in this chapter [section 7.3], at a certain point the design research activities proceeded in parallel with the engagement process, but progressively more distant from the development strand. Indeed, as it frequently happens with web-based technologies, radical and rapid innovation in languages and framework, force developers to integrally revise the structure of applications and this takes time. During this restructuring several solutions to improve expressiveness and direct utility of the platform in local actions had been outlines. They include [see also Fig. 7.24]:

- the **introduction of "role tags"**, as lightweight mechanisms for the management of responsibilities in cooperative activities and in case of distributed coordinative practises, to be used in combination with initiatives and groups
- a **spatialised user profile** based on the areas of interested corresponding to the different roles covered different social structures and within various networks of collaboration
- the introduction of **groups' categories** instead than global categories and tags only
- the integration of an **"area calendar"** with the global calendar in form of timeline
- the **configuration of user/group dashboards** with an assisted management of pre-sets of filters to facilitate the user switching among the different dimensions of his/her life by keeping as pre-sets of entity, temporal or text filters associated with a specific spatial and social context
- and most important the **automatization of a series of use patterns of the platform as emerging and recurring in the hundreds of applicative scenarios** defined with the participants in the process and based on preliminary combination of entities and sub-entities to be proposed to users and openly readapted to the purpose and structure of specific local actions.

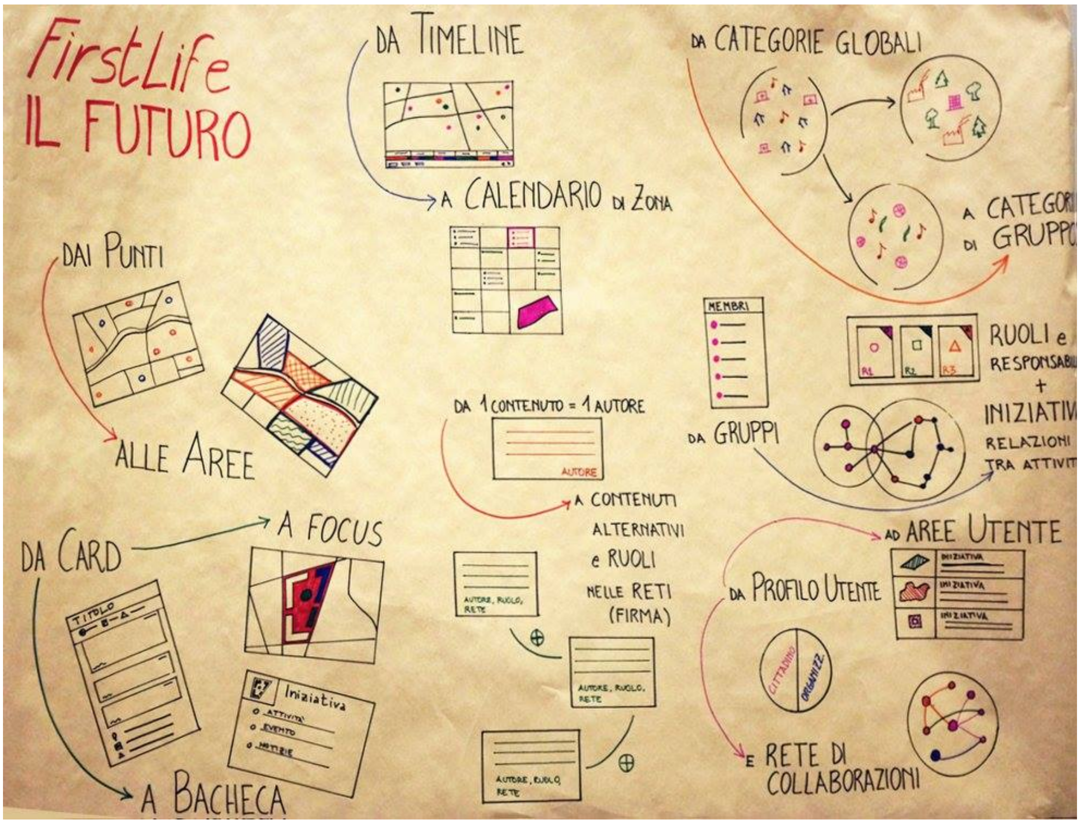

Fig. 7.24 A workshop artefact with the planned integrations and changes for the V5 of the FirstLife platform. Source: author photo

With this last point, the goal was to instantiate the **metaphor of a worktable for local actors** sharing the city as their working area, definitely moving beyond the idea of collective map that can be the result of a collective effort in "weaving the representation of the city" [see Fig. 7.25].

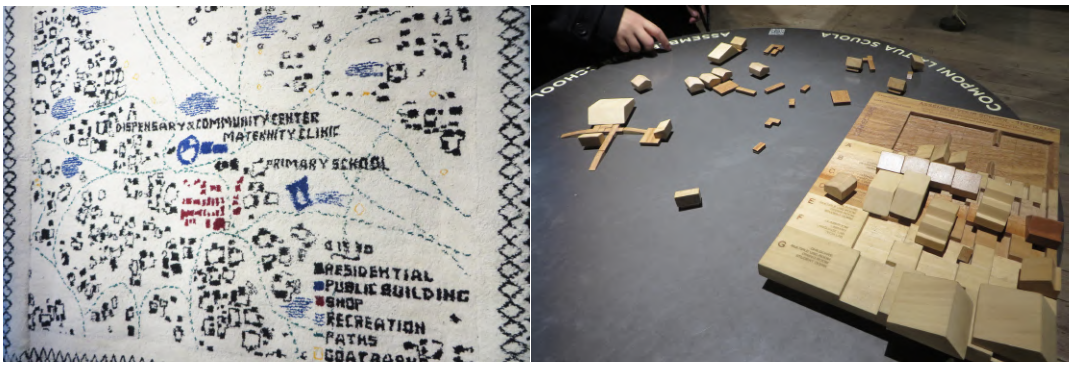

Fig. 7.25 Illustrative images for the shift of metaphor from textile maps to a shared worktable of modular pieces (source: authors photos from the Exhibit "Biennale di Architettura Venezia 2016")

As mentioned in section 7.3, this chapter only reports on the design and development process until December 2017. After that period, development team and strategies changed, and I did not longer work for the project. Updates and new directions can be easily found online searching for the new version of the platform prototype.

7.5 THE APPLICATIVE SCENARIOS OF A CIVIC SOCIAL NETWORK

Along the design and research process for crafting the civic social network FirstLife, I collected over 400 applicative scenarios from different classes of stakeholders, in several domains of activities, and rendering various forms of local development actions at every scale of action. Respectively: 120 in 2015, 160 in 2016, and 140 in 2017. In this section, I am going to briefly describe a selection of the most interesting ones under the light of the **analysis of the potentialities and issues associated to the introduction of a civic social network in established, emerging or future city practices**. The selection had been made by considering the existence of recurrent patterns across multiple applicative scenarios, even when elaborated in different settings (that will be made explicit case by case; see also the concept of meta-practices in section 5.4.4, chapter 5). Thus, I chose the ones more appropriate and richer to support the understanding of the relationship between the intervention on city dynamics and the challenges for a city-mirror-like platform.

As anticipated in Chapter 6, the research strategy of relying on multiple case studies had been driven by the need to balance coverage and robustness of the findings by assuming the three core models presented in Chapter 5 as the common framework of analysis across the three case studies, but also exploiting the uniqueness of each case to explore more in depth a section of each core model (while the sum of three case studies provides in depth coverage for all the sections of the core models, as in a mosaic). As regarding the first case study, the most extended of the three in terms of coverage and devoted time, the empirical and applied research activities provided the opportunity of investigating a wide range of city practices concerning almost all levels of social structures, interconnection among city systems and infra-systems, and roles of technologies in coordinative, cooperative and collaborative dynamics. Nonetheless, **this first case study allowed to examine more in depth the strict relation among the scale of action in the physical space of the city and its representation mediated by the digital environment created by the civic social network, taking into account, on one side, the resources involved in the actions and, on the other side, the projection of values and positions of different city stakeholder over their actions and the platform.** Then, the prominence of the map-based interface in the interaction with the FirstLife platform allowed to stress in particular the **constraints to coordination and cooperation at different scales and within atypical dynamics** [see also section 7.1]. Thus, in this case, **the applicative scenarios will be presented clustered by their scale of action** [from section 7.5.1 to section 7.5.5] **and then discussed primarily in relation to potentialities, risks, and issues in coordinative dynamics associated with the hypothesised and/or tested use of the platform, focusing more specifically on how the interactions with map-based interface and digital contents impact over these dynamics** [section 7.5.6].

7.5.1 REPRESENTATION OF THE APPLICATIVE SCENARIOS

As mentioned earlier, the term scenario is commonly used in Information Systems, HCI and related disciplines to indicate a rich and detailed description of the interactions between the user and a system (e.g. when, where, but mostly how he/she use the system in minimal use cases, see also Chapter 8, section 8.3). The same term in other domains, especially urban and policy domains, is used to indicate the representation of a context and the actions of multiple subjects made or envisaged within this context to pursue a determined goal. In this dissertation, the word "scenario" is always used to indicate settings and flows of a multiplicity of users implementing a certain action, in which are also highlighted the types of interactions with the system under development or its components, in the space and over time.

7.5.1.a Representation of the applicative scenarios during the design and research activities

During the three years of engagement activities for FirstLife, the applicative scenarios had been discussed and developed with the participants in several ways. Often the flow of actions and the related interactions on the platform had been visualised on paper, to move then to experimenting with the platform in a "digital sandbox", the general platform or dedicated branches. These **two aspects (flow of actions and interactions) had been operationally combined by considering the platform entities and sub-entities (and some specific features such as the timeline or the multi-descriptions or posts and comments) as part of a toolbox aimed at representing even complex scenarios with a limited "set of pieces"**. While the visual outputs changed case by case and evolved over time, the **toolbox metaphor based on using entities and key features as objects** remained unchanged in the practical activities of the participatory design process. As a result, the generated applicative scenarios are almost all comparable in their structures. Thus, their platform-mediated representation can be used as a proxy for analysing the forms of technology support (by using also the other information sources for the research, see section 7.3.5.a). Following a few examples [see Fig. 7.24-7.29].

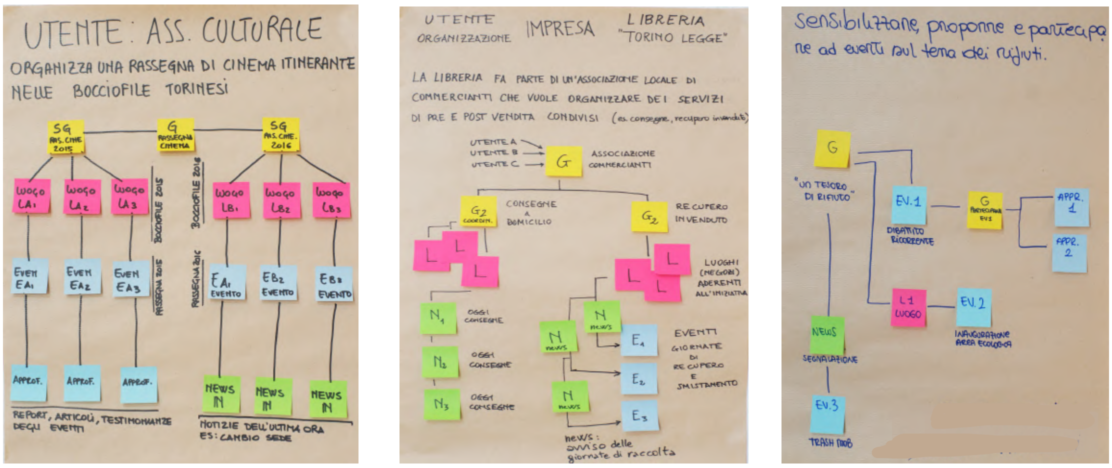

Fig.7.26 Three examples of applicative scenarios built during workshops and meetings with post-its and pens

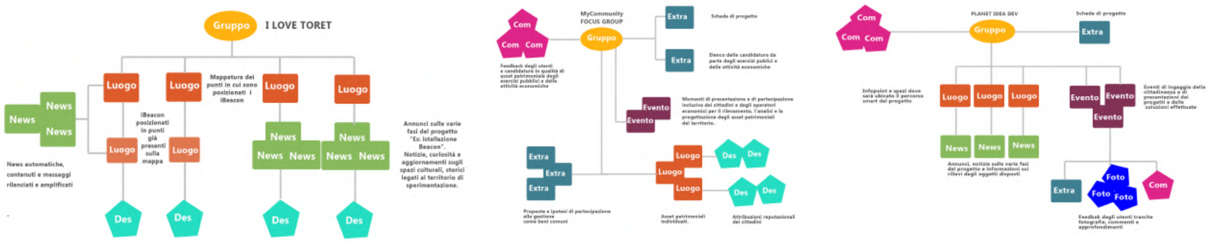

Fig.7.27 Three examples of applicative scenarios built in collaboration with multiple groups involved in the same initiative, but using the platform according to different patterns

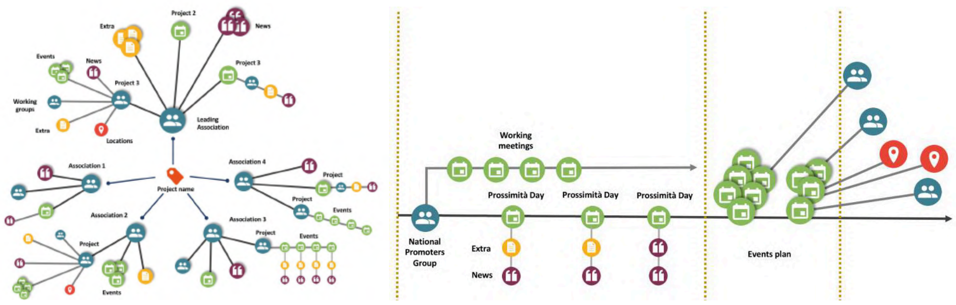

Fig. 7.28 Example of the post-workshop representation of an applicative scenario and the temporal development or another related scenario, discussed in follow-up activities to support the starting of experimentation in working settings.

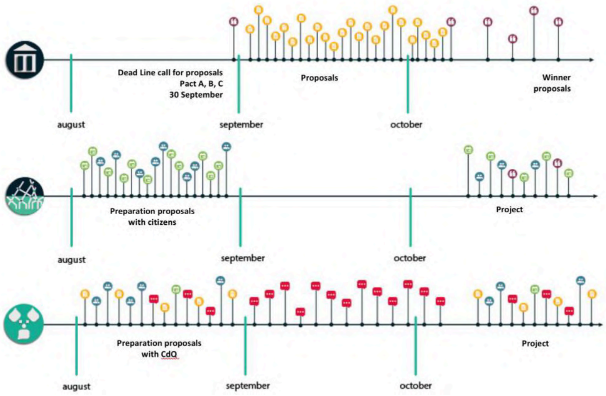

Fig.7.29 Example of the representation of an applicative scenario implemented over time and requiring parallels flows of interactions with the platform by different stakeholders.

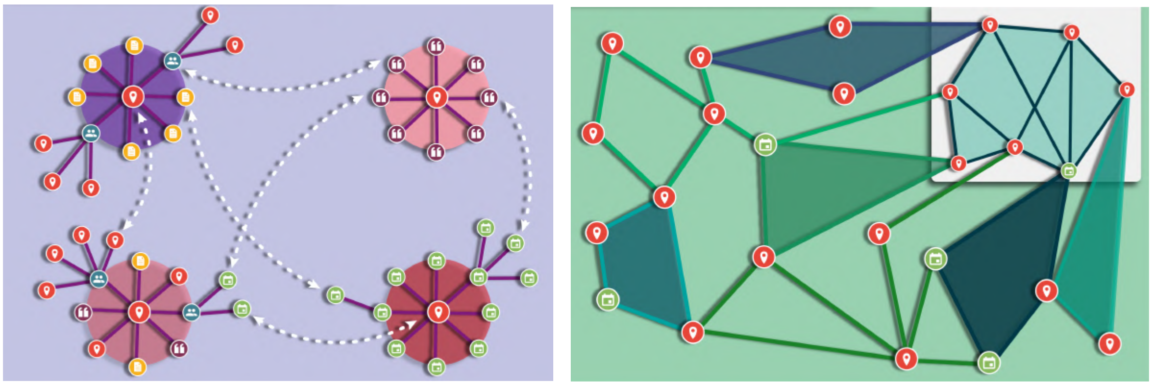

Fig.7.30 Example of applicative scenarios developed with one stakeholder and used as probes to discuss with other stakeholders, revise and integrate the initial hypothesis.

Fig. 7.30 Screenshots of the FirstLife platform V5 taken between May and September 2017 and providing a view of selected implemented applicative scenarios. Top left, Network della Prossimità. Top right, Porta Palazzo market square. Bottom left, first cycle of activities in the Co-City project. Bottom right, Distributed events of the festival della Cultura dal Basso. [Source: graphic materials such as posters and brochures I prepared for the dissemination activities of FirstLife]

7.5.1.b Presentation and representation of the applicative scenarios in this dissertation

Most of the **applicative scenarios examined for a civic social network** are focused on:

- **urban regeneration initiatives aimed at combining social innovation with the improvement of the quality of life and built environment, including the organisation of distributed events in the city**
- **restructuring and experimentation of new services in the domain of health, education, social assistance, and activation of community engagment processes**
- **discovery of local resources, events, opportunities**
- **consolidation of sectorial networks at territorial level and policy decisions**
- **shared services for local enterprises, micro-and small companies or professionals >resources**
- **transparent management of urban transformations**
- **identity building and collective storytelling of the city**
- **educational experiences and transition from school to work**

The colour associated with each theme is also used to cluster the scenarios presented in the following section. The eight clusters are the same indicated for the Open Labs [see section 7.3.4-b].

All these applicative scenarios are associated with a **framing of "civic" closer to social innovation processes** instead than democracy-supporting-actions [see section 7.2]. The same scenarios are thus illustrating various types of **local development actions intended as actions oriented to increase or consolidate the cultural, social, institutional and economic assets of a city, expanding the capabilities of individuals and collectivity** [see Chapter 1].

Representing and presenting the applicative scenarios in this thesisto make them accessible to potential readers constituted a challenge in itself, or better an almost impossible mission. More than other already challenging tasks such as mapping visions and concepts across different disciplines. And for several reasons, that include the following three.

- Firstly, when we talk about civic technologies or collective actions in the city, most of the typical scenarios documented in the literature address focused initiatives such as the participatory design of small public spaces or public awareness operations on topics of public relevance. While sometimes interesting from a research perspective, these experiences are included in the category of "episodic bottom up initiatives" covered already by part of existing web-based technologies (see Chapters 3 and 4) and not exactly really central in the management of the city and local development processes. Thus, not central either for the scope of understanding the potential capabilities of City Mirrors. In the case study of FirstLife, **I focused instead on the core activities at the local level, the ones included in the intermediate space between top-down programmes and bottom-up initiatives that is currently underexplored in the literature and not supported by existing solutions and web-based technologies** (see Chapter 3).
- Secondly, the ambitious goal of contributing to understand how to mirror city dynamics implied to investigate a wide range of actions in urban settings. This goal had been creatively pursued by structuring the research and design process around the central idea of *"getting the city in the room a piece at the time"*, described in section 7.3. **To keep aligned goal, activities, and presentation of**

results, necessarily this wide range of actions examined in urban settings must be rendered to share insights and lesson learned with the reader. In addition, an effective communication with the reader requires to report this experience in a way that is clear and transparent, but at the same time not excessively overwhelming, **even though we are talking about a condensed extract of city** activities that could be overwhelming regardless of its semplification.

- Thirdly, a thesisis supposed to be a linear text presenting contents in a linear way. But the **dimensions for rendering the examined scenarios are more easily understandable visualising them not in a linear way**. Nevertheless, it is required to comply with the general caractheristics of the disseration as a writing artefact. In addition, the tacit constraints would be to keep this presentation contained in a few pages, differently from planning reports for instance.

Carefully considering these elements to mediate among contrasting needs of completeness and accessibility, **I decided to present the applicative scenarios in a table form**at (instead than by using linear descriptions) to make their exploration quicker and easier by leveraging on the opportunity of a multi-dimensional comprehensive overview of the scenarios through a bidimensional spatial arrangement of contents and associated colour codes. Thus, **the tables below are not data*, but the concise elaboration and presentation of the results of the empirical research activities developed in collaboration with the participants in the research.** Some of the scenarios, while summarised in a few lines, implied months of work with city stakeholders to reach a convergence over the central issues of the actions to be supported and the potential forms of technology support that were appropriate given the geometry of the social forces involved case by case.

For each applicative scenario, I provide:

- a short description of the setting or addressed problem, or the needs and initiative to be supported
- the role potentially covered by a CSN in the actions envisioned by the applicative scenario, specifying the most relevant features of the platform case by case [described in section 7.4]
- the classes of stakeholders involved, both online and/or offline in the envisioned actions.

The scenarios had been anonymised, removing any identification of individual or specific organisations, indicating instead their type and the related class of stakeholder (LG, local government; PB, public bodies; BS, businesses; NP, non-profit; CP, capital holders; AC, universities and knowledge sector).

The next four sections present a selection of applicative scenarios associated with all the themes mentioned before, while developed in various forms at different scales:

- **national, regional and county/province scales** [section 7.5.2]
- **city scale** [section 7.5.3]
- **district and neighbourhood scale** [section 7.5.4]
- **urban blocks, building and indoor scales** [section 7.5.5].

After the presentation of the applicative scenarios, in section 7.5.6, I briefly highlight the peculiarities and recurrent patterns concerning the role of technology in these applicative scenarios, with a particular focus on the interactions and uses of digital maps and contents, the issues related to technology-mediated communication and their impact over coordinative and cooperative dynamics in consolidated and emerging practices across projects, programmes and services in city settings.

7.5.2 APPLICATIVE SCENARIOS AT THE NATIONAL, REGIONAL AND COUNTY SCALE

Table 7.4. Applicative scenarios at the national scale

National scale			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
01	***INTER-GENERATIONAL VOLUNTEERS*** *Setting.* A consortium of over 500 associations and 80.000 associates relies on an average of 11.000 volunteers that every day provide support services to elders in the majority of Italian regions. These services include transports, socio-cultural animation, food support, learning paths for the third age, inter-generational engagement, counselling, and other non-health services, both in ordinary times and during emergencies. *Problems.* Annual activity reports are partial and incomplete, most of the activities remain untraced, difficult coordination with other agencies and organisation operating in the same area.	▪ Providing a shared online space where simply **annotating periodically the main actions of the different units in local hospitals or other social and health care facilities** [news, subentities, initiative, tags] ▪ Enabling the volunteers, in most of the case acting as individuals or in small group, to easily **connect with other groups** of the same association, related ones, or partner organisations [initiative, tags, group] ▪ **Collectively monitoring the volume and impact of the consortium activities at the local, regional and national scale** [tags, initiative, map-based interface, timeline], included the action under special circumstances such as earthquake or flooding	Consortium of over 500 associations and voluntary groups (NP), public hospitals and health care facilities (PB), Civil protection (PB), Cooperatives (BS), Foundations (CP), Universities (AC), municipalities (LG).
02	***PROXIMITY WELFARE NETWORK*** *Setting.* A network of social enterprises, cooperatives and non-profit organisations are committed to experiment, implement and promote alternative forms of welfare services based on spatial and relational "proximity" on a wide range of domains including social and working inclusion of migrants and marginalised groups, support to disabilities and independent living, rehabilitation programmes from dependencies and addictions, public engagement in environmental protection. *Problem.* Difficulty to support the exchange of good practices among groups working on the same topics, difficulty of synergies for funds or on joint projects.	▪ Enabling the **sharing of documents and experiences across territories**, easily retrived by filtering on specific targets (e.g. Sub-saharan Africa migrants) or topics (e.g. environmental protection) or working line (e.g. cultural integration through job placement) [extra, event, group, tags, initiative] ▪ Supporting **cross-territorial experimentations** and programmes or the **replication of experiences in new areas** [extra, groups, initiative] ▪ **Visualising the network of organisations working on social innovation** in each area and their partnerships [places, initiative]	Social enterprises and cooperatives (BS), Associations and consortia of hundreds of cooperatives and non-profit organisations (NP), Foundations (CP), Unions (NP).
03	***NATIONAL GATHERING ALTERNATIVE WELFARE*** *Initiative.* Organisation of the "Biennale della prossimità", the gathering of representatives of the Network for the Proximity Welfare happening every two years. The event is organised by following a participatory and democratic process for over than 8 months of periodical meetings of national and local promoters, as well as preparatory events in several cities in Italy. *Problems.* Make visible this process and better coordinate the numerous appointments.	▪ Keeping trace of all the **meetings with the national and local promoters for designing, organising, and preparing the event**, making public the key decisions, orientations and updates [event, initiative, news, group] ▪ Launching **calls for contributions or ideas** to structure the event [news] ▪ **Facilitating contacts and networking among the organisations participating in the event** before, during and after, by allowing users to fill their card including key info on their organisations and projects [place, extra, tags], as well as easily identifying other organisation working on similar themes [tags, initiative, group]	Social enterprises and cooperatives (BS), Associations and consortia of hundreds of cooperatives and non-profit organisations (NP), Bank Foundations (CP), Unions (NP), municipalities (LG).

04	***MUNICIPALITIES BEST PRACTICES EXCHANGE*** *Setting.* Independent association of small and medium municipalities aimed at facilitating and accelerating the definition of new city regulations to trigger and support social innovation processes. The network tries to balance the lack of expert human resources, budget and experience typical of small municipalities with the horizontal transmission of lesson learned and protocols at inter-municipal level. *Problems.* Communication is still fragmented, and exchanges disorganised or mainly informal. Difficult identification of other municipalities working on the same themes.	▪ Crowdsourcing **survey of the good practices concerning social innovation** implemented in the municipalities, combining institutional information and the stories of the organisations involved in the projects [extra, group, initiative] ▪ Sharing or giving references for **accessing to local regulations** developed to support various forms of social innovations [group, initiative] supporting the establiment of **trans-territorial thematic working groups** to replicate some experiences and protocols ▪ Providing a shared and public **monitoring tools to assess the distribution of new policies and their impact at the local level** [map-based interface, timeline, extra, initiative]	Small and medium municipalities (LG), non-profit organisations (NP) and donors funding local development projects (CP).
05	***PURCHASING AND COMMISSIONING UNITS*** *Setting.* The new national laws regulating public procurements for public administrations and local agencies impose the aggregation of purchasing and commissioning operations in units with human resources having recognised expertise and experience, possibly grouping multiple municipalities. *Problems.* Balancing operations imposed by protocol with the self-organisation of groups closers to the needs of each agency or administration (in terms of lack of resources) and aware of the specificity of each territory (to avoid decisions inappropriate for the local context).	▪ Mapping **public works included in the pluriennial plans** mandatory for each administration, publicly accessible to the public (businesses included) [places, initiative, tags] ▪ Facilitating the **syncronisation or alternative temporal arrangments among closers areas** interested by concurrent or sme type of public works [news, events, group] ▪ Enabling the formation of working groups among public administration and local agencies requiring **assistance on specific issues, proposing exchanges of competences or collaborations** in joint public procurement processes [news, group]	Group purchasing organisations and public procurement commissioning units for administration and public agencies (PB), services and goods providers (BS).
06	***INDUSTRIAL GROUPS TERRITORIAL IMPACT*** *Setting.* Industrial group working on multiple domains (environmental and mechanical engineering, construction industry and real estate, energy, food transformation), supporting several internal or associates research centres to innovate processes and products and services, employing hundreds of suppliers all over Italy, but also actively engaged in extensive projects for the transformation and recovery of dismissed industrial areas. *Problem.* Difficulties in building a clear industry footprint (communicable and usable by others) including both production and local activities involving the entire network of enterprises. Difficulties in making communicable and tangible the effects and impact of the corporate social responsibility's strategies supporting local development operations from an industrial and research perspective, other than financially.	▪ Visualising the **territorial network of infrastructures, companies and facilities** of the industrial group [places, initiative, tags] ▪ Following **projects and initiatives organised at a territorial level** along the process of rehabilitation of dismissed manifacturing sites [events, groups, timeline] ▪ Documenting the collaboration with research centres and other institutions and their **impact in terms of policies, job creation, social value produced, eperiences**, [initiatives, group, events] potentially fostering synergies across territories or domains of expertise	Industrial Group (BS) and consortium of managed enterprises and production sites (BS), suppliers (BS), private research centres (AC), universities (AC), non-profit organisations (NP).

Table 7.5. Applicative scenarios at the regional scale

Regional scale			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
07	***EMERGENCIES AND AGRICULTURE RESOURCES*** *Setting.* In case of **natural calamities** (e.g. floods, landslides, storms, hail), civil protection intervenes to safe and protect the life of people. However, in those areas where the majority of the population live primarily of the incomes coming from valuable cultivation and farming (e.g. vineyards, fruit and olive groves), extensive damages to their lands can cause the destruction of family business and severe social issues lasting for years. In some areas, **formal and informal consortia of small producers collectively set actions to prevent, timely safeguard or recovers as possible their resources**. *Needs.* Supporting **alerting systems managed independently from the civil protection official channels**, while keeping the opportunity to coordinate their actions with them. Supporting distributed and self-organised actions, suggesting disseminating effective measures and actions to single owners.	▪ Setting up the **digital entry-point to join as volunteers the recovery groups** distributed on the territory [groups, initiative, tags] ▪ Making accessible within the groups **shared protocols by type of crops and livestock**, and providing a communication space for the farmers searching for advices and suggestions [extra, tags, filtering system, posts, news] ▪ Broadcasting **real-time updates about on-going operations** [news, posts, map-based interface] ▪ Launching **calls for help in the local area** or **reporting critical situations to the volunteers** belonging to the various groups [news, posts, groups, map-based interfaces] ▪ Providing to residents and other emergency responders, such as the civil protection, an **overview of the parallel on-going actions independently implemented** to assess needs and risks [map-based interface, timeline, news]	Local producers (BS), sectorial associations of producers (NP), municipalities (LG), civil protection units to be informed (PB).
08	***EARLY WARNING ACTIVATION*** *Problem.* Early warning systems activated in case of emergencies and reserved only to the communication of official indications by local authorities in case of an emergency have a limited reach; they rarely are timely activated or activated at all in case of minor events; they do not provide an easy and accessible way to report critical cases or situations to the civil protection; they do not support the public and residents to dialogue with groups and organisation managing the early response; do not keep trace of intervention for ex-post and long term assessment.	▪ Activating an **open monitoring platform permanently accessible** for the management of the emergency response by the civil protection or the assisted self-organisation of residents and local bodies in case of minor situations ▪ Supporting **local mixed groups helping in the phases of preparation, recovery and transitions in the weeks or months after the emergency** through a common space communication space for **planning new actions and sharing real-time updates** [groups, events, timeline, map-based interface] ▪ Sharing the **risk factors associated to each area** to support residents and groups to choose their best option case by case [extra, places] ▪ Faciliatating the **production of impact reports** and **emergency policies** by analysing frequency, periodicity, intensity of different kind of emergencies happening at the local level, in conjunctions with the temporary or permanent groups activated in different setting, and the structural resources at a territorial level (such as industries, services, infrastructures) [timeline, filtering systems, map-based interface, entities and subentities].	Municipalities and upper-level authorities such as provinces and regions (LG), Civil protection units (PB), Firefighters (PB), Emergency Health care units (PB), ambulances (NP/PB), residents (CP) and volunteers' groups (NP).

09	***INTEGRATED SOCIAL AND HEALTH SERVICES*** *Setting.* A single cooperative organises its daily activities relying on 65 units (or teams) working in health care facilities all over the region, ranging from local clinics to major hospitals. These units provide health care and auxiliary services (e.g. cleaning, supply management). At the same time, every unit actively implement the job placement and independent working programmes reserved to young people with physical and mental impairment, former inmates, long term unemployed. *Needs.* Experimenting the public communication of their activities outside global social networks or commercial platforms. Facilitating the exchange of experiences among different units and between the staff of each unit and the organisations, families, patients supported every day.	▪ Establishing an **online group associated with each facility** covered by the cooperative to provide a dialogue space among the cooperative staff, volunteers of the cooperative and volunteers associated with other organisations working in the same facilities, and the beneficiaries of services [groups] ▪ **Weekly or montly recording of the main activities of the cooperative units**, managed indipendedtly by the units' leaders [news, extra, posts, timeline] to facilitate mutual support and exchange among the different units based on their experiences, skills, practices ▪ Promoting **campaigns and temporary initiatives organised by the cooperative** or implemented with other partners and public agencies [news, initiative]	Cooperative providing health and social services to chronic ills and disables (BS), external partners and suppliers of additional services (BS/NP), families and carers of assisted patients (CP).
10	***SUSTAINABLE TOURISM*** *Setting.* Aggregating sustainable tourism offers at a regional level as options and experiences built through the collaboration with alternative hospitality services, customers, and environmental groups beyond the competitive logics of sharing platforms. *Problems*. **Avoiding a centralised engagement and management** of customers and new groups. Difficulties in enabling the **collective storytelling of these experiences.**	▪ Visualising the **hospitality services promoting sustainable practices** and promoting their approach [initiative, extra, places] ▪ Facilitating the starting of **mixed working groups to discuss and reach a consensus over the best practices** that could benefits hospitality enterprises and the environment [groups, initiative] ▪ Supporting **long-term connections among service providers and guests to document their experiences** through spatialised stories linking all the places and people that made them possible [posts in places, extra, initaitives, tags]	Formal/Informal hospitality providers (BS), mountains, environmental, cultural associations (PB), guests (CP).
11	***CROSS-SECTORIAL SYNERGIES*** *Setting.* Regional authorities want to set up a platform enabling all the subjects working in the sectors of culture and tourism to coordinate their initiatives, strengthen their capacity to access to public and private funds, develop synergies to enhance the social capital and cultural and environmental assets of the Piedmont Region. *Problems.* Dealing with the **lack of information, fragmentation of programmes and initiatives**. Avoiding closed platforms reserved to experts only and **excluding the public**. Addressing the needs of subjects with **different capacities in terms of human resources and operative strategies** (e.g. seasonal initiatives based on volunteers only, or large cultural organisations).	▪ Structuring and organising an open, flexible and iterative data collection to create a **dynamic registry of the regional organisations working in the sector of tourism and culture**, by directly involving these organisation to work with the staff of the regional authorities through the platform [places, sub-entities, initiative, tags, filter system, map-based interface] ▪ Supporting regional authorities to work as **matchmaker between local organisations and funding bodies** on the basis of the experience and capabilities of local organisations as emerging from the registry [filter systems, news, events, groups] ▪ Facilitating **periodical assessments of the impact of funds and regional policies** implemented in the sectors of tourism and culture on the basis of the projects and initiatives implemented in different areas [events, groups, initiative, timeline]	Regional authorities (LG), Cultural institutions (PB), Public and private museums (PB, BS, NP), Creative industry (BS), Tourism sector (BS), Foundations and donors (CP), Associations and organisations in the sectors of culture, arts, heritage protection (NP).
12	***MUSEUMS STORIES*** *Problem.* Most of the museums situated outside the main cities and touristic destinations have difficulties in attracting visitors from outside. Then, for their survival and remaining opened, it is essential to rethink the provided services, but also the use of their spaces in relation to local communities, organisations (e.g. schools, third sector). *Needs.* **Enhancing the connection of museums with the territory. Projecting art or crafts works outside the museum spaces** and promoting alternative	▪ Visualising the **connections between the art works and pieces contained in the museum and the territory**, especially for the items locally produced [places, initiatives, tags, map-based interface] ▪ Making accessible the **histories of the artwork, the artists, the exhibitions and the museum** beyond the institutional portals and physical archives to the large public [places, extra, initiatives]	Museums and cultural institutions, both public and private (PB, BS, NP), artists and creative professionals and agencies (BS), schools and learning institutions (PB, NP).

	fruition modalities. **Connecting better with other organisations** (included other museums) working in cultural promotion and heritage conservation.	▪ Involving **artists, experts, and visitors to narrate and provide their points of views on the works** exposed in the museum or in temporary exhibitions [multiple descriptions for places, extra, groups for exhibition, initiative] ▪ Opening resources such as **museum spaces or related areas to activities such as seminars, workshops, concerts, and performances** organised by other local organisations coordinating timing and conditions for the access [groups, events, news]	
13	***LIBRARIES AND READING/STUDY GROUPS*** *Setting.* **Public libraries** are investing in becoming **places for social aggregation and culture dissemination**, going beyond their institutional mission of providing access to books and reading spaces. In the region considered in this study, public libraries are also organised upper-level centres or consortia for the management of library resources, supposed to promote and coordinate the initiatives implemented by each library. *Needs.* Giving **visibility to the informal groups** that often self-organise their activities keeping the library as their base (e.g. reading groups, study groups, reading therapy, local research initiatives); **integrating the formal services provided by the libraries with the valuable informal services provided by informal groups and volunteers.** *Problems***.** Lack of information about the services, groups, and initiatives supported by each library, resulting in the impossibility to coordinate their activities to improve their reach and maximise the use of existing resources (social and material resources).	▪ Setting up an **online entry point for the spontaneous groups** organising reading clubs, after school clubs, writing laboratories and small seminars, to remain updated on planned activities (groups, sub-entities such as events and news in the group) ▪ **Facilitating communications and informal arrangements among the library users** (news, posts) ▪ Building a **comprehensive profile of the formal and informal services provided by each library** and the modalities for their fruition (places, initiatives, sub-entities) ▪ Providing an **overview of the territorial services provided by the network of local libraries** (places, initiatives, sub-entities) and associated organisations such as cultural and educational institutions ▪ Facilitating **real-time updates among libraries during particular events** opened to a wider public such as the book days or schools' tours (news associated to places)	Individual libraries (PB/NP), consortia of civic, regional, and thematic libraries (PB), spontaneous reading and working groups operating in the libraries (NP), schools (PB), community organisations (NP).
14	***LOCAL TRUSTS AND CONSORTIA NETWORKS*** *Setting.* Local trusts and place-based or thematic consortia of public and private institutions have the mission of preserving and enhancing the historical and artistic heritage (i.e. traditional built environment and monuments), landscape ensembles and naturalistic areas, but also food and artisanal excellences that often constitute the backbone of local economy outside the major urban centres. Their mission relies on their capacity to **attract funds, external capitals, managing and implementing programmes, but also collaborating with the public or private institutions, as well as the enterprises directly engaged in tourism, cultural sector, arts, manufacturing by matching opportunities and local specificities.** *Problems.* No connections among trusts and consortia operating on the same area or theme; difficult matchmaking between funds availability, bids preparation, and available resources (human and institutional resources first).	▪ **Mapping campaigns, online surveys and open questions** about the most significant places in the region such as enogastronomic excellence production centres, historical and architectural monumental sites, naturalistic areas and protected landscape (places, and sub-entities such as extra and news associated with places, initiatives, map-based interface and timeline) ▪ **Territorial skills mapping** at the level of local organisations connected to the trust **to expedite the preparation of proposals for bids and funding agencies** (groups, tags, filtering system, news) ▪ Communicating **updates about planned activities, promotion and initiatives** in the places managed by all local trusts (events, news) ▪ Organising the **collection of multimedia contents to document past and on-going preservations and development projects**, activated policies, regulations covering the use of places and local resources (groups, extra, timeline) for evaluation bodies and the public.	Foundations (CP), thematic or locality-based associations for the territorial promotion (NP), local producers of enogastronomic and artisanal products (BS), public agencies for the protection of the cultural heritage and landscape (PB).

15	***CREATIVE INDUSTRIES AND PROFESSIONALS*** *Needs.* Supporting micro and small enterprises lacking of internal digital skills to approach the construction of their **online storytelling**; facilitating the emergence of **trust-based networks** in the production and supply chain of specific sectors; **revamping or restructuring traditional crafts and creative activities**, letting the public and professional to discover how to launch new activities or collaborating with the existing ones.	▪ Enhancing **stories and values behind the products and services of small enterprises**, as well as their evolution and roots in the territory [places, extra, posts] ▪ Broadcasting **updates** about products and services, events, career and funding opportunities for specific types of enterprises or productive sectors [news] ▪ Supporting the emergence of local **production and supply chains often based on long-terms partnerships** among local enterprises [map-based interface, initiative] ▪ Facilitating the **activation of shared services among enterprises of the same category**, as well as **partnerships for knowledge transfer across domains** [groups, news, initiative] ▪ Searching for **services, resources, and products on a proximity basis** [map-based interface, filtering system]	Creative industry, including design, arts, communication enterprises and agencies (BS), tourism operators (BS), category associations and boards (NP), foundations and local founding bodies (CP), clients and customers (CP).
16	***PROMOTION OF TRADITIONAL CULTURES*** *Problem.* The numerous voluntary groups engaged in keeping alive traditional music, theatre, celebrative customs, local rituals, and other cultural expressions developed locally struggle to have a sustainable turnover of people in charge of the organisation of their various initiatives, but also in accessing temporarily to the spaces and physical resources available in their areas (of which they are usually not aware). Other issues are related to the challenges of large federations of associations (e.g. regional traditional choir associations, in Piedmont over 600), often not having any online presence, and basically working in complete independence and isolation from others. *Needs.* Searching for volunteers. Understanding the resources accessible for free to the volunteers. Discovering the initiatives of related associations belonging to the same federation or operating on the same area. Facilitating the documentation of their activities without the burden of managing websites or social media pages.	▪ Broadcasting **calls for volunteers and resources to prepare local events**, as well calls for partnerships and participation in call for funds provided by local and regional bodies (news, events) ▪ Co-planning of **dates and venues of events scheduled in close areas and in the same period** (events, tags, category system) and partial co-organisation of some events through temporary joined working groups (groups) ▪ Collaborative **mapping of local associations** divided by topic, theme, area, and on-going collaborations (places, initiatives, tags, filter system) to allow the discovery of other groups working on the same area or topic and fostering potential collaborations ▪ Building an **online archive of the events and initiatives promoted by the voluntary groups** and associations (map-based interface and timeline for a spatial-temporal navigation of the events) ▪ **Collective storytelling of the experiences** of volunteers, participants, residents, communities involved in the promotion of traditional cultures in the regions (extra, groups) to enhance the continuity of the local action on the territory and the competences, values, visions of the associations, as well as their growth over time.	Informal associations and structured organisations operating in the sectors of culture, arts, and entertainment mainly through volunteers (NP), including choirs, amatorial theatre companies, communities of artists, groups for the protection of local traditions, villages associations ("proloco" in Italian).

Table 7.6. Applicative scenarios at the county/province scale (in between the region and the city)

County/province scale			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
17	***MICRO-REGENERATION ACTIONS*** *Initiative.* Project involving students (from 3 to 18 years old), their families and teachers, collaborating with the charity managing the initiative and the technical staff of six small municipalities across. The project goal was to identify a public space in each city to be collaboratively regenerated for hosting new functions designed for children and teenagers.	▪ Collecting **multiple perspectives on everyday public spaces in each city** from the students divided by school, age band, themes, but also from other members of local communities and school environment [posts in places, tags, initiatives] ▪ Supporting schools to organise **on-field exploration and mapping campaigns** in collaboration with other local partners and families [events, groups, news] ▪ Collectively documenting the **regeneration activities carried out in parallel** in different cities [events, groups] ▪ Facilitating the **comparison among the activities carried out in the six cities**.	Non-profit organisations, leading the project or participating to the activities (NP), six municipalities (LG), University providing technical support and training (AC), primary and secondary schools (PB), students' families living in the six municipalities (CP), shopkeepers and professionals operating in the areas chosen for regeneration actions (BS).
18	***PROFESSIONAL TRAINING AND TERRITORIAL DISCOVERY*** *Initiative.* Project involving high-school students distributed all over small municipalities (85) in rural and mountain areas. **On field training** to **use knowledge skills** to serve **local development goals** through the enhancement of the value of the **cultural heritage and natural ecosystems in new local practices and policies**.	▪ Training through **online/offline gamification patterns** [groups, news] ▪ **Organisation and management of distributed collective digital mapping campaigns** structured by area, schools, and themes and coordinated to ensure the full coverage of the municipalities supporting the initiative [groups, events] ▪ Development of a **shared dynamic representation of the explorative paths and territorial resources** publicly available and integrable to be used by local agencies and third parties for their projects and decisions [groups, places, stories, plus initiatives].	Municipalities (LG), international agencies and organisations for the protection of the cultural heritage and environment (PB-NP), Local and Regional Environmental agencies (PB), Schools (PB), Universities (AC).
19	***BUYING LOCAL - KM0 ECONOMY*** *Setting.* Numerous groups across the metropolitan area self-organise the **collective purchasing of fresh foods and other commodities from local producers** once a week, managing then their distribution. *Problems.* Limited transparency in the choice of producers, lack of flexible systems for the distribution of products, difficult planning to face sudden increases of requests to specific local producers.	▪ **Mapping local producers** and usual distribution points [places] ▪ **Coordination of the distribution points** and **collection of weekly deliveries** [events, groups] ▪ **Creating groups producers-customers** to exchange updates, suggestions for the use of products, or questions [groups] ▪ **Visualising connections among local producers** or between producers and markets or food fairs [initiative]	Associations and volunteers collaborating in the management of the relationship between each group and the network of producers (NPO), individual and collective clients (CP), small local producers (BS).
20	***FOOD ECOSYSTEM*** *Initiative.* Applied research project aimed at **studying the food ecosystem at a metropolitan scale** and opening a dialogue platform with civil society organisations and businesses experimenting new modes of food production, distribution, consumption, recycle	▪ Representing the **ecosystem of organisations working on the themes** [groups, places, stories] ▪ **Facilitating individual and collective engagement** in local initiatives and the food ecosystem [groups, events, news].	Academics in Social Sciences (AC), non-profit organisations and informal groups working on projects and themes related to food sustainability (NP).

7.5.3 APPLICATIVE SCENARIOS AT THE CITY SCALE

Table 7.7. Applicative scenarios at the city scale

City scale			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
22	***NEIGHBORHOOD SOCIAL HUBS*** *Setting.* In a few neighbourhoods distributed in the city there are socio-cultural aggregation spaces hosting support services for citizens (e.g. tax and benefits counselling), recreational activities (e.g. sport, creative workshops), and training courses. These structures also act as **permanent engagement agencies on the territory** to implement projects promoted by local organisations and the municipality. *Needs.* **Decentralise and multiply the storytelling of the experiences supported on the territory**. Creating synergies between the new social hubs and the consolidated ones, and with other local institutions.	▪ **Shared overview of the initiatives, projects and events** organised and promoted in the various social hubs [events, news, initiatives, timeline, map] ▪ **Coordination of the working groups** (internal or associated organisations) in each social hubs and the ones operating in more than one [groups, initiatives] ▪ **Collecting the stories** of people and communities involved by the social hubs and facilitating the dialogue with other local actors [posts associated with every entity, initiatives for light-weighed and incremental aggregations of related contents].	Cooperatives and organisations managing the socio-cultural hubs on behalf of the public administration (BS), non-profit organisations using their spaces for local initiatives (NP), professionals providing training and counselling services (BS).
23	***DEVELOPING URBAN COMMONS PROJECTS*** *Setting.* The city administration recently approved a new regulation to make easier the self-organisation of associations, groups (and potentially small companies and social enterprises) to take care of dismissed buildings or other facilities (e.g. schools) and public spaces considerable as urban commons for local communities. *Needs.* Supporting the **development of proposals** for taking care of urban commons aggregating different local groups; making transparent the process of **public assessment of concurrent proposals** on the same commons; following the **experience of management of urban commons**.	▪ **Participatory and/or distributed mapping** of urban commons, resources available or proposed for reuse, made by local authorities and civil society [places, initiatives, news on mapping campaigns] ▪ **Publication of proposals and projects** of reuse and setting up of groups to further develop the proosal online and offline [extra, groups, events] ▪ Tracing of the different steps for the **assessment and approval of proposals** [extra, news] ▪ **Organising and documenting collective activities** associated with the commons mangaed by the different groups [events, extra, news] ▪ **Enabling the assessement** of the commoning projects over time and in relation to different areas of the city [map-based interface, timeline]	Socio-cultural hubs (BS/NP), volunteers' groups and non-profits organisations (NP), municipality (LG), University (AC), schools (PB).
24	***CONTINUOUS CITY SURVEY*** *Problem.* The **atlas of municipal services**, both public and private, takes years to be completed, but the changes in the address, use, and classification of local services are usually more rapid. As a result, public data are outdated or not accurate, making difficult public policies and planning decisions, but also not supporting efficiently everyday uses by privates and citizens.	▪ Enabling the **dynamic updating of information about municipal services** by sharing the responsabilities over its accuracy and completeness with residents and owners [places, news, extra] ▪ Organising on **field validation operations** to check the correspondence between information provided and status quo by targeting new services or areas under intense changes [events, news, initiatives] ▪ Tracing the **evolution of city services**, but also the stability of certain businesses categories to provide decision support to local entrepreneurs [map + timeline]	Municipality (LG), businesses (BS) and services providers (BS/PB), residents (CP).

25	***PUBLIC ART MANTENANCE*** *Setting.* Over the last two decades local authorities with public and private bodies promoted extensive public art programmes, resulting in **hundreds of new artworks distributed in the city**, integrating the already numerous historical pieces. *Problems.* The documental resources associated with these works are available in **static archives** unknown to the public and difficult to integrate. The **nature of the artworks requires timely interventions** not following schedule and logics of the ordinary maintenance of public furniture.	▪ Making easily **accessible and usable the documental resources** associated with each art pieces collected by trusted sources such as public authorities, foundations, experts, museums [extra] ▪ Supporting **identity consolidation in marginal neighborhoods** around events and people that marked the story of the city and the self-organisation of cultural initiatives [groups] ▪ **Facilitating maintenance and management** of the artworks by providing a light weighed reporting system to connect visitors and responsible units [news]	Multiple Departments of the municipality (LG), Experts belonging to foundations, research centres, and cultural institutions (NP, AC, CP), residents and tourists (CP).
26	***RETAILERS ASSOCIATIONS*** *Setting.* There are over 50-55 retailers' associations, usually aggregating most of the retailers, professionals, and craftsmen working along the main commercial streets of the different areas of the city (not corresponding to neighbourhoods or blocks or districts). The official role of these associations is to promote synergies and events involving their associates during weekends or public holidays (i.e. special openings, festivals), but usually they also work as reference point for municipal regulations and news on the major concerns of local retailers (e.g. public works closing the access to their shops). *Needs.* Creating connections among retailers' associations covering contiguous or near area to coordinate weekend events. Making easier to replicate internal management models decreasing the workload for the association leaders. Making visible the association activities to the municipality and other actors to promote their instances in case of issues (e.g. micro-criminality). Defining alternative channels to paper flyers to inform local residents about their initiatives and helping related arrangements (e.g. closure of parking in the area for car-free days).	▪ **Shared overview of the planned or on-going activities** promoted and organised by the retailers'associations in different areas of the city [timeline, map, events] ▪ **Enabling joint temporary working groups** across different associations for specific events or initiatives [groups, events] ▪ **Mapping of the retailers** adhering to the association and to specific initiatives [places, groups, initiatives] ▪ **Broadcast news** of interests for local retailers and their clients such as road works or utilities disfuctions or parking closure [news, map]	Shopkeepers (BS), Commercial Associations (NP), Cultural and socio-animation groups (NP), City District (LG).
27	***CYBER-BULLYING*** *Problems.* Cyber-bullying is an issue dramatically worsening in the last years, often having catastrophic consequences on the well-being of children and teenagers. The main problem is preparing schools and teachers to identify and deal with this issue, organising ad-hoc education paths both for victims and perpetrators, facilitating the adoption of appropriate policies shared among local schools.	▪ Mapping the schools implementing specific **measures, policies and training options to contrast cyber-bullying phenomena** [extra, events, groups, map, timeline] ▪ **Identifying local referents, consultant or listening points** to consult in case of needs, within and outside the schools (e.g. in public libraries) [places, news] ▪ Promoting specific **projects and spontaneous initiatives on these topics** carried out by students, their families, other local organisations [groups, initiatives, timeline]	Integrative education providers (NP and BS), public and private schools (PB, BS), families (CP) and students.
29	***EDUCATION SERVICES*** *Problems.* Families and students struggle to find, compare and elaborate information about the education programmes of the hundreds high schools to choose what to apply for[72]. Municipal sources	▪ **Publishing and aggregating information about the educational offer and profile of schools**, considering both public and private schools [places, tags, map]	Parents associations (NP and CP), integrative education providers (NP and PB), schools (PB).

[72] In Italy, forms and contents taught in different high schools significantly change on the basis of the "type" (Classics, Science, Industrial, Psychology, Pedagogy, Economy, Design and Arts) and "class" (lyceum, technical, professional) of the selected school, even though they all ensure the possibility to continue in university courses. Students are in the band age from 14 to 19. No proximity criteria are applied for admissions, often merit criteria. Students can commute from the entire region every day to attend the

	include only basic info and limited exclusively to public schools. Studying the individual websites of all the schools to find info about programmes, projects, territorial liaison for integrative training is extremely complicated. These websites do not provide inputs on the experiences of other students, the staff, the environment. In addition, it is difficult to have a clear picture of the other services available for young people (e.g. health counselling, libraries) near the school. There is no support to understand how to match various family needs in case of sibling attending different schools or of different ages from nurseries to universities because of the fragmentation and scares accessibility of information.	▪ **Enabling the autonomous update and integration** of the information by the schools, teachers, or other [news, posts, timeline] on a shared online space ▪ **Sharing stories and experiences** related to the educational offer provided by the schools from the perspective of teachers, students, families, other members of the school staff [extra, posts associated with places] ▪ **Enabling the assessement of proximity services close to the schools**, accessible to students and their families [places, groups, initiatives, news]	
30	***WRITING COLLECTIVES AND CITY NARRATIVES*** *Setting.* Experimentation with creative professionals and students of a creative writing and multimedia production school. *Needs.* Try to build organic collective narratives of places (one place – multiple narratives) or build "collectives" writing in the city and over the city, remotely collaborating to create visual-map-text stories.	▪ **Thematically connecting media** produced by multiple authors over time and in the space [extra, initiatives, timeline, map, tags] ▪ **Showing the different perspectives** on places and their evolution [sub-entities, places, posts, extra]	Creative professionals, especially writers and visual artists (BS), cultural associations (NP), creative writing and multimedia schools (BS).
31	***MUSLIM COMMUNITIES*** *Setting.* The activities of the Muslim community are organised around 16 mosques that are centres for worship, and most importantly aggregation spaces and reference point for any issue in the related communities (multi-ethnic and multi-national communities). *Problems.* The coordination of prayers times, adjusted on a daily basis, is still done manually by people and through papers moving among the mosques. The cultural and social activities (e.g. study of Moroccan traditional texts and accounting support for small shopkeepers with limited literacy) of the main youth Muslim groups are unknown outside the mosque, preventing the engagement of non-Muslim participants and the acknowledgement of their value for the city, beyond religious differences (as it is more common for Christian organisations).	▪ **Broadcasting news** on prayer times and religious or community activities [news, intiatives] ▪ **Coordinating the working groups** operating in different mosques to avoid the overlapping of community events or to provide services consistent in timing and periodicity (e.g. every Thursday at 5 pm) in various points in the city [groups, events, initiatives, map, timeline] ▪ Setting up **public discussion and engagement groups** organised by area or nationality and tracing the connections and collabroation with other local actors [initiatives, groups] ▪ Documenting **projects and interventions promoted at the local level** [extra, events, initiatives]	Mosques volunteers (NP), youth religious or cultural associations (NP), shopkeepers and services providers close in the Muslim nationality-based communities (BS).
32	***BEYOND FACE-TO-FACE*** *Setting.* A consortium of associations and social enterprises works all over the city in projects and continuous programmes for community development, social inclusions of disables and elders, drug addiction rehab, support to mental health, assistance of minors and adults exposed to critical familiar environments. They work with the municipality, but also with other services consortia, health and social services, job placement agencies and companies running EU projects. *Problem.* Most of the territorial activities aimed at engaging the beneficiaries of the various programmes are still done face-to-face in one-to-one meetings, generating a workload that is unsustainable because of the shortage of volunteers and funding resources. This schema makes also difficult to extend the reach of their actions to people complete disconnected or new in local communities because based only on direct referrals.	▪ **Broadcasting news on upcoming programmes** reserved to specific target social segments in specific areas [news, initiatives] ▪ Providing an **overview of the the activities supported** by the consortium in different areas of the city and identifying the physical contact point on the territory [events, groups, places] ▪ Setting up **online contact points** accessible outside conventional channels [groups, extra] ▪ **Thematically clustering news and activities** by target users, project, collaborations [initiatives, map, timeline]	Cooperatives and suppliers of education and social services (BS), associated non-profit organisation collaborating on specific initiatives (NP), city districts (LG).

selected school if it offers specialised programmes difficult to find in cities closer to their home. The same kind of issues of this scenario had been examined also for navigating bachelor's degree programmes all over Italy or in foreign countries.

33	***MAJOR INFRASTRUCTURES - SUBWAY*** *Setting.* Preparation of the project and preliminary works to build the new subway line crossing the entire city and connecting some of the most deprived areas with the city centre and affluent neighbourhood in the southern area. *Problem.* Managing and supporting a transparent and organic large-scale participatory process with online and offline activities, involving the professionals in charge of the project and the local communities at large, going beyond marketing campaigns and fictitious engagement.	▪ Overview of the **planned intervention points** (subway station and related accessory spaces) in each neighborhood interested by the works [places, extra] ▪ Promoting **online and offline events** aimed at engaging residents in the project development [events, initiatives, groups] ▪ **Coordinating multiple events** happening at the same time or distributed over months, giving timely updates in case of unplanned changes [news, events] ▪ Documenting these events collectively and **comparing the proposals emerging from discussions and activities**, integrated with **notes and technical documents** provided by the engineering team or local engagement agencies [events, extra] ▪ Enabling the **formation of local groups** to develop specific proposals keeping the dialogue with other local actors [groups, extra]	Construction companies and engineering studio (BS), municipalities and city districts (LG), local engagement agencies (NP/BS), community organisations (NP).
34	***RESEARCH ABOUT SPORT*** *Initiative.* Research project aimed at evaluating the economic impact of major sport events in the city, including past events, and the relationship between sport activities and use of public spaces and sport infrastructures.	▪ **Mapping public spaces** used for sport activities and sport infrastructures [places] ▪ **Recording major sport events** over time on the map [events, timeline, map] ▪ **Collecting additional materials** from press and stories or impressions of the participants about events or changes in the use of spaces, both through targeted crowdsourcing campaigns or curated works by researchers [extra, groups, tags, timeline]	University research group (AC), departments working on the sport sector in the municipalities (LG), sport associations (BS/NP).

7.5.4 APPLICATIVE SCENARIOS AT THE DISTRICT AND NEIGHBORHOOD SCALE

Table 7.8. Applicative scenarios at the scale of a city district or sector

City District scale			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
35	***CITY DISTRICT LIASON*** *Setting.* City districts are the lower tier of public administration (corresponding to the parish councils in the UK), with limited budget and autonomy from the municipality, but growing responsibilities. *Problems.* Lack of support for the new role of social brokers and needs collectors that city districts officers are called to do. Difficulty to communicate the limits of the agency of the city district administration respect to other authorities as regarding ordinary operations, such as the maintenance of green areas and public furniture.	▪ **Gathering needs and requests on specific topics or related to the improvement of some areas** [places, subentities, groups] with the chances of associating and engaging the relevant subjects or authorities case by case ▪ **Timely updating residents and users about interventions planned** by the district and upper-level administration conneted to the district administration ▪ Facilitating the **planning of public and private interventions over the next weeks and months** through the assesement of the optimal timing given, for instance, the schedule of minor work roads, pruning, mantenance of green areas, but also commercial events, private works, schools extra openings	City district administration (LG), municipal and province administration (LG), public and private suppliers for maintenance of green areas and public infrastructures (PB, BS), non-profit organisations working in the district (NP).

36	***SOCIAL SERVICES*** *Setting.* Social services are organised in local units covering the needs of each city district. As public agency under social security and health care national agencies, they work independently from the city district administrations and with large autonomy from the municipality. These local units manage the numerous providers and subcontractors working on the field with disables, elders, minors, and other vulnerable groups. *Problems.* Fragmented picture of services and difficulties in communication and coordination with subcontractors, among them, and with the public.	**Connecting the cooperatives, social enterprises, and non-profit organisations** acting as subcontractors for the social services **to their operative area** and to their other activities [places, initiative, posts, tags] ▪ **Automatically creating multiple thematic maps of the available social services in the district** by target group, provision timing, or access requirements [initiative, tags, category selection] to facilitate the public agency in its periodical assessements, but also potential beneficiaries, their carers, and other service providers to assess the current offer against their needs.	Social services agencies (PB), subcontractors providing social services (BS), city districts and municipal administration (LG), assisted families and patients.
37	***COMMUNITY BUILDING AND SUSTAINABILITY*** *Setting.* Neighbourhood characterised by the highest rates in the city as regarding aging population (formers workers in local manufacture sector, frequently isolated) and migrants recently moved there (not necessarily well integrated), and including some deprived areas hindering the success of commercial activities and local services. *Initiative.* Community building project aimed at aggregating people around additional services such as the community oven, apiary, garden, and shared allotments to cultivate edible products. The project involves also local shopkeepers as “social antennas” to connects their clients (e.g. needs of after school classes for children of migrants and retired teachers).	▪ Supporting the shifts organisation **for using the community faciliaties and spaces managed by the projects** by different groups, including the organisation of classes and small social events [places and subentities, events, groups] ▪ Enabling **self-help and thematic working groups** associated to the various activities such as the apiary or the collective garden [groups, news] ▪ Broadcasting locally the **offers and requests of services** such as housekeeping or after-shool classes, **helping local shopkeepers to easily act as matchmakers of their clients** (helping their clients as volunteers in the project and on the platform) [news, initiatives]	Cooperatives providing social, education, and support services to the population (BS), cultural and environmental associations (Np), residents groups (CP), local shopkeepers (BS).
38	***HORIZONTAL KNOWLEDGE TRANSFER*** *Initiative.* Annual programme to train and support groups of teenagers to become activators of new local projects aimed at meeting the needs of their age band; mentors of their peers and younger children in after school, sport and digital literacy skills; bridges between their families, schools and local institutions. All the activities are co-designed between the organisations supporting the initiatives and the trained groups. *Needs.* Supporting the young participants to organise the peer to peer activities in an easy and traceable way, making smooth also the coordination of sport and social events, classes, and other initiatives carried out in the premises of the organisations and sports associated with the programme.	▪ Providing an **accessible and collaborative archive of the activities** related to the programme, and its participants (both as mentors and mentees), as well as the schools and sport clubs involved [map, timeline, places, event, initiative] ▪ Supporting **youth working groups divided by area, age band or theme** to discuss and decide about the details of the peer to peeer activities [groups, initiative, news].	Cooperatives and professionals managing the projects and providing socio-animation services (BS), schools (PB), sport clubs and associations (BS, NP), management of public sport infrastructures (PB), donors and private foundations (CP), children, teenagers, and their families (CP).
39	***COMBINING CULTURE AND PUBLIC TRANSPORT*** *Initiative.* Periodical event aimed at connecting multiple neighbourhoods of the city district through music and art performances hosted on some vehicles of public transports stopping in correspondence of small museums and cultural institutions adhering to the initiative. *Needs.* Communicating and publicly sharing real time updates on the position of the vehicles used for the event (not following their ordinary paths and schedule). Connecting the various events connected to this initiative over times, the organisations involved and extending the participation of the public and other local partners.	▪ Making possible to follow and actively participate to the event by letting the organisers to **broadcast updated about the arrival of the vehicles at their designated stops**, including on-going performances and the planned one at the arrival, available seats, **alternative options** like following the artists in the nearest public spaces such as squares and museums for other live performances [news, initiative] ▪ Keeping a **dynamic trace of the series of events over time and in space** [map, timeline, event, initiative] to	Cultural association managing the initiative (NP), Public transport companies (PB), musicians, artists and other creative professionals (BS), museums (PB), small associations and volunteers' groups (NP).

Table 7.9. Applicative scenarios at the neighborhood scale

Neighbourhood scale			
	Setting/Initiative/Problems/Needs	**Main applicative scenario of a CSN**	**Involved stakeholders**
40	***NATURAL SHOPPING AND SOCIO-CRAFT CENTRE*** *Setting.* A neighbourhood informal association is committed to combine economic, social and cultural development in one of the old boroughs of the city, and over the years promoted a self-managed progressive regeneration of unused buildings and decaying buildings. One of the pillars of this process is the attempt to made local shops, new artisanal workshops, informal cultural spaces working together by promoting the compatibility of different activities in the same space (e.g. butcher, photo exhibition, food preparation courses, or hairdresser and bookshop, or “housing maintenance booking point” and pottery production). The goal is reinforcing their mutual support and engagement in designing and experimenting unconventional services and initiatives in a sustainable way. *Needs.* Facilitating the matchmaking of activities and spaces; keeping trace of experiments and positive or negative experiences; improving the accessibility of hybrid services and collaboration opportunities.	▪ **Broadcasting calls for partnerships** to share space and services in established shops and studios [news] ensuring a reach higher than from a single fb page or website. ▪ **Supporting the development of new services or the sharing of existing ones** at the local level [groups] ▪ **Keeping trace of temporary partnerships** and enabling the sharing of these experiences for potential replication or variation [places, extra] ▪ **Promoting the starting up of new collaboration and services** in the neighbourhood [events] ▪ Documenting **joint initiatives among the owners of shops and craft workshops** in the neighbourhood carried out with other groups of citizens and cultural institutions [initiative, events, groups]	Neighbourhood association (PB), local retailers (BS), professional and private services providers (BS), commercial consortium for the commercial regeneration of the neighbourhood (PB).
41	***URBAN SPACES ACTIVATION*** *Initiative.* Eight-day festival aimed to activate the community in discovering neglected places in the neighbourhood and use them for artistic and cultural activities. The festival included 140 events autonomously organised by 104 civic associations and dozens of independent performers having the promoters of the initiatives as only common point of reference. The events were distributed in 67 places, subjected to also rapid changes due to adverse weather conditions and unplanned situations. The goal was triggering a bottom-up urban regeneration starting from intangible and temporary transformations of places, by engaging the local community, and in particular migrants (that are over the 30% of the residents). The main challenge was the space-time coordination among performers operating in the same area and between the organisers and the “activators”.	▪ **Overview of the hundreds of events in the programme**, distributed over time and space for the public, in an accessible and dynamic way [map, timeline, events] ▪ Enabling activators to **independently build the descriptive card and related contents of their event** [event, subentities], impossible operation for the organisers, sometimes not even aware of last minute events added to the programme to keep the festival fluid and open. ▪ Facilitating the sharing of technical resources among groups by **managing requests and offers** [tags, news] ▪ Supporting volunteers and management groups working on **setting up the stage for spectable and perfomances** all over the neighbourhood [groups, news] ▪ **Broadcasting updates** in case of adverse weather conditions or unplanned circumstances ▪ Sharing of **memories and observations** on the events outside institutional or closed channels [extra, sub-entities, posts]	Cultural association managing the initiative (NP), musicians, artists, small associations and volunteers’ groups (NP), city district (LG).

42	***SPORT IS THE CATALYST*** *Setting.* A local tennis club operates in the neighbourhood for decades since the '60. Its core mission is to promote tennis not just as an elite sport activity but as something accessible to everyone and to every age. This mission is pursued by pro-bono courses for vulnerable children; several fundraising campaigns to extend the economic accessibility and reach of the club to unemployed, migrants, elders; proactive bridging of the sport dimension with the familiar and community dimensions of members through social events and periodical initiatives in the neighbourhood. *Problems.* Sport is just a shared activity to support the club mission, but it is difficult to reflect online the social impact of their activities as a whole.	▪ **Broadcasting updates** about new courses and social events [news, events, places] ▪ Sharing the **experiences of collaborations** with schools and local communities [groups, extra, initiative] ▪ Making visible **external support to other local projects** related to the promotion of sport, sociality and well-being [initiative] ▪ **Organising the evidences** of all these activities in an organic way, manageable by different members of the club and other volunteers or associated [timeline, posts, sub entities]	Sport club (NP/BS), schools (PB), residents (CP), city district (LG).
43	***SPONTANEUS SPORT ACTIVITIES*** *Problems.* Spontaneous groups and initiatives for outdoor sports rely for their dissemination on word of mouth only and are difficult to find on online social networks. Analogously, safety and training advices for individuals practising sport alone in the neighbourhood green areas are scarcely accessible, preventing women and other groups to fully benefit of available outdoor infrastructures.	▪ Sharing **time and venues for groups'gatherings**, proposals of joint activities among runners and other sport practioners, open air sport lessons [event] ▪ Building **thematic maps** of safe places, or informal equipement for sports such as parcour, associated with dialogue groups where to ask for advice and suggestions [groups, place, sub-entities].	Sport association and volunteers' groups (NP), residents (CP), city district (LG), donors and foundations (CP).
44	***JOB PLACEMENT CHALLENGES*** *Setting.* Schools and local companies are facing the challenges of the ministerial requirements for activating apprenticeship periods for students in secondary education. Training and job placement agencies would like to support job opportunities to enhance local excellences in crafts, services and manufacturing. Social cooperatives fight to facilitate the job placement of vulnerable young people and accompanying them in this path, as well as the companies or other organisations hiring them. *Problems.* Disconnection of the schools from local productive activities and services consistent with the training path for their students. Missed opportunities for trainees in traditional craft workshops, professional studios and other services. Difficult calibration of training courses on the basis of local needs and opportunities. Lack of inclusive working paths for vulnerable people, due to the uncertainties over these experiences.	▪ Associating the **mapping of local companies** with the **skills in demand for training or apprentiship or job trial experiences**, especially in the cases in which the companies'needs do not correspond with their core business (e.g. car repair shop searching for graphic designers to make new flyers, position opened to students from an artistic lyceum and not only from professional schools in mechanics) [places, subentities, tags] ▪ Mapping trasversal or **transferable skills associated with the educational programmes** implemented in the different schools (e.g. creative writing and journalism in a classical lyceum, rapid prototyping in a technical school) [places, sub-entities, tags, groups]. ▪ **Keeping trace of these experiences** over the years to consolidate local partnership between schools and neighborhood businesses, or externally fund job placement programmes for specific target groups ▪ **Aggregating the training needs** of local companies respect to their internal resources and future recruitment processes	Job placement centres (PB), training agencies for lifelong learning (BS), cooperatives working with disables and vulnerable people to easy their work placement (BS), high schools (PB), city district (LG).
45	***INNOVATION TESTBED*** *Initiative.* Experimental programme aimed at testing technological solutions and products of 36 companies and start-ups in one of the neighbourhoods of the city, with the support of the district council and the municipal administration. *Needs.* Having a virtual entry point to follow the various testing experiences over a few months. Facilitating synergies among different companies and local groups working on themes and similar issues.	▪ Without replacing the institutional portal of the initiative or the companies websites, providing a **joint space for the participants in the programme to engage citizens** to share comments, observations, questions about the on-going experimentations [groups, events, posts, sub-entities, initiative] ▪ Provising a **synoptic view** to the municipality and potential other investors to **assess past and on-going experimentations** and their impact [map, timeline, extra]	Municipality administration (LG), city district (LG), communication agencies (BS), private foundations (CP), start-ups and companies testing their product and services in the area (BS), residents (CP).

	Collecting feedbacks and experience to understand the solutions more appropriate to address shared city challenges for future adoption by privates or local authorities.	▪ Faciliating the **connection among different proposals and with other businesses consolidated in the area** (e.g. innovative ecologic packaging solutions and fresh food shopkeepers) through the possibility of informal support to specific experimentation or open call for collaboration [news, groups, initiative]	
46	***NEIGHBORHOOD MEMORY COMMITTEE*** *Setting.* A committee of volunteers collected for decades every documental trace of the historical events happened in the neighbourhood and having public relevance for the community and the city. These materials have been organised and even published in booklets and essays, that unfortunately remain in the closet of the volunteers' meeting place. The volunteers had been frequently engaged in the past by schools, researchers, and local groups to share their knowledge in a variety of initiatives. However, the advanced age (over 70-75) of all volunteers rises worries about the risk of losing the valuable heritage of local knowledge built over decades if it will be not publicly opened, maintained and enriched by new volunteers. *Needs.* Transferring their knowledge in a different form than booklets or in-person meetings, more sustainable for them and in the long term.	▪ **Mapping of places and events having historical significance** in the neighborhood by highlighing their connections over time and their transformation [places, sub-entities, events] ▪ **Involving schools and other organisations to integrate online the information shared by the memory committee** and make sustainable their effort, but acting independently from its members [groups, events, initiative] ▪ **Contributing to consolidae the sense of community and the identity of the neighbourhood** by framing new projects and initiatives in relation to the local heritage, both material and immaterial [events, groups, initiative]	Neighbourhood volunteers' group working as living archive (NP), schools (PB), local organisations (NP), city district (LG), neighbourhood library and social hubs (PB). [Note: In this extraordinary case, most of the volunteers did not even have an e-mail or never "surfed the internet", but they approached the FirstLife platform without particular fear or issues. In their group (about 12-15 members), they were used to work together joining expertise and skills of different members and self-organising their activities in a way to have a person with a recognized expertise on a specific topics with a person with good writing skills with a person able to use a computer for digitalizing text and materials].

7.5.5 APPLICATIVE SCENARIOS ASSOCIATED WITH URBAN BLOCKS, SPECIFIC BUILDING UNITS AND INDOORS

Table 7.10. Applicative scenarios at the scale of urban blocks

Urban blocks			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
47	***REAL ESTATE IN FORMER MILITARY AREAS*** *Setting.* A former military area with historical building used as barracks until two decades ago had been acquired by public and private investments groups planning its transformation through a real estate development project (targeting upper class future residents). At the same time, the area is strongly linked to II World War events and local residents demand respect and preservation for some sites within the block. Lastly, part of barracks had been used for two decades to host primarily refugees evicted after the acquisition of the area, despite the efforts of the organisations continuously working there to provide material and social assistance. *Needs.* Supporting a constructive dialogue among the different stakeholders involved to build negotiated solutions to transform the area. Preserving the precious memory of a neighbourhood usually known uniquely for its industrial past and the precarious conditions of its building environment.	▪ **Providing a neutral space to share materials and documents presenting the instances of all the stakeholders involved in a comparable way**, avoiding the disparity of impact between the 3D renders of architects and designers (fascinating, but not informative) usually published on their website and marketing materials on one side, reports of hundreds of pages related to the variant of the regulatory plan of the city on institutional portals (informative but not legible) on the other side, and more modest documents prepared by cooperatives and local committees (clear in their motivations, but not considering other positions). In particular, **presentation of the specific and puntual solutions addressing the different concerns on the table: housing plan, preservation area, refugees relations, access to public and semi-public spaces** [places, extra, sub-entities such as subplaces and discussion groups associated with specific subplaces and solutions].	Public investments organisations (PB/BS), professional design studio (BS), residents' associations (CP), cooperatives working migrants and vulnerable people (NP), municipality (LG), cultural institutions interested to the place as cultural heritage (PB/NP).

48	***CONTESTED ZOO OPENING*** *Setting.* A large green area close to the river has been entrusted by the municipality to a company that has won the public tender for setting up a naturalistic centre for recreational and educational activities. The project implies huge opportunities for the regeneration of the area, that remained abandoned for decades, out of the control of public authorities because illegally occupied, and not even accessible to local residents because of security risks. However, environmental groups contest the opening of this new centre envisaging potential future mistreatment of the animals that will be hosted in the centre, equated to a zoo (despite the reports of biologist and experts ensuring the respect of all measures to offer the best environment to animals, and the good reputation of the company in charge of similar facilities in other areas). *Needs.* Facilitating a debate over the transformation of the area based on the actual interventions that had been planned and their potential impact for the local regeneration, framing the different perspectives in a way that is understandable for the general public.	▪ **Mapping of the planned interventions in the area, description of their characteristics and access to relevant documentation** on the evaluations and measures ensuring the well-being of animals, to contrast misinformation and enhance transparency [places, sub-places, extra] ▪ **Supporting distinct online discussion groups on the interventions on the interfaces or point of contact between the zoo and the neighbourhood**, opened for negotiation between the concessionaire of the area and other local stakeholders [group] ▪ **Documenting and leaving open for further clarifications the outputs of the offline public meetings for the debate** about the zoo opening among the interested parties [event, news, group] and chances to associate other related activities organised by environmental association [initiative] ▪ **Follow up on the proces**s, including final approval, public works, and starting of the activities [news, events]	Environmental and animalist associations (NP), group of residents in the closer areas (CP), industrial consortium guiding the project (BS), researchers (AC).
49	***TEMPORARY USES OF DISMISSED WAREHOUSES*** *Setting.* The closure of large production plants in the automotive industry has left the abandoned warehouses unused for many years. In some cases, these warehouses occupy large urban blocks extended for over than 100.000 square meters configuring a gigantic hole in the urban tissue. *Initiative.* Programme to support temporary uses of a part of these spaces by start-ups and innovative manufacturing companies searching for large spaces to run their activities, but also opened to proposals of other stakeholders interested to carried out cultural, artistic and social initiatives. *Needs.* Helping the organisations managing the area and the promoters of temporary uses to navigate the new functions of the warehouses because extremely dispersed within the block and changing over time. Reconnecting the warehouse to its surround, attracting residents, potential customers, and other local organisations.	▪ **Dynamic survey of the individual lots available for reuse**, with timing and conditions for access [places, sub-places, extra, pod-cast], providing an overview of the occupied spaces and the ones still free at any time ▪ **Broadcasting calls for proposals** by the plant's management and **calls for partnerships by start-ups** and local organisations [news] ▪ Keeping **track of the temporary uses** and the programme of related initiatives [event, timeline] ▪ Visualising the connections between the new or temporary activities and other complementary services and activities in the neighbourhood [initiative]	Consortium of public and private bodies managing the ex-industrial area (BS/PB), cultural institutions for urban regeneration (PB), universities (AC), businesses (BS) and non-profit organisations interested to the use of spaces, municipality (LG).

50	***HOSPITAL REHABILITATION AND TRANSFORMATION*** *Setting.* One of the biggest and oldest university hospitals in Italy has to undergo a radical transformation from acute and chronic care centre in research and innovation centre (keeping med school and labs) and hub of territorial decentralised health care services to comply with the new standards of security and efficiency for public buildings. At the same time, new pavilions of the hospital to address acute patients' needs will be built in the surrounding area. This transformation is supposed to be conducted by opening the process, the design and the implementation of choices to the participation of the hospital staff, students, patients and families, residents in the area and companies working for, within, and around the hospital. *Needs.* Managing multiple forms of participation appropriate to the different groups involved in the transformation process, by distinguishing topics, timing, areas for their involvement. Keeping trace of the progressive transformation of the working spaces of the hospital, providing public real time updates about changes in the paths, works, open areas, risks.	▪ Managing the participatory process by **allowing different type of stakeholders to directly contributing to specific proposals concerning their areas of interests or expertise** (such as medical staff, university students, residents, suppliers) by connecting the spaces under design or transformation to dedicated online working groups [places, sub-places, groups, initiative, map] ▪ Calling different users groups to contributing in **outlining and reflecting on the use of spaces to support the project team in making appropriate decisions about the plan of interventions** [posts in places, initiative, tags] and their order of execution ▪ Sharing the **temporal plan of the spatial arrangments** needed during the progressive rafactoring and repurposing of the hospital buildings and outdoors, to facilitate staff, patients, and visitors to plan their own activities in relation to the planned works [map-based interface, timeline, events] ▪ **Monitoring the progress of the rehabilitation** and providing a **dynamic and open assessement tool to evaluate the engagment** during the phases of participatory design and the **transformation process** [map, timeline].	University hospital and associated health care facilities (PB), Staff of the hospital (PB), residents and families of patients (CP), universities (AC), regional authorities and municipality (LG), engineering studio in charge of the project (BS), general contractors and subcontractors hired for works (BS), public engagement agencies (BS/NP).
51	***PARTICIPATORY DESIGN OF A NEW GREEN AREA*** *Initiative.* Environmental remediation (asbestos removal) of an area previously occupied and activation of a participatory process for designing the new garden open to the public, in particular children and elders, in a neighbourhood deeply lacking green areas. *Problem.* Small scale participatory processes usually engage a limited number of participants, missing the opportunity to understand and meet needs widely perceived. *Needs.* Keeping the process transparent for both the people directly involved and other stakeholders accessing only to the results of the design process.	▪ **Preliminary mapping of the area** interested by the participatory design process and its surroundings, in terms of other facilities and green areas and by sharing the relavent document to understand the factors potentially impacting on the process [places, extra] ▪ **Participatory annotation of the criticalities and observations during the group visit** to the area [event] ▪ **Announcing the appointments and workshops** related to the participatory design, an d potentially other parallel initiatives contesting the process itself [event, news] ▪ **Sharing of the proposals** elaborated by the participants and opening to comments by other residents and interested parties [extra, group] ▪ **Thematic discussion groups** moderated by the facilitators **to examine inputs and constraints emerging from the process and the dialogue with the public administration** involved in the implementation of the proposal [group, subentities] ▪ **Follow up on the implementation process** form the official approval of the final proposal to the start of the works in the area to its opening to the public [news, event]	Regeneration offices of the municipality administration (LG), city district administration (LG), engagement agencies (PB), residents (CP).

52	***GLOBAL SLOW FOOD EVENT*** *Setting.* Over 200.000 visitors and 7000 delegates (companies, activists, teachers, experts and journalists) from 150 countries convey every two years in one fair area for a few days to exhibit and learn about innovative food production, processing and supply chain to promote biodiversity, land preservation, anti-climate change measures, and fair exchange protocols. *Problem.* The social capital generated by aggregating and connecting all those people during the fair is only partially exploited due to the difficulty of strengthening those connections after the event to spread sustainable innovation and experiences.	▪ Mapping of the **temporary spatial arrangements due to the event**, included access, road closures, path deviations for the residents, and FAQ [places, sub-places, news] ▪ Supporting organisers, delegates and visitors during the event by **broadcasting updates and last-minute changes in the programme** [news] ▪ Collectively creating a **common pool of information about the delegates proposals** by involving visitors too [groups, extra, initiative, tags] ▪ **Providing to each delegate a virtual space to present their products, services, projects**, that is connected to their personal resources (e.g. online materials and website), but **shared with other delegates**, making easier potential connections, **networking opportunities, and collaborations** during and most of all after the event [places, extra, initiative, tags, map] ▪ Mapping **local, national and international partners of each delegate and of the event** [initiative] providing a rapid overview of the impact and reach of the festival to be used for **self-assessment and communication purposes**.	Organisers of the festival (BS and PB), local producers and exhibitors (BS), visitors (CP), commercial and institutional partners (BS, PB, NP).

Table 7.11. Applicative scenarios focused on single buildings, open spaces or indoor

Buildings/public spaces/indoors			
ID	**Setting/Initiative/Problems/Needs**	**Main applicative scenario of a CSN**	**Involved stakeholders**
53	***MARKET SQUARE*** *Setting.* One of the biggest open-air markets in Europe, with over 1000 stalls assembled and disassembled every day at morning and afternoon for 6 days a week, hosting other activities in non-market hours. *Problems.* Reduction of traditional customer base and drastic changes of the needs of new customers (privileging information clarity and high-quality products), difficulties due to the competitions with supermarkets and conventional shops, extremely limited resources to invest in customer support services. All factors endangering the chances to keep the market running in the medium term. *Needs.* Low-cost organisation and management of new appropriate customer support services.	▪ Providing a **shared bullettin board/commercial flyer** where each vendors can daily update offers and products, indipendently from others [news, places subentities, tags] ▪ Creating **referral groups** among vendors selling complementary products (such as fresh bread and cured meat) to create trust-based chains of high-quality product to support customers in their choices [initiative, tags] ▪ Organising **shared delivery services** on-demand after the market closure, cooridnating the collection of the product to be delivered with the usual way back of vendors and their empty vehicles [groups, news]	Local Development agency (PB), retailers and cooperatives providing auxiliary services to the market (BS), historical market associations (PB) Customers (CP), Schools (PB).
54	***IN/OUT THEATERS LIFE*** *Setting.* Two theatres on the outskirts of the city collaborate in offering experimental theatre experiences to attract publics usually excluded by more conventional seasons in historical theatres for economic, social or cultural reasons. Spectacles produced by emerging local, national and international companies. *Initiative.* Connecting the stories represented in the spectacles to the real-life experiences of the public, connecting the stories and the experiences along the seasons, connecting people through stories.	▪ **Coordinating the two theatres seasons and the related appointments** (e.g. presentations, dinners, public events) [events, initiative, news] ▪ **Opening the documentation of the events and spectacles to the public** through the sharing of additional media and observations [events] ▪ Visualising the **connections between places and stories represented in the performances and the experiences of the public** and supporting the	Theatres companies and groups (BS/NP), public (CP), local associations (NP), schools (PB), owners of entertainment venues (BS).

	Needs. Structuring, simplifying and extending (over time and in its reach) the collection of this bundle of stories from paper to digital to amplify the cultural and social impact of theatre experiences.	collection of these stories [places, initiative, groups]	
55	***FROM CO-HOUSING TO EXTENDED CO-LIVING*** *Setting.* A constellation of a few dozens of co-housing spaces (single apartments and entire buildings) hosts volunteers sharing their domestic or community spaces with refugees, migrants, and vulnerable people and activating co-managed and self-organised small daily services and initiatives benefiting other guests and residents. *Problems.* Strong internal effort to coordinate the activities in large complexes or across co-housing relying on the energies of individuals. Fresh start at every change of the co-housing guests and loss of memory. Mistrust and scarce engagement of other residents. Denial of the existence of critical situations of social vulnerability in more conservative and homogeneous areas, preventing collective solutions sometimes easy to implement (such as fighting isolation).	▪ Creating a "**spatialised calendar" of the activities across the various co-housing** to help the groups of volunteers working there [through subentities such as events and places within other places] ▪ Activating **thematic discussion groups on topics related to the activities carried out in the co-housing and the supported inclusion programmes**, accessible to non-volunteers [groups, news] ▪ Supporting timely self-organised **social interventions** through a ligh-weighed open alerting and engaging systems for each residential area including one of the co-housing structures, but not limited to volunteers and guests [groups, news]	Cooperatives and non-profit organisations working with refugees, migrants, and vulnerable people, residents (CP) and co-housing guests, donors and private foundations (CP).
56	***RESEARCH NETWORKS PROJECTIONS*** *Setting.* A university department hosts almost 40 different research groups, all of them participating in several local, national, and international projects, contributing to research and development programmes in collaboration with public authorities and industries. *Problems.* The activities of each group (intended as expertise, projects, collaborations) are unknow even to other groups on the floor, and the contribution of the department to the third mission of the university entrusted to limited institutional communications only, leaving internal and external potential synergies remain unexploited.	▪ Collectively building **thematic maps of the research topics** and projects of different groups sharing the same spaces while not working together to stimulate reciprocal awareness [groups, sub-entities places] ▪ Visualising the **connections between each research group and their local partners** in projects and long-term collaborations [initiatives] and activating new connections through calls for partnerships and projects [news] ▪ Co-organising **joint actions such as dissemination or public engagement events**, but also joint research activities such as the recruitment for volunteers and testers [groups, events, news].	University Department and research groups, university and department management, public engagement offices of the university (AC).
57	***ENVIRONMENTAL SUSTAINABILITY & UNIVERSITY*** *Initiative*. Programme supporting environmentally friendly behaviours by students and academic staff in the new university campus, as regarding the improvement of waste collection and recycling, quality and sustainability of the food supply, decreasing of energy consumption, and incentive to alternative mobility options such as public transports and cycling.	▪ **Mapping the "green points"** for waste collection and recycling inside the new university pavilions and structures [places, subentities] ▪ Activating **working groups promoting sustainability-related projects** for students and university staff [groups, extra, news] ▪ Promoting the **self-organisation of individual and groups in relation to sustainable food and mobility choices**, such as car sharing offer/requests or Km0 promotions in food services activities [groups, news, initiative, places]	Research groups and university students (AC), suppliers and providers of auxiliary services - food and cleaning (BS), students' environmental groups (NP).

58	***TREASURE HUNT*** *Initiative.* Gaming experiment organised as a treasure hunt in one of the commercial areas of the city, combining exploration of the spaces (markets, arcades, shop galleries, pavilions), with the direct interaction with the shopkeepers adhering to the game and the online interaction with the organisers and other players.	▪ Using the **temporalised tips available as geo-localised contents in the interactive map** of the market indoors spaces to find the highest number of unique items hidden in each of the 50 shops [map, timeline, news] ▪ **Navigating the commercial area** identifying the activites involved in the game [places, sub-entities, initiative] ▪ Relating with other players and the organisers, reading **real-time updates and asking questions on the tips** [news, posts]	Volunteers' group (NP), stalls owners in the markets and local retailers (BS), residents participating in the game (CP).
59	***MAJOR CONFERENCE VENUE*** *Setting.* Conference attended by over 750 speakers and participants, hosted in a three floors conference hall/hotel. *Needs.* Orienting the attendees through hundreds of events along 4 days in the conference venue. *Initiative.* Live demo experiment.	▪ Providing access to an **interactive version of the programme navigable in time and space** [places, events, news, subentities, tags] ▪ **Associating working or discussion groups to specific events** such as workshop to develop network conncetion also after the conference [groups, initiative] ▪ Thematically **clustering contents** shared by the participants [extra, posts, tags]	Research group setting the demo, attendees to the conference (AC).
60	***INTERNATIONAL SOCIAL KITCHEN*** *Setting.* Multiple national communities from Africa, Asia or South America every month self-organise public and private events (e.g. religious celebrations, weddings, parties, concerts) by using the facilities of an independent social hub and extensively mobilising community resources (people, shared assets, equipment, and so on). *Problems.* Access to key people and resources is still based on informal mechanisms, first of all word of mouth. *Needs.* Making easier the organisation of these events and reinforcing the inclusiveness of these communities toward newcomers, outsiders, local residents and other communities.	▪ Collaboratively **documenting the initiatives, projects and collaborations** supported by the social kitchen management [place, subentities, initiative] ▪ Visualising **connections and relationships among the ethnic communities and the social kitchen**, especially as regarding the access and use of shared resources usefull for ceremonies and major events (e.g. stereo systems, helpers) [events, groups, initiative] ▪ **Engaging residents and non-members improving the accessibility of the events** by sharing details on participation forms, especially for religious or semi-private celebrations [events, extra]	Consortium of cooperatives and non-profit organisation managing the independent social hub (BS/NP), residents (CP), national communities and their associations (CP/NP).

7.5.6 COMPARATIVE ANALYS AND DISCUSSION OF THE APPLICATIVE SCENARIOS ACROSS DIFFERENT SCALES

The results and discussion of the comparative analysis of the applicative scenarios at the different scales refer to a set of factors and directions examined for outlining:

- the **integration of a map-based platform in collective actions**
- the **scale of actions** and their representation on a map-based platform
- the **communication framework** for a collective use of a map-based platform in a multi-stakeholder context.

7.5.6.a A map-based platform in collective actions

A. Type of contents and type of objects

The first two factors considered in the comparative analysis of the applicative scenarios in relation to the integration of a map-based platform in local actions are:

- the **type of contents** used to represent the activities related to scenario
- the **type of objects** described by these geo-referenced contents.

As mentioned in section 7.4, the FirstLife prototype offered five **type of contents** that users could add directly on the map as points of interest: **places, events, groups, news, and extra** (the last entity mainly interpreted as stories, project descriptions, and short reports). As regarding the **type of objects** described by the contents, a macro-partition divided them in **tangible and intangible**, respectively related to physical objects (such as buildings) and to immaterial elements usually not traced in maps.

Most of the applicative scenarios related to collective actions had been associated to a balanced use of points of interest corresponding to places (and tangible entities) and points of interest connecting groups, extra and news to a specific location, even without a specific place hosting the activities. The representation of events or groups expressed this fusion between tangible and intangible elements thanks to their temporary visualisation on the map combined with their localisation in a specific place. This use pattern, recurring in the majority of scenarios, highlighted the conflict between a static view of map-based contents constantly associated with permanent physical entities and the potentialities of the real-time sharing (and visualisation) of activities-related contents, differently from the majority of map-based platforms offering almost exclusively static views.

B. Functions of the map in the actions

The analysis continued considering the **prevalent use of the map** and the **prevalent use of geo-referenced user-generated content**s in different settings.
The four functions of a digital map in collective actions emerging from this work are:

- **map as a background image**
- **map as filter and explorer**
- **map as reality amplifier**
- **map as the representation of spatial objects.**

The digital map is used only as a background image when the actors engaged on the platform share homogeneous goals and the characteristics of contents available on the platform are already known to the end-users. In these cases, the information retrieval and the interaction with specific contents are mainly made through textual searching options, independently from their visualisation on the map. For instance, as regarding the applicative scenarios of national networks for alternative welfare services, the dataset available on the platform is constituted exclusively by social services organisations and community projects adhering to the network. The activation of new working groups and inter-territorial networks is based mainly on thematic convergence instead than spatial proximity. At a lower scale, such as in the applicative scenario N.41, the map is functional to represent distributed events across a neighbourhood, but the users of the platform actively producing new contents were mainly related to the organisation of the festival (promoters, collaborators, performers) and the coordination of logistics. In both cases, the use of the platform limited to homogeneous groups and their knowledge of the context leads to a secondary role for the map, compared with other options.

On the contrary, **when the dataset is unknown to the end-users, the data exploration is preferentially done by zooming the area of interest and visualising a reduced number of contents that could cover heterogeneous topics and have several different purposes.** In **this framework, the map is mainly used as a geographical filter.** For instance, in the majority of the applicative scenarios analysed at the regional scale and linked to cultural and touristic activities, the representatives of local associations and organisations shared the same virtual space with creative and tourism industries. In those cases, field observations and joint experimentation in real operations showed that the preferred way to select the information was by using the map to focus on a specific area and then exploring what the contents in that area because usually the majority of groups do not know other actors working in the same area or their activities. Similarly, in city scale scenarios, the contents on the map covered a wide range of activities performed by the different stakeholders. The end-users of the platform in almost all the applicative scenarios, including the general public, not necessarily were aware of local projects and activities, but nevertheless could be engaged at the local level, for instance by attending meetings and events.

The map seen as an amplifier of the reality emerged in the cases where there are no direct relationships between contents and places, but their proximity, distribution, and concentration on the map can impact on the spatial decisions to be taken because they alter the understanding of the context. As an example, in the scenarios N.17 and N.23, the concentration of urban commons mapped in a specific area can lead to thinking that in that area there is a more engaged community and prioritise the regeneration programmes consequently. Alternatively, in scenarios such as N.58, the concentration of tips to proceed in the treasure hunt could impact on the players' strategy of participating in the game. Or in scenario N.45, the concentration of points of interests in the central square of the district considered as the core place of the innovation testbed initiative offered an interpretation about the on-going experimentations corresponding to their ideal projection instead then real compresence.

Lastly, **the traditional use of the map as a realistic representation of spatial objects has been proved as determinant only when the primary actions to be supported are offline explorations within the physical environment (building, squares, city block), because of the users' need to have visual connections between the abstract representation on the map and the space to be explored.** In this kind of situations, the participants involved in the research often stated that it could be useful to have also a 3d architectural models overlapping the map. It is worth to note that the **spatial navigation was still seen as an individual activity** also in relation to collective actions, where the end-users pursue their own goal helped by the contents added by other users without activating any connection with other users through the platform.

C. *Functions of the geo-referenced contents*

These functions of the map are correlated with the functions of geo-referenced contents to be intended as distinct layers overlapping the map. **When the map is seen only as a background, the geo-localisation of contents on the map is considered as an organising principle to archive static or dynamic data, integrate different sources of**

information, standardise their visualisation. This is recurring especially in the applicative scenarios where user-generated contents are associated with intangible entities corresponding to the traces of social activities such as social services or events.

The map as a filter tool is particularly important where geo-referenced contents about tangible and intangible entities have the function to document processes and actions over a large area in a long time, monitoring transformations and impact of decisions. For instance, in the applicative scenarios dealing with long-term coordination of different actors, or the management of a complex project, or when the same area can host several activities over the time. In these cases, activities and places could change month after month influencing local decision-making processes.

Learning, collecting opinions, broadcasting news, and navigating a space through tips can be seen as different ways to use geo-referenced contents as elements to build a shared understanding of a scenario among platform users when the map is used as reality amplifier. Alternatively, if the focus of the action is on a specific physical space, geo-referenced contents can be functional to support local actions on tangible entities, such us elaborating a proposal for a physical transformation in a public discussion or making shopping decisions.

D. Temporal aspects of the actions affecting the use of geo-referenced contents

By analysing the functions of the geo-referenced contents on the map, the temporal aspects of the applicative scenarios become relevant to understand the kind of coordinative and cooperative practices that the CSN could support. The factors considered to analyse the temporal characteristics of the scenarios are:

- the **timeframe** of the initiatives or projects
- the **periodicity** of the initiative or the activities performed within it, to highlight if they are extraordinary activities or replicable ones
- the **timeframe of the main activities** implicating some forms of collective organisation within the initiative
- the **validity time of geo-referenced contents** displayed on the map, or rather for how long it is relevant they remain visible on the map.

Under these factors, the principal distinction among the applicative scenarios is between **long-term and short-term initiatives**, respectively lasting more than 6 months or less.

In long-term actions, the activities tend to be usually concentrated in a few shortest time intervals that dot the general timeline of the action and correspond to events, meetings, workshops, procedures, project milestones, possibly repeated over a period of one or a few months. Nevertheless, the visibility of contents on the map is relevant well beyond the time of activities, because of their use as traces of on-going processes or general systems of relationships. Within this operational framework, the coordinative practices mediated by the platform are mostly asynchronous actions among users interacting also in an offline dimension.

For instance, in the applicative scenario N.03, the four-day event completing the two-years organisation of the "Biennale della Prossimità" was intended to present and support the services of all associations and cooperatives adhering to the initiative. However, by displaying projects and common themes on a shared map, the users have the possibility of integrating the contents provided by the promoters, and creating a space for dialogue and mutual awareness among different local groups intended to activate new collaborations for the next iteration of the event. In case like that, map-based contents about on-going and future projects should remain visible for the entire cycle of preparation of periodical activities, while the single event is limited to a shorter time. Similarly, in all cases concerning the construction of a coordination space among heterogenous stakeholders, the tension between temporary contents and permanent contents is related to the need of communicating the on-going and planned activities, but at the same time trace the past ones as part of the process of extending engagement in local activities, matching needs and resources among different users groups, disseminating the outcomes of the activities.

In short term actions, the time intervals of relevant activities overlap the general timeline of the projects or programmes. The activities are often organised in cycles with a short periodicity that correspond to a specific phase of an action. Within the framework of short-term initiatives, a CSN platform is called to support mostly synchronous actions of independent users in a cooperative context. Therefore, the validity time of contents displayed on the map could be limited to a duration functional for organisational purposes.

As an example, in the on-going public debate about the transformation of a former barrack into a residential complex (N.47), the in-presence debate lasted a few hours, while the online discussion remained open for about two weeks. The visibility of contents was critical during that phase to allow the participation of interested parties, but after that deadline, the platform does not remain the reference point in the process. Analogously, in scenarios such as N.53 or 60, updates about community events or the availability of special products at the market stands are relevant for the platform users only for their validity time or for the duration of the promotion. Then, could be replaced by other contents about new offers or new activities supporting new decisions or practices.

E. Relations between online and offline actions

After the analysis of the functions of the map and geo-referenced contents, the focus on the temporal aspects characterising the initiatives under study highlighted the importance of situating the **use of the platform within a process including offline and online interactions**. To this regard, the factors considered in the comparative analysis included the definition of:

- **the type of online actions enabled by the map-based platform**
- **the type of offline actions enabled by the map-based platform**
- **the relations between them**
- **the type of spatial decisions guiding these online and offline actions**

The **types of online actions** enabled by the platform range from the communication of past and on-going activities, to the management and monitoring of resources (people and goods) thanks to real-time updates from their operational context, to the planning of future actions based on the understanding of local dynamics. While in the first case, the promoters of actions rely on the platform more than other involved actors, in the remaining ones the benefits of using the platform are opened to all actors participating in a specific action. The communication purposes are predominant in the applicative scenarios in which the primary need of the organisations and groups involved in specific action is to render a complete picture of their work-in-progress, especially when it has an innovative profile or goes against consolidated services and practices. In the other scenarios, the opportunity to rely on user-generated contents spatially and temporally characterised is functional to two-way interactions among participants, organisers, and other engaged actors.

The **types of offline interactions** enabled by the platform had been defined in relation to the level of reciprocal engagement with other platform users and to the required level of convergence of their objectives, as outlined also in the third core model in Chapter 5. They included:

- competition, when the stakeholders involved in local actions have the same goal to reach, but there are not reciprocal interactions and mutual help
- cooperation, when the stakeholders share a specific goal and act in an interdependent way to achieve it
- coordination, when the stakeholders act independently to contribute to high-level goal framing the

actions of all of them, but not their objectives
- collaboration, when the stakeholders act driven by distinct goals that could be achieved or could benefit from a joint success of all of them.

Competition dynamics have been openly observed almost exclusively among stakeholders having a consolidated profile and a narrow domain of action, and they were marginally relevant in relation to local businesses in comparison with public and cultural organisations. Coordination dynamics activated by the knowledge of the context ensured by the platform are almost exclusive in the cases implying the organisation of distributed events or the provision of distributed services by multiple units. Cooperation dynamics have been identified when the participants could autonomously contribute to local initiatives by acting individually, generating new contents on the platform or in offline events. Collaborative dynamics had been rarely identified and their recurring characteristic was not to be traced on the platform by choice of the participants.

The main **type of relations between offline and online actions** enabled by the platform have been grouped in **integrated, dependent or independent**. The applicative scenarios offering examples of integrated actions were characterised by the sequentially between the use of the contents of the platform and the related offline actions. For instance, the online mapping of resources or events used as a guide to develop regeneration proposals. The dependence of offline actions from online actions was stronger in scenarios entailing monitoring activities and real-time management of contingencies in a shared virtual space. On the contrary, complete independence between online and offline actions had been observed in scenarios rooted on routinely activities or, on the opposite extreme, projected toward radical innovations. This led the analysis to investigate the type of spatial decisions connected to the use of the platform to understand better how it can be effectively integrated into local initiatives.

The type of spatial decisions enabled by the platform has been defined accordingly to the classification in policy decisions, resource allocation decisions and resource status decisions [see Chapter 5]. The same scenarios in which where online and offline actions progress independently from the interaction through the platform were largely associated with policy decisions. Indeed, policy decisions defining positions, choices, and operative strategies in a defined context were relying on the support of the map-based visualisation to orient the choices but not to implement them. For instance, the cooperatives motivated to activate new local partnerships, or the real estate developers engaged in the rehabilitation of a former barrack could consider the contents shared on the platform only as one of the sources for their informed decisions. A similar situation was in place for the cases in which the public administration could elaborate its own assessment of the context and future strategies relying on the data available on the map jointly with the constraints imposed by the management of the project, but without actually using the platform in the process.

Differently, resource allocation decisions resulted to be centred on assessing the convenience of making an effort of coordination or networking in a cooperative environment where the exchange of information was the key-element for interactions dependent from the platform contents. In this setting, the decision makers are both the map-users and the map-producers because their roles are not distinct, and the timing of decisions is set independently by each user. At a different level, resource status decisions are strictly dependent on the updating of information on the map as it is observable in all applicative scenarios involving timely operations such in emergency or for the organisation of events. In these situations, the timing of decisions is set collectively by the timing of the activities and circumstances. Receiving updates on the progress of events in another area, or on the planned actions in the short term, or on the achievements of other actors engaged in the activities through a map-based visualisation could offer a synthetic view of the context to support timely logistic decisions both by the map producers (e.g. organisers of a specific action) and map users (e.g. public, customer, helpers, players).

7.5.6.b Scale of actions and map-based visualisation

Accordingly to the core model presented in Chapter 5, the preliminary classification of the applicative scenarios relied on the definition of the scale of actions for local development processes. The scale of action has been defined not as a geometrical proportion between real objects and their map-based representation as in cartography, but as the geographical unit within which all the actions included in a project, process or programme take place or impact on.

To explore the relationship between the scale of action in each initiative and the map-based visualisation of the activities and the contents describing them, the factors considered in the comparative analysis included:

- **the scale of activities**
- **the scale of relevance for the exploration of contents**
- **the scale for a significant aggregation of contents**
- **the spatial pattern of activities**
- **the spatial properties of objects described by geo-referenced contents.**

The participants in the case studies identified the scale of activities always at a lower level compared with the scale of the initiative and usually expressed them by a range of scales instead than a specific one. Indeed, according to the literature as well [Montello 1993], when we have geographical units that can only be known abstractly, such as the country, region, or province, the cognitive representation of everyday activities is brought back to the scale of ordinary actions, ranging from indoors to the neighbourhoods, of which we can have a direct experience even if fragmented. In some specific cases, when a part of actions related to the activation of networks and partnerships can be done without face-to-face interactions, the scale of activities reaches the level of the province or regional scale. In applicative scenarios including actions virtually covering the entire city area or a city district, usually the objects of actions are buildings and open spaces relevant at a neighbourhood level. In applicative scenarios going from the neighbourhood scale to lower scales, the scale of activities tends to settle on the indoor scale because of the activities are frequently directly developed in specific physical spaces.

The scale of relevance for the exploration of geo-referenced contents by the end-users, intended mostly as the public not directly involved in the initiative, overlaps the scale of activities for the lower levels, from city district to indoors. On the contrary, at the upper levels, the scale of relevance is bigger than the scale of activities because of the influence of the perceived impact of the project compared to the single activities through which it develops.

Almost specularly, the scale for a significant aggregation of contents to represent a local action resulted to be the immediately lower level for the upper scales from the national to the city level. This evidence is related to the fact that regional or national initiatives can be decomposed in parts while keeping the complexity of their underlying processes. At lower scales going from the neighbourhood to indoor spaces, the intermediate level of the building scale resulted to be instead more frequently appropriate than the level of city blocks or indoors.

In relation to the spatial pattern of activities, the applicative scenarios had been clustered into three groups:

- projects with distributed activities, equivalent in term of their importance for map producers and end users
- projects based on distributed activities with a local concentration in a few local points to be considered predominant respect to other locations because hosting the operational headquarters of promoters or main stakeholders related to a specific action determining a sort of "gravitational areas"
- projects based on activities concentrated in a circumscribed and limited space, and distributed only within its physically related parts, often at the scales of building blocks, open spaces, buildings, indoors.

The spatial properties of the objects described by geo-referenced contents highlighted that intangible entity could be adequately represented by punctual visual signs (markers or equivalent), while to support a clear understanding of tangible entities such as squares, green spaces, buildings, or landmarks it is preferable to use areas-based representations.

7.5.6.c Communication constraints of a shared map in multi-stakeholder context

The comparative analysis moved than to examine the communication constraints deriving from the creation and use of a shared map in a public virtual space. The communication among all the interested parties is indeed one of the essential elements to foster coordinative or cooperative practices, but making public most the contents related to these practices can generate issues at the organisational level resulting in the non-use of the platform.
The principal characteristic of web-based platforms visualising geo-referenced user-generated contents on a shared public map is that the communication is always of the type many-to-many. In other terms, multiple contents providers can add new contents in the same area or integrate the existing point of interests by adding sub-elements to the contents produced by other users. Unlikely from a website or the walls of mass social networks, the result is not a private space where the communication is modelled as one-to-many, but a common virtual space where the visibility of contents and their open structure is intended to support collaborative practices mediated by the platform in itself. At the same time, map-users can read different sources of information related to different projects, activities, organisations by exploring a specific area of interest and developing their own spatial decisions based on an integrated view of the context.

The main communication problem highlighted by the map-producers involved in the research is that their message can be altered in its perception from the other closed elements visualised on the same area or by the sub-contents added to their original ones. Indeed, the map can suggest indirect relationships among contents (especially among people or activities) displayed on the map. This side effect of the map as amplified of the reality could be an unwanted and uncontrollable outcome from the perspective of map-producers. For map-users, the overlapping of contents related to different topics, with different level of reliability and relevance, can make more difficult to use the platform effectively.

This communication problem is related to the misalignment between the communication patterns allowed by a map-based platform open to multiple contributors, always many-to-many, and the preferred communication patterns in part of the initiatives based on one-to-many, one-to-one, and many-to-one information exchanges.

Analysing the ordinary communicative register of the leading actors and other stakeholders involved in most of the applicative scenarios, the more critical misalignments between formal and informal frameworks emerges in local actions where the promoter was a public administration, but the use of the platform was intended for other parties usually communicating informally with their publics and end-users. Indeed, the formal style of communication often reflects a vertical organisational structure where the external transfer of information is mediated by authorisation protocols and exclusive appointments of one or more members of the staff sharing specific contents on behalf of their institutions. These organisational rules limit the possibility for public officers or their staff to actively became map-producers on a platform having horizontal governance such as a CSN aimed at collecting multiple perspectives about on-going activities and projects. These constraints are mainly due to the fact that the responsibility for the information shared by a public administration always fall on the organisation and not on the individual users affiliated with the organisation. This setting impacts also on the potential adoption of the platform by the other groups involved in a project because the online engagement is conditioned by the possibility to activate a dialogue with the other interested parties. If one of these parties is the public administration, this become more difficult through a public platform, even if partially counter-intuitive.

An interesting applicative scenario illustrating this point was the N. 11. In that case, the regional administration led the platform-based initiative, but the tool was intended for independent use by the institutions, professionals and groups working in the cultural and touristic sector keeping an independent relationship with their peers and with the regional administration. The Regional administration shared information following a formal style (exemplified by the map contents showing the results of a survey on museums and cultural associations), but this did not affect the possibility for other stakeholders to use the platform as an operational tool in the framework of horizontal and informal relationship between contents providers and map users. Specularly, in the applicative scenario N. 33, the public debate was organised by a semi-public cultural institution following an informal style for their regular communications. However, the relevance of urban transformation to be discussed in this specific initiative impacted on the degree of formality of contents to be made public and on the general level of contributions.

In the other case studies characterised by an informal communication style adopted by both promoters and involved stakeholders, the potential use of the platform relies predominantly on individual contributions of users participating in the initiatives. Their affiliation with one or more specific groups or organisations is a qualifying element of their communication less than their specific perspective on activities directly managed, lived and documented. Despite heterogeneous competences, knowledge, experiences, points of views, a more flexible organisation of non-institutional groups can facilitate the exchange of information in an inter-organisational setting through a CSN. The key element emerged from the participants in the study is that, in these cases, the individual user is responsible and accountable for the production and sharing of public contents. Therefore, individual content providers can collaborate in producing a map representing their initiative in a plural environment and their interpretations by the map users is focused both on the contents and their authors, but not necessarily on the organisations they belong.

The relation between map-producers and map-users had been analysed under the light of the priority over the control of information shared on the platform. The results are three kinds of patterns having different needs as regarding content moderation requirements, authorship and ownership of data, interaction with map-users not involved in the project such as the general public or indirect stakeholders.

High priority over the control of information is related to institutional initiatives where the access to information is critical in itself, because of the role of intermediation assumed by the leading actor between the partners in the initiative and the general public. Indeed, providing institutional contents on an open platform challenges the relation between local administration and end-users because providing public information is the infrastructure of this relation and the cornerstone of the identity and mission of local authorities. Thus, the moderation of contents (both directly authored or not, belonging to the project, or only visible in association with the project area of interests) is perceived by institutional actors as an essential requirement to prevent accountability issues, reputational risks, misrepresentation of activities and missions. However, this requirement is conflicting with the horizontal governance of a CSN, possibly resulting in a low engagement of public officers in this kind of tools.

Medium priority over the control of contents displayed on the map is mostly associated to the protection of indirect parties involved in the projects, such as vulnerable groups, children and their families, residents. In these cases, sharing public information about on-going activities is part of the functions of the leading actors, but it is not part of their identity and role. Thus, the moderation options expected and requested are focused only on contents belonging to the project the promoters are responsible for, but not on the other contents displayed in the same area. Therefore, moderation options are not oriented to control the relationship with the end-users internal or external to the initiative, but to maintain the integrity of the project under the promoter's responsibility.

Low priority over the control of information had been observed in the initiatives where the moderation needs are limited to prevent inappropriate behaviours of other platform users, such as the publication of offensive contents. The responsibility of moderation is shared by the community of users instead than by a specific user. The risk that unwanted contents directly associated with the initiative (or indirectly related because visualised in the same area) can negatively impact on the project activities is relatively low.

The priority over the control of information is strictly related to the potential coexistence of multiple overlapping maps in the same area, and to the need to physically separate the contents of a specific project to the ones of other initiatives, while in the same area and the same period. Indeed, the last factor explored in the comparative analysis of the applicative scenarios was the relation between the extraordinary activities (such as a project or one-time initiatives) and other ordinary activities in the area of interest. Initiatives oriented to support ordinary activities through platform-based services benefit from the overlapping of a plurality of contents associated to the same geographical units where the activities related to the project take place. In these cases, the additional contents can help in reinforcing social networks by visualising connections, thematic and spatial proximity within a local community. Short projects oriented to introduce new temporary functions and extraordinary activities in an area are correlated to the frequent request of separating the contents related to the initiative from others associated to the same area. The motivation is to facilitate end-users in the retrieval of the needed information, even if maintaining the relations with other on-going activities in the same context could be useful to contextualise a new project. When the project activities partially overlap the ordinary functions of one or more stakeholders, the desired approach should be oriented to divide contents related to ordinary and extraordinary activities building different maps with a part of transversal contents repeated in each aggregation (by geographical units or topics).

7.5.6.d Practical Implications and Recommendations

On the basis of the insights, heuristics and emerging patterns provided by the comparative analysis of the applicative scenarios, it is possible to formulate some recommendations for the integration of a map-based platform (having a civic orientation and conceptually modelled as a City Mirror) in local actions.

1. Collective actions and uses of a map-based platform

The analysis covered the study of a map-based web application under the point of view of the pragmatic of the map, the syntax of the displayed contents across multiple scales, and the semantic associated to geo-referenced user-generated contents. As regarding the applications of a map-based platform as operational tool in local development actions, the pragmatic of the digital map resulted to be at the intersection between:

- The **knowledge of the context** by map-producers and map-users
- The **integration point** of the platform in the flow of online and offline actions.

The users' knowledge of the initiative context (pre-existing at the use of the platform) is the main factor impacting on the type of interactions with the map and with user-generated contents. The patterns observed in the applicative scenarios are mainly corresponding to the following two:

- **Low contextual knowledge leads to an intense use of the map for discovering and exploring the area, but to a low engagement in the active production of new contents.**
- **High contextual knowledge leads to a marginal use of the map to access to the information, but to a more intense engagement in filtering, integrating, or producing contents in a "familiar" environment.**

The uses of the map as amplifier of the reality or as a support to the spatial navigation is associated mainly with the first pattern, while the use of map as background or as filter with the second one. The active contribution of users in producing new contents had been observed in the case in which they were integrated in the documentation process of the initiatives or in sharing and integrating existing information with some updates. The interesting element of this observation is the conflict between the use of map as spatial descriptor that inhibits or does not motive users to actively contribute in enriching the platform information, and the use of geo-referenced contents as a form of "spatially organised" communication, but not necessarily requiring a direct interaction with the map. Therefore, the spatiality is assimilated just to a property of the contents and not to a constitutive element in the exchange of information among users.

According to the two patterns, the coordination and cooperation practices enabled, supported or mediated by a city-mirror-like map-based platform change drastically. Indeed, a high contextual knowledge is related to the existence of an explicit common ground among all stakeholders involved in a certain action. This common ground could be represented by a theme covering their activities or specific project goals to achieve or a long-term partnership. On the contrary, a low contextual knowledge is associated with the cases in which the involved stakeholders have no direct or pre-existing relationships and also the activities carried out within a specific initiative are short term and not completely defined for external actors.

In the first case, the practices supported by the platform are developed according to roles and objectives clear to the participants and organised toward an effective coordination, diminishing the overall workload. In the second case, the uncertainty of roles and tasks lead to a "reactive" use of the platform for coordinating independent players or individual decisions, but at the same time this more frequently ends in the non-use of the platform. This is also confirmed by the principle of coordinative and cooperative artefacts as "normative constructs" [Schimdt 2000], that can enable the action only in presence of clear rules and roles for the implementation of actions.

The implications of these notes for practitioners and researchers approaching the selection or design of map-based platforms are twofold. The choice of the platform to adopt must be related to a preliminary assessment of the knowledge of the context by the intended users and the corresponding "weight" of the interactions with the map and with the contents provided by a specific application. The recommendation is to privilege platforms allowing multiple modality to access and integrate the contents especially in the initiatives involving a defined and stable group of stakeholders, aware of the competencies and tasks of other stakeholders, and engaged in medium- and long-term processes. In alternative, if an initiative or project envisages a short or discontinuous participation in the activities by an aggregation of not-defined stakeholders, it could be preferable to adopt platform having a map as main interface and content aggregator.

The second set of recommendations concerns the visualisation style of the map and the level of detail of the displayed contents in relation to the applicative scenarios. The practices in which the map mirrors the physical context where the stakeholders are acting could be better supported by a realistic visualisation of spatial objects. For instance, in a project aimed to the rehabilitation of an old building or to the organisation of specific activities in a green area. In these cases, the use of satellite images, pictures, and possibly 3Dmodels could facilitate an easier understanding of the context of actions. Indeed, in these cases, the standard visualisation focused on routing purposes, with a schematic representation of spatial objects and mobility infrastructures is less effective, as observed in basically all the applicative scenarios. On the other side, practices in which the map is used a conceptual tool for the spatial organisation of contents could benefit from an abstract representation of the space of actions, because the focus is on social interactions and intangible spatial entities. Thus, details about infrastructures or elements of the built environment are irrelevant, but also distracting and increasing the effort of users in discriminating the relevance of the visual inputs provided by the map-based platform.

As listed above, the other element shaping the use of a map-based platform in coordination and cooperation practices is defined by its integration in the process to be supported, or in other words, by the causality between the access to geographic information and the consequent actions or decisions in the projects or processes to be implemented. The patterns emerging from the analysis of the applicative scenarios highlighted that:

- **Actions resulting from decisions about resource allocation or responding to a specific resource status (where resources include material and immaterial resources) are more likely connected to a functional use of the map and geo-referenced contents for self-organisations and coordination purposes**

- **Policy decisions rely only marginally on the use of the map and geo-referenced contents, disconnecting the potential adoption of the platform from the development of the local actions.**

It is important to note that an open map-based platform de facto extend the possibility to make resource status and allocation decisions to all the stakeholders involved in local development actions, regardless of their contributing role as content producers or users. On the contrary, policy decisions are often under the competence of the stakeholder promoting or leading the initiative only. The benefits coming from the use of the platform are prevalent and distributed among all parties in the first case, while the utility of the platform for the non-promoter subjects could obstacle its use in the cases following the second pattern.

The assessment of the needs to be addressed by the map production, the distribution of the benefits from that, and the definitions of the goals to achieve through the sharing of geographical information in a public virtual space are all critical points, especially in the cases of significant asymmetries of effort and benefits. On the contrary, the use of a map-based platform in urban projects and processes in which the access to geographical information support actions and decisions of all the stakeholders involved in the process allows to respond to a plurality of needs without extensive pre-assessment procedures. This could potentially help in increasing the utility of a digital tool to support offline actions as well, leading to an evolutive, plural, and open definition of goals and objectives in collective actions.

In these cases, it is essential a correct management of temporal properties for the geo-referenced contents, not as a “time category” or a fixed attribute of map objects as it is standard in most of map-based platforms, but as a dynamic relation between map and informative layers. The chronological order of contents or visibility choices set on static time interval could affect the retrieval of relevant information for the stakeholders interested to use them in their activities. In alternative, the recommendation is to opt for platform allowing the users to set the temporal parameters to select and access to the relevant contents in specific task.

2. Scale of actions, city practices and map-based representations

The recommendations related to the scale of action that could be extracted by the comparative analysis of the applicative scenarios are based on an essential principle: the external scale of the project, formally defined and independent from direct experiences and human interactions, is distinct from the internal scale of the project based on the perception of the impact of activities and their hierarchy.

Design choices for the visualisation of the internal scales of the projects (scale of activities, scale of relevance, and scale of significant aggregation of the contents on the map) should start from the identification of the spatial patterns of actions to be supported and the "weight" of each action within a process. The weight of each action, transposed by style choices for the visual signs on the map, is relevant to improve the understanding of the context of actions (especially as regarding social dynamics) and should be possibly controlled by the user through customisable parameters and setting options.

As regarding the external scale of the project, the goals should be to avoid a misleading representation of the context and to support real actions through a correct representation of on-going processes at the local level. These outcomes can be pursued by a diversified visualisation of background map and georeferenced contents at upper and lower scales, preferring a conceptual representation in the first case, especially if the objects of actions are intangible entities.

3. Map-mediated communications in multi-stakeholder collaboration practices

The recommendations about the support to map-mediated communications in multi-stakeholder context can be summarised as follows.

- Balancing the level of formality and informality in contents belonging to correlated maps or filtered views of contents. On one side, by reinforcing the relations among contents produced by the member of the same organisations to present them as a unit. On the other side, by working on the user model to make the production of contents compliant with the organisational protocols in terms of independence and authorisations.
- Working on the moderation options at the level of single contents and not as a general setting of the platform or the project because of the different level of information control required by different situations, needs, partnerships. This is also essential to make easier the creation of multi-perspectives maps.
- Facilitating the extraction and visualisation of independent map-based subsets of contents to be embedded in institutional portals, organisation or project websites, community pages in social network applications.
- Structuring the platform by integrating connected branches reserved to specific projects and initiatives including extra-ordinary activities compared to the activities ordinarily carried out in the related area of interest.

7.6 A CIVIC SOCIAL NETWORK AS A CITY MIRROR. PRELIMINARY ANSWERS TO THE RESEARCH QUESTIONS

RQ1: *What users' characteristics should be represented on a City Mirror for offering to the city stakeholders a better understanding of the social context in which they operate?*	The extensive engagement process conducted for this case study highlighted the importance of keeping a strict consistency between the roles covered by users within the social structures in which they operate and the roles played on the platform without introducing implicit **subordinated relationships among users, between individual users and collective entities, among collective entities.**
RQ2: *What factors should be considered for matching the specificity of the city context and the patters of local development actions with the unspecificity of the online environment defined by a City Mirror?*	In this case study, the balancing between specificity of the domains of actions of city stakeholders and the environment provided by the CSN relied on allowing a **clustering of actions and segments of users on the basis of the pursued goals in the city and through the platform**, but also in configuring the **platform as a toolbox** where the platform components could be aggregated and reconfigured to follow the patterns of a multitude of applicative scenarios.
RQ3: *What type of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a city mirror in comparison with other existing tools?*	FirstLife as a CSN proposed an operational model for **the reintegration of the different perspectives over the city and local development processes in terms of knowledge and goals, but also protocols and norms for actions.** This model is one of the preconditions for creating a common information space among different stakeholder and enable the potential coordination and cooperation over their actions in un unauthoritative way.
RQ4: *What types of social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?*	The operational context in which most of the research and experimentation has been conducted (the metropolitan area of Turin) allowed to understand how the combination of **social fragmentation** and extreme pervasiveness of **local government-related institutions** can impact on the response of other actors to the adoption of the platform.
RQ5: *What types of approaches could be applied in the design process for balancing the functional and non-functional requirements associated with the different perspectives and goals of city stakeholders?*	The approach designed and implemented along the evolution of the platform relied on multiple techniques of requirements elicitation and transfer into the platform design based on modulating the **weight and priority of the expressed desiderata against the type of on-going engagement, the uniqueness and deepness of the provided insights, the alignment between applicative scenarios and aims of the platform** (beyond its contingent scope).

RQ6: *What criteria should be considered for evaluating the correspondence between the platform functionalities and the expectations of the city stakeholders to be supported in their actions?*

The experimentation of the platform with a wide range of users segments showed the importance of assessing the correspondence between, on one side, **the responsibilities of single user over the interaction with the platform contents** (e.g. add, integration, editing, connection, sharing) **or in the relationship with other users mediated by the platform** (e.g. membership of a group or light-weighted cooperation), and on the other side the **impact and limitations potentially imposed on the choices of other users**, within or outside the platform. Another important factor to be considered in the assessment are the **risks associated to give visibility to local coalitions**, frequently associated with specific spatial patterns. Thirdly, the assessment requires to consider **competitive advantages and asymmetries of information** sometime structurally needed for the implementation of local development actions.

7.7 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 7 to the three outcome spaces outlined in Chapter 2, Section 2.7. Analogously to the previous chapters, the contributions of Chapter 7 are briefly described in the table below.

Table. 7.12 Mapping the chapter contributions with the outcome spaces of the TD framework

<table>
<tr><th>OUTCOME SPACES</th><th>TYPE OF CONTRIBUTION</th><th>CHAPTER 7</th></tr>
<tr><td rowspan="3">SYSTEM KNOWLEDGE</td><td>THEORETHICAL CONTRIBUTION</td><td></td></tr>
<tr><td>METHODOLOGICAL CONTRIBUTION</td><td>[SECTION 7.3] This chapter presents the methodological approach, strategies, and techniques used to metaphorically “get the city in the room” along the entire development process of a working prototype of a civic social network. In this sense, this experiment contributes to the current debate on extending the forms of participatory design for digital technologies in three ways:
highlighting the issues and discussing the solutions for managing still face-to-face large-scale participatory processes with users having various levels of digital literacy and openness to engagement
pointing out the obstacles related to the forms of participation when the transformation of social dynamics and local interests is at stake, beyond the implementation of a digital tool
proposing the potential hybridisation of methods and tools more common in urban disciplines and policy-making with the ones usually preferred in technology design in order to address the challenges of the city context in which the use of technology is affected by organisational, sectoral, and city-specific constraints. In particular, the novelty of this hybridisation is linked to the fact that is not associated with the design of tools supporting urban planning practices (as in other related works), but oriented to deal with city processes and the integration of digital technologies.
By presenting this methodological approach, this chapter also provides an example of a complex participatory design process successfully implemented within an Agile framework, detailing the practical arrangements to coordinate development and engagement activities. Lastly, this chapter introduces and clarifies the “Serial Action Research” method, intended as the application of action research principles and techniques with multiple groups in parallel and in sequence along the research process, instrumentally used as a requirement elicitation and scenario building strategy.</td></tr>
<tr><td>EMPIRICAL CONTRIBUTION</td><td>[SECTION 7.5] The main empirical contribution of this chapter is the presentation, analysis and discussion of 60 applicative scenarios of a civic social network in social innovation processes in the city context. The value of this scenarios relies on their development in collaboration with different segment of city stakeholders starting from the identification of urgent needs not currently supported by other web-based technologies, continuing with the specification of the requirements for appropriate technologies, and in most of the case experimenting the prototype in real-world settings.</td></tr>
</table>

TARGET KNOWLEDGE	FOR RESEARCHERS	
	FOR TECHNOLOGY DESIGNERS	[SECTION 7.4] The practical contribution of this chapter is the **analysis and discussion of several interactional patterns associated with specific design choices implemented or not at the subsequent releases of the prototype**. The analysis focused on the interaction with a map-based interface connected to a timeline for the dynamic visualisation of geo-referenced and temporalised contents. Other key topics concerned: the direct and indirect interaction with multimedia contents subjected to collective creation, integration, extension, editing; the relation between the affordances of specific solutions for the users account and their approach to content creation; the issues due to potentially wrong inferences due to competing inputs provided by the map and the shared contents.
	FOR URBAN PRACTICTIONERS	[SECTION 7.5] The numerous applicative scenarios reported in Section 7.5 shade light on the **limits and potentialities of web-based techs in everyday activities related to various services and domains of urban operations**, but also on various temporary uses of city spaces. They constitute a starting point to help urban practitioners (planners, facilitators, mediators, policy makers, consultants) **extending the range of their operations and community development projects potentially supported by new digital tools.**
	FOR CITY STAKEHOLDERS	[SECTION 7.5] This chapter provides an overview of several needs and activities currently not supported by existing technologies, and it highlights potential **benefits coming from technologies built on cross-domain shared operational needs**.
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNWOLEDGE	USERS	[SECTION 7.2] The **platform users had been framed in this case study as agents of change in the city**, actively and directly operating to provide or improve or innovate essential local services impacting on the economic and social development of the city. These users, belonging to groups, organisations, communities and networks, operate independently or in cooperation with public authorities that are not considered as the only subject able to implement changes in the functioning of the city. **Users' actions online and offline are assumed as always having a political connotation**, intended not as forms of participation to the ritual of politics and democracy, but as **individual contribution to the construction of the city as political and social entity**, shaped by collective values, actions having a collective relevance, and collective social dynamics. **Transformation paths** in the design of technologies for cities could benefit from appropriately **consider, frame and support the political driver and goals of individual and collective actions**.
	CITY	[SECTION 7.2, 7.4] This case study not only focused on the city primarily as a socio-political entity, but also highlighted the **malleability of the definition of the city in its material and institutional reality reconfigured by concurrent and competing representations of actions, places, local actors**. Indeed, on one side the study insisted on the civic perspective on the city intended as the dimension of all the actions in the public domain, and on the other side this perspective opened the field of investigation to a plurality of structures, practices, and discourses around local activities and processes. These activities and processes are usually left outside of the main concerns of urban technologies and their focus on the physical environment of cities, preventing structural changes in the governance models of the city functioning. **Transformation paths** in the design of technologies for cities could instead originating from the **effort to render and harmonise concurrent representations of the city.**

	TECHNOLOGY	[SECTION 7.2, 7.5] The prototype of a civic social network allowed to explore the **issues, limitations, and forms of appropriate support for the coordination (and in some cases cooperation) of heterogenous segments of users in a variety of domains, taking into account the norms regulating social relationships at a formal and informal level.** Indeed, the developing process pointed out how the management of online contents and the kind of online interactions can deeply affect even the possibility to carried out collective activities based on horizontal relationships and multiple level of understanding and value attributed to the same operation by distinct subject. **Transformation paths** in the design of city technologies intended to support social innovation processes could prioritise the **mitigation and review of online social interactions inconsistent with the nature, type, and forms of social interactions in multi-stakeholder environments**.

PUBLICATIONS

The following publications include part of the contents or some concepts presented in Chapter 7 (while in a preliminary form) or are related to this case study.

- Lupi L., (2019) ***Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development***, IASDR 2019, Manchester, United Kingdom. *[Conference paper, Design]*

- *Antonini A., Boella G., Buccoliero S., Grassi E., Lupi L., Schifanella C., (2018). ***WiP: Personalizing Focus Area in Map-Based Applications***, 2018 IEEE International Conference on Smart Computing – SMARTCOMP, Palermo, Italy. *[Conference paper, Informatics]*

- Lupi L., (2018). ***Rethinking digital maps as collaborative tools: An empirical study on how a map-based platform can be integrated in multi-scale and multi-stakeholder urban actions***. 12th AESOP Young Academics Conference: Navigating Change, Groningen, Netherlands. *[Conference paper, Urban planning]*

- Lupi L., (2018). ***Mirroring the City. Toward Web-Based Technologies to Support City Stakeholders in Local Development Actions***, Swiss Inter- and Transdisciplinarity Day 2018 – Inter- and Transdisciplinarity in a Digital World, Lausanne (CH). *[Poster and Extended abstract]*

- Lupi L., (2017). ***Co-design of use patterns to rethink offline activities through civic technologies***, Workshop "Creative and inventive methods in CSCW research", 15th European Conference on Computer-Supported Cooperative Work, Sheffield (UK), 2017. *[Workshop paper, CSCW]*

- Antonini A., Lupi L., Boella G., Schifanella C., (2017). ***Time and timing in the city: how to represent dynamic urban entities on a map-based platform*.** 15th International Conference on Computers in Urban Planning and Urban Management CUPUM 2017, Adelaide, Australia. *[Conference paper, Urban informatics]*

- *Antonini, A., Boella G., Buccoliero S., Lupi L., Schifanella C., (2017). ***Foundations of map-based applications***, 12th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications, Porto, Portugal – ISBN: 978-989-758-229-5 *[Conference paper, HCI]*

- *Antonini A., Boella G., Buccoliero S., Lupi L., Schifanella C., (2017). ***Topology-aware indexing system for Urban Knowledge*.** 2017, IEEE Technically Sponsored Computing Conference 2017, London, United Kingdom. *[Conference paper, IS]*

- Lupi L., Calafiore C., Antonini A., Buccoliero S., Sanasi L., Schifanella C., Boella G., (2017). ***FirstLife. A geo-social network to support participation in urban design***. *Modern Methods and Tools for Public Participation in Urban Planning* 2017, Poznań (PO). *[Extended abstract, Urban Planning]*

- Lupi L., Antonini A., Boella G. (2017). ***Urban commoning in a civic social network: the case study of FirstLife***, 2nd International Conference SSPCR 2017 – Smart and Sustainable Planning for Cities and Regions, Bolzano (IT). *Extended abstract, Urban Planning]*

- Calafiore A., Lupi L., Antonini A., Boella G., Salaroglio C., Sanasi L., Schifanella C. (2016). ***FirstLife, a Social Network for Collaboration and Co-production of Services.*** 2nd CINI annual conference on ICT for Smart Cities and Communities, Benevento (IT). *Extended abstract, Urban Informatics]*

- Antonini A., Lupi L., Boella G., Buccoliero S., Schifanella C., (2016). ***Collaborative Multi-Perspective Urban Knowledge and Civic Media: A Never-Ending Design Challenge***, The Sixth International Conference on Advanced Collaborative Networks, Systems and Applications, COLLA2016, Barcellona, Spain – ISBN: 978-1-61208-517-3 *[Conference paper, CSCW]*

- Lupi L., Antonini A., Boella G., Schifanella C., Sanasi L., (2016). ***Back to public: rethinking the public dimension of institutional and private initiatives on an urban data platform***. 2016 IEEE International Smart Cities Conference – IEEE ISC2, Trento, Italy. *[Conference paper, Urban Informatics]*

- Lupi L., Antonini A., Boella G., Mason E., (2016) ***Real society in virtual space: a platform to share responsibilities in urban regeneration processes***, in G. Colombo, P. Lombardi, G. Mondini (edited by), 9th International Conference on Innovation in Urban and Regional Planning INPUT 2016, Conference Proceedings Book "e-agorà/e-ἀγορά for the transition toward resilient communities", Turin, Italy. *[Conference paper, Urban studies]*

- *Antonini A., Boella G., Lupi L., Schifanella C., (2016). ***Civic social network: a challenge for the co-production of contents about common urban entities***, in Yoshino, T., Chen, G.-D., Zurita, G., Yuizono, T., Inoue, T., Baloian, N. (Edited by) Collaboration Technologies and Social Computing, Proceedings of the 8th International Conference, CollabTech 2016, Kanazawa, Japan, Springer, 2016. – ISBN: 978-981-10-2618. *[Conference paper published as a book chapter, CSCW]*

*authors in alphabetic order, not by contribution.

Two more papers prepared to report on the overall research process and outputs related to FirstLife remained unpublished. The final drafts of these papers can be provided on request.

- Lupi L., Antonini A., Boella G., Schifanella C., (2016). ***A civic social network as urban collaborative platform: the case study of FirstLife***. - *[Conference paper, CSCW]*

- Antonini A., Lupi L., Boella G. (2016). ***Building a map-based social network for crowd-sourced urban data: the case study of FirstLife****. - [Journal paper, HCI].*

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CHAPTER 8.

ASSEMBLING A COOPERATIVE URBAN GOVERNANCE PLATFORM

CHAPTER 8. OVERVIEW

Chapter 8 reports on the process of **assembling an urban governance platform**, WeGovNow. The WeGovNow platform constitutes a second example of *"City-Mirror-in-the-making"*, intended to address the needs of multiple stakeholders, their different purposes and actions at different scales and in various domains of local development actions.

In this case study, e-government tools had been restructured into instruments **fostering the cooperation among city stakeholders in urban transformations**. This case study provided the opportunity of investigating social, operational and technological constraints of a **multi-component platform** in which different technologies must be harmonised into a coherent virtual environment adaptable to multiple services. The coherence challenge was set by the different framing of users, cities across and technologies across different components of the platform.

Chapter 8 has the same structure of Chapters 7 and 9 reporting on the other two case studies. It is organised into seven sections, as follows.

- Section 8.1 recapitulates the **essential characteristics of the WeGovNow project** considered for the research design and the construction of this case study.
- Section 8.2 frames the **WeGovernment paradigm** in relation to smart governance and cooperative governance models, by looking at the City Mirror proposal as a potential enabler of technology-mediated cooperative urban governance models.
- Section 8.3 explains the **structure and implementation of the design and research process** associated with the case study.
- Section 8.4 describes the **applicative scenarios of the WeGovNow platform** (co-designed with the city stakeholders involved in the project) and their analysis finalised at extracting requirements and expectations to inform the design of the platform and the related services.
- Section 8.5 reports on the decomposing/recomposing/transforming activities aimed to **restructure the platform components in we-gov tools** acting in a synergic way to support the urban processes and services outlined in the applicative scenarios.
- Section 8.6 formulates the preliminary answers to the **research questions** (stated in Chapters 3 and 4) based on the design and research process of the WeGovNow platform.
- Section 8.7 summarises the **chapter contributions**, according to the outcome spaces of transdisciplinary research.

Connection with previous chapters. The case study of WeGovNow incorporates part of the lessons learned from the first case study (Chapter 7) and moves the research focus from understanding the context of actions to understanding processes and services happening in the common space of the city and the platform. The core models described in Chapter 5 oriented and informed the analysis of the case study, developed according to the research methods and techniques introduced in Chapter 6.

Connection with following chapters. The research activities associated with this case study allowed to refine and identify several core concepts impacting on the representation of the functional and social systems of the city, furtherly elaborated in Chapter 10. The evaluation process of the WeGovNow platform deeply informed the elaboration of the assessment framework reported in Chapter 11.

CHAPTER 8. DETAILED TABLE OF CONTENTS

8.4.3 Co-Design of Public Administration-Driven Projects

8.4.3.a From the field
8.4.3.b Outputs of the service co-design
Phase 1: Call for participation
Phase 2: Co-design activities (online and offline)
Phase 3: Discussion and selection of proposals
Phase 4: Call for contributions & call for tender
Phase 5. Follow up of the project

8.4.4 Co-Management of Public Spaces, Urban Commons and Shared Resources

8.4.4.a From the field
8.4.4.b Outputs of the service co-design
Phase 1: Identification of urban commons
Phase 2: Development of civic proposals and agreements for their management
Phase 3: Co-management of spaces, monitoring and reporting.

8.4.5 Co-Organisation of Private Initiatives Facilitated by the Public Administration

8.4.5.a From the field
8.4.5.b Outputs of the service co-design
Phase 1: Collaborative building of the business/managing model
Phase 2: Local network activation
Phase 3: Inter-organizational coordination
Phase 4: Network consolidation and growing
Phase 5: Periodical calls for ideas/projects

8.4.6 Co-Production of Services Between Public and Private Sector

8.4.6.a From the field
8.4.6.b Outputs of the service co-design
Phase 1: Assessment of the existing provision of local services
Phase 2: Needs assessment
Phase 3: Aggregation of complementary offers
Phase 4: Definition of new targets and services
Phase 5: Co-production of services

8.1 SYNOPSIS OF THE CASE STUDY

The case study about assembling an urban cooperative governance platform presented in this chapter is associated with the WeGovNow project. As introduced in Chapter 6, section 6.5, WeGovNow was a European Project funded by the Horizon 2020 Research&Innovation programme. The project started in February 2016 and ended in January 2019. WeGovNow involved 13 partners from the UK, Germany, Sweden, Greece, and Italy. The trial sites were Turin (IT), San Donà di Piave (IT) and the borough of Southwark in London (UK). The main goal of the project was to develop a platform aimed at leading the **transition from e-government to we-government models by integrating seven consolidated technologies for citizens reporting, digital participation, shared planning and co-production activities, and open data analysis** (from now defined as platform components) [Tsampoulatidis et al. 2018].

The framing of the WeGovNow project as a case study of *"City-Mirror-in-the-making"* is outlined in the schema below [Fig. 8.1], summarising how different aspects of the project had been considered in the research design in relation to the overall multi-case study strategy, as described in Chapter 6, section 6.3.

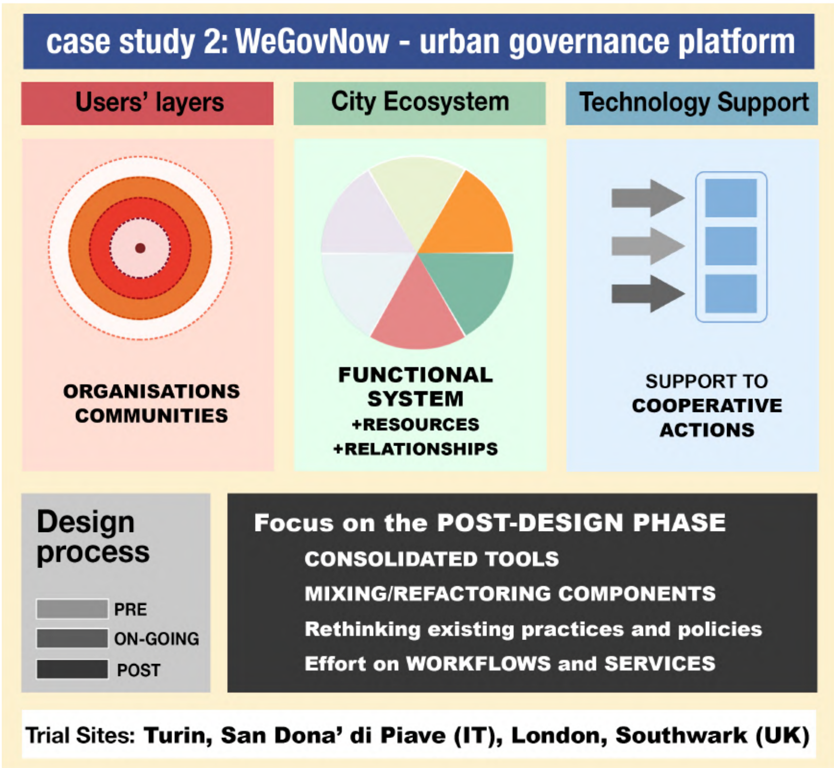

Fig. 8.1 Synopsis case study 2

This second case study provided the opportunity of investigating:

- representation, roles and actions of **organisations and communities**, as two of the most relevant users' layer in this specific application (reasons explained in the next section)
- interconnections and interdependences in a set of **functional clusters of city activities** under the perspective of institutional constraints of public and private sectors
- the role of technology and **technology-based services to support cooperative actions** for restructuring urban governance models
- strategies and protocols to **connect design and evaluation of technologies to city processes.**

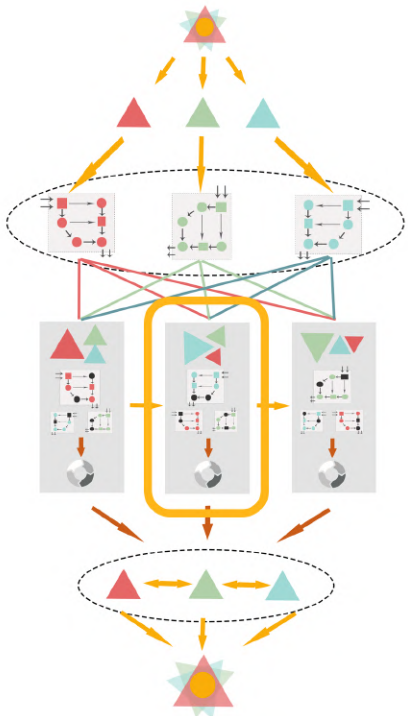

Fig. 8.2 Mapping of the second case study in the TIDS protocol

Within the TIDS research protocol, this second case study is an alternative instantiation of the core models of the User, City and Role of technology (see Fig. 8.2). Instantiating the core models into digital artefacts is a way of extending knowledge and understanding on the problem of connecting technologies and local development actions by supporting city stakeholders in their activities and relationships.

8.2 WE-GOVERNMENT AND CITY MIRRORS

In this section, I am going to provide some background elements to contextualise this case study in relation to the we-government paradigm and the research on smart and/or cooperative urban governance models[1].

In the previous case study, I examined the civic dimension of actions into the public domain and how technologies can enable new models of social innovation in the city. I also experimented and analysed how supporting those relationships and processes explicitly going beyond the interactions between citizens and public authorities that often limit the scope of civic technologies. The focus of the previous case study was mainly on informal actions, bottom-up initiatives, projects and programmes in the fluid space of local practices for urban regeneration, social services, cultural projects, and self-organised collective activities.

In this second case study, I move my attention on **actions that require to be negotiated and jointly implemented by public authorities and other stakeholders operating in the city**. The focus of this case study is on the **innovation of the city governance toward more cooperative models**, and how web-based technologies could potentially support this progressive change.

[1] Among the disciplines considered as roots for this study, the topics of collaborative and/or smart governance are mainly addressed in the fields of Urban Studies and Information Systems, respectively with a focus on institutions or technologies. In both cases, political sciences provide essential references, theoretical support and integrative concepts for the analysis. See also Note 2.

8.2.1 THE WE-GOVERNMENT PARADIGM

The expression **"We-government"**[2] identifies a paradigm foreseeing a transition from a governmental engagement model framing citizen in the role of customers of public services toward new collaborative forms of shared management of collective services between governments and citizens [Linders 2011]. From a technological perspective, the We-government paradigm is aimed at overcoming the limits of e-government solutions (see also Chapter 4, section 4.3) by **exploiting the potentialities of web-based technologies to enhance collective actions for the social good**.

The theoretical framework of the We-government developed by Linders explicitly relies on pre-existing studies about collaborative government [McGuire 2006, Wanna 2008], open government [Lathrop & Ruma 2010, Harrison et al. 2012], wiki government [Noveck 2009, Nam 2010] and government-as-a platform [O'Reilly, 2010]. The novelty of the We-government paradigm is in its comprehensive classification of government-citizens relationships and co-production practices mediated by web-based technologies [Linders 2012].

Since mid '80s, the idea of **citizens as active co-producers of public services** emerged by considering them as partners in the production and delivery of services, and not only as "tax-payers" [Mattson 1986]. This perspective evolved later towards a more systemic framework, as proposed by Castells in his conceptualisation of the *"Networked State"*. The key element of that envisioned societal transformation was identified in the multiplication of the types of relationships between government and citizens, characterised by variable configurations of shared powers and responsibilities in their collective actions into the public sphere [Castells 2001]. However, **this vision remained suspended** and without applications.

In parallel, the idea of public administration and governments operating as companies for "citizens-customers" became predominant in most of the countries in the world. Principles and practices associated with this idea are aggregated under the label of *"New Public Management"* [Gruening 2001, McLaughlin et al. 2002]. That idea significantly contributed to establishing the core values promoted and supported by **e-government technologies** [Persson & GoldKuhl 2010]. Indeed, the main goal of these technologies remained **to improve the efficiency of public services according to business-like parameters**. However, **rigidity, proceduralism, bureaucratisation, distance from the users' needs and expectations** determined a very limited success of e-gov solutions for decades [King 2007].

Recently, the combination of emerging **web-based technologies and social movements** (asking for more extended, in-depth and inclusive engagement processes into the public sphere) contributed to a **renewed interest in possible forms of cooperation between governments and civil society** [Horne & Shirley 2009] supported by new forms of "digital governance" [Dunleavy et al. 2006].

In this new setting, Web 2.0 technologies started to play the role of game-changer in empowering individuals and social structures [Amichai-Hamburger et al. 2008], enabling distributed forms of inter-organisational and inter-sectoral collaboration at a larger scale [Benkler 2006], and impacting on the planning, implementation and management of public functions within governmental institutions [Bertot et al. 2010]. Indeed, web-based platforms allow to potentially overcome the two obstacles toward a generalised co-production of services: the **coordination of distributed actions** on the government side and the **self-organisation of local actions** on the side of civil society. However, as discussed in Chapters 3, 4

[2] The we-government paradigm had been defined within the sub-domain of Public Administration studies and Political Sciences focused on the analysis of roles and impacts of Information and Communication technologies over the management of public services.

and 5, the gap between the **hypothetical exploitation of Web 2.0 potentialities and its real-world applications is bounded to the social acceptability** of (making visible) fluid hierarchies, powers relationships, uncertain responsibilities within platforms oriented to support co-production practices.

Against this background, the value of the **We-Government paradigm** is acknowledging that the **relationships between citizens and government goes beyond the traditional vertical interactions** (citizens providing inputs and government providing services) to include new forms of horizontal public sector-civil society partnerships and self-governance [Linders 2011]. Still, the actual implementation of a we-government paradigm is challenged by:

1) the need of rethinking contents, materials and channels of **communication** among *"people who share common private interest(s) in a public good"* to support the coordination, integration and synchronisation of their contributions into collective actions [Flanangin et al. 2006]

2) the demand for **sharing public responsibilities** and **reframing the concept of accountability** of governments and civil society under a new social contract [Benkler 2006, Linders 2011]

3) the imperative of relying on an idea of **legitimacy** of actions into the public sphere that must go beyond the conventional schemas of input and output legitimacy, respectively defined as *"government by the people"* (i.e. following people decisions expressed through votes) and *"government for the people"* (i.e. operating in the supposed public interest) [Scharpf 1999, Schmidt 2013].

This last point is particularly important to understand the role that web-based technologies are called to cover for potentially enabling we-government processes. Indeed, **e-government technologies are instrumental in supporting input and output legitimacy**, respectively based on using technology for consulting citizens or providing evidence to them of the efficiency and high-performances in the delivery of public services [Chatwick and May 2003]. On the contrary, **we-government technologies should work on establishing and supporting a *"throughput legitimacy"***, also corresponding to the expression *"governing with people"* [Scharpf 1999, Schmidt 2013].

The throughput legitimacy is defined as a form of legitimacy relying on: a) the **quality of the engagement process to set up collective actions**[3]**;** and b) the **transparency of the rules and procedures in the decisions making and implementation of these actions** [Bekkers & Edwards 2007, Schmidt 2013]. This new legitimacy schema extends the domain of technology from supporting governments to supporting democratic, open and cooperative[4] forms of governance [Fromkin 2003]. Under this perspective, **government is just one of the many actors interacting into the public sphere** (and on digital platforms serving these new forms of governance) [Chatwick & May 2003].

[3] The quality of the engagement process is here intended in terms of concrete, productive shared actions (not only formal consultations), that in the scale of participation of Arnstein would correspond to partnership and delegated power [Arnstein 1969].
[4] The term "cooperative" is intended as composition of autonomous interdependent efforts toward an objective of collective relevance. Fromkin use the term "collaboration" to indicate the same concept, but I preferred to keep using the term cooperation, consistently with the meaning attributed to it in this work.

8.2.2 WE-GOVERNMENT PARADIGM, SMART GOVERNANCE, AND COOPERATIVE URBAN GOVERNANCE

Narrowing the view from the national level to the scale of cities, the topic of the "we-governance" become blurred. Moving from the State to local governments, alternative governance models should be confronted with the contingencies of urban governance, but also the influence of current smart city visions.

The idea of open governance mechanisms in the city context enabled by the availability of new technologies had been elaborated by several scholars in the concept of ***"smart governance"***, defined by Chourabi et al. [2012] as one of the six key dimensions of smartness. Nevertheless, smart governance is also the less explored aspects of the smartness [Bolivar 2015]. In addition, the expression "smart governance" is very frequently used simply as a more fashionable synonym for e-government [see e.g. Nam & Pardo 2011, Lombardi et al. 2012, Scholl & Scholl 2014].

A recent literature review on smart city governance [Meijer & Bolivar 2016] confirmed that the topic of the governance of smart cities is in some way completely disconnected from the use of technology in itself, and mostly associated with the relationships among city stakeholders in smart city initiatives. On the other side, the use of technology is strictly limited to involving citizens in a *"smart decision-making"* or trying to create a *"smart administration"* [Meijer & Bolivar 2016]. Another literature review on smart governance, including also some works close to the we-government paradigm, underlined the potential value of collaborative decision-making processes grounded on *"evidences from data"* [Pereira et al. 2018]. Indeed, in that work, the focus on the collaboration of citizens, *"primarily citizens"*[5], is strictly framed as a collaboration in the definition of public policies (according to the strict formal definition of *"collaborative governance"* [Ansell & Gash 2008]) and not in the implementation of decisions, co-production of services and self-organisation of city stakeholders. Thus, the very concept of **smart governance is trapped in between input and output legitimacy mechanisms**. In other words, it remains centred on a local government still supposed as the main actor of the city social ecosystem. Under this kind of visions, digital technologies continue to be instrumental in collecting and providing inputs and outputs, but not in supporting multi-stakeholder collective actions (that can be independent from the agenda of the local government).

Differently from smart governance literature, numerous convergences between **we-government** and cooperative multi-stakeholder governance mechanisms can be identified in studies addressing the challenges of **urban governance.** Indeed, cities are contexts continuously changing because of technological innovations, but mostly because of social, cultural and economic transformations forcing to rethink the way cities are managed and developed. In particular, institutionalist approaches[6] in urban research have deeply explored how innovative practices appear and sometimes become consolidated in cities because of new types and forms of relationships among city stakeholders are transformed in new shared norms [Healey et al. 2000]. In particular, **Healey refers to governance as the term *"used to encompass all forms of collective action focused on the public realm"*, and she indicates a path for a governance transformation moving from *"episodes"* to *"processes"*, and then to *"cultures"* to rethinking mutual relationships, responsibilities, and actions of city stakeholders into the public arena** [Healey 2006]. In this sense, the central form of legitimacy examined and targeted in **innovative urban governance** processes is exactly the **throughput legitimacy** (that is also the core of the We-government paradigm).

[5] Chapter 3 extensively explains the limitations of the focus on citizens in understanding city dynamics.
[6] Institutional approaches in urban research are the approaches based on studying urban dynamics in relation to city institutions, where institutions are the norms, rules and practices regulating our existence in cities. See, for instance, Healey 2006.

At a general level, the throughput legitimacy of multi-stakeholder governance process can be classified as "*institutional*" or *"constructive"*. While an institutional throughput legitimacy points toward pluralistic processes aimed at reaching consensus, **constructive throughput legitimacy is more radically based on the active negotiation of interests, goals, and procedures** [Schmidt 2013]. The constructive and negotiated form of throughput legitimacy is the dominant of urban governance processes, but also the only form than realistically can enable local stakeholders to coexist in the same space and deal with the complexity of city dynamics [Häikiö 2007, Connelly 2011, Eshuis & Edwards 2013]. **Fluid governance mechanisms are demonstrated as particularly important at a community level and neighbourhood scale** [Lowndes & Sullivan 2008, Leighninger 2008, Connelly 2011], **where they still remain anchored to organisational arrangements and not to individual initiatives of citizens** [Skelcher et al. 2005, Connelly 2011].

These studies provide a solid theoretical perspective on urban governance issues, and practical indications to focus on communities and organisations for exploring cooperative governance mechanisms (as done in the case study presented in this chapter). However, they do not consider the specific role of digital technologies in these dynamics nor outline a vision of how technology should facilitate collective actions in urban governance.

To summarise, research on smart governance ignores the needs and implications of the throughput legitimacy in city dynamics and the use of technology in a multi-stakeholder arena. In parallel, urban governance research ignores the impact and practices associated with new technologies in cities. This double gap is even more critical considering that recent comparative analysis of the design, implementation and adoption of e-gov technologies in different contexts confirmed the fundamental influence of social, cultural, economic, geographic, legal, and political differences in the development of distinctive types of e-government services within different institutional environments [Warf 2014]. Indeed, the characteristics of specific national and urban contexts[7] are considered primary factors in conditioning the realistic forms of cooperation between governments and civil society. Certainly, there is no reason to think that the characteristics of the context are less important for we-government technologies, intrinsically stressed by multiple concurrent visions, competencies and strategic agendas.

8.2.3 WE-GOV TECHNOLOGIES AND CITY MIRRORS

As highlighted in the background presented so far, **we-government technologies** are supposed to have essential characteristics in common with the design proposal of the City Mirror.

- Firstly, we-gov technologies should provide an environment enabling **multiple stakeholders** to coexist and potentially interacting through technology at the level of organisations and place-based communities.
- Secondly, we-gov technologies necessarily should support **multiple purposes** and courses of actions, evolving over time under the influence of context and other concomitant actions. The forms of support to these actions are focused on composing the self-driven contributions of different actors into collective actions publicly relevant. Therefore, these forms of support are mainly oriented to enable cooperative practices (more than coordinative or collaborative practices).
- Thirdly, we-gov technologies are required to support these practices at **multiple scales**. Indeed, local governements and public agencies virtually operate at the scale of the entire city and at upper levels. At the same time, local organisations and communities usually act at district or

[7] While in USA, North Europe, and Asian Countries most of e-government services are provided by national and regional institutions, in other countries including France, Spain, and Italy they are under the competence of municipal and local authorities. In the UK, e-gov technologies are mainly provided by national authorities and semi-public agencies.

neighborhood level or their infra-scales. Consequently a connection among multiple levels is essential to guarantee their effective cooperation.

While the literature on we-government (and related models) does not provide specific indications about how to design such technologies[8], it outlines two general inputs for their future development. These inputs insist on the importance of **focusing on service design** and **analysing local processes**.

1) **Service design is central to the idea of implementing we-government processes and designing technologies supporting these processes.** On one side, the public sector is called to *"embedding"* its capabilities into the social ecosystem for co-developing public value in synergy with civil society and business [O'Reilly 2010]. On the other side, other actors are invited to be actively engaged in addressing shared issues and finding common or feasible solutions through self-organisation mechanisms for service re-design, delivery and monitoring [Linders 2011, 2012].

2) **The analysis of local processes is considered a priority to overcome at least the shortcomings of existing e-gov technologies** [Yildiz 2007]. Focusing on technology only and its outputs cannot lead to appropriate solutions for addressing the constraints and criticalities of different public and private stakeholders, their roles in society, the possible mechanisms for the delegation of power among them, the dichotomy between government and administration, as well as the one between government and governance [Yildiz 2007]. Nevertheless, the analysis of local processes does not ensure that the technologies designed on these insights will be able to motivate city stakeholders in contributing and becoming more active because of technology. Unfortunately, this is still one of the major challenges also in the broad domains of HCI and IS research [Preece & Shneiderman 2009].

The **case study of the WeGovNow platform** as an example of City-Mirror-in-the-making had been developed by deeply **analysing the relationship between structure and nature of both local processes and digital technologies** aimed at supporting cooperative governance actions. Then, service design approaches and techniques had been used to connect the analysis of local processes and digital technologies with the actual development of the unified platform. As I am going to explain in the next section, the specific challenges of the WeGovNow project led to **hybridise classical service design methods with approaches, tactics and tools of Urban Planning and Interaction Design**.

Additionally, the case study of WeGovNow enlightened some peculiar dynamics of local processes in the different contexts corresponding to the three cities involved in the project (Turin, San Dona' di Piave, London). Each of them is characterised by different institutional geometries, political orientations, and framing of the role of technology and cooperative governance process into a specific vision of the city management. Thus, this case study provided the opportunity to partially explore the **influence of social, cultural, economic, geographic, legal, and political differences in the use of technologies to mediate the relationships between governments and civil society**, accordingly to the Warf 's recommendations [2014].

The most interesting aspect of the case study of WeGovNow is the exceptional and absolutely ambitious mission of **refactoring[9] technologies and urban governance processes at the same time**, trying to design not a platform but a complex socio-technological system intended to be replicable and adaptable to different settings in Europe. Even though the project activities and my research focused on more manageable tasks and achievable objectives, this underlying vision constituted a strong orientation along the design process.

[8] As made explicit, this literature is not in design-oriented domains and therefore the articulation of requirements or technological frameworks is quite vague.
[9] The term "refactoring", borrowed from the domain of software development, is used here to indicate the specific process of restructuring the internal structure of tools and governance mechanisms without altering their external behaviours.

8.3 DESIGN AND RESEARCH PROCESS

I carried out the design and research activities associated with the case study of WeGovNow from October 2016 to August 2017. During that period, I continued my professional collaboration with the development team of the Department of Computer Science of the University of Turin that coordinated the integration of the different software components into the WeGovNow platform. At the same time, I worked with the project partners also in my capacity of PhD researcher. In this double capacity, I followed and analysed the design and implementation process of a multi-component platform from the perspective of the software development teams and the municipalities involved in the project.

Considering that the goal of the WeGovNow platform was compatible with the scope and model of the City Mirror, I had the opportunity of actively contributing to the project both as required by my professional activities[10] and by pursuing my personal research agenda. In particular, I investigated the interdependences between users' models, city visions and role of technology in supporting cooperative governance protocols in different contexts and in relation to different types of tools.

8.3.1 A SERVICE DESIGN ORIENTATION

As mentioned above, service design techniques had been used in this case study to move from the analysis of the platform components and local processes to the jointly refactoring of the scope of technologies and the nature of multi-stakeholder governance mechanisms. More specifically, **service design tools had been used as communication tools to discuss governance changes with the involved stakeholders in practical terms.** These tools enabled us to analyse together the implications of potential alternatives to current practices and the role of technology in different types of local development actions.

[10] As also specified in Chapter 6, section 6.7, I have been involved in the WeGovNow project from February 2016 to December 2018 in a dual position. On one side, I served as a professional by collaborating with the Department of Computer Science of the University of Turin, project partner responsible for coordinating the development of the WeGovNow platform. In that capacity, my tasks included the management of the local project stakeholders and the support to the internal development team in engagement, design, testing and training activities. On the other side, especially from October 2016 to August 2017, I carried out independent research activities as PhD candidate working on the topic on the design of city technologies supporting cooperative governance processes among different stakeholders operating in the same urban context.
The research activities that I carried out in WeGovNow can be considered independent because not requested by superiors or employer, not included in my job tasks or job description, not covered by my contract, and mainly performed in extra-work time considering the conventional 37.5 hours/week.
This clarification about my double role in the WeGovNow process is essential to make completely clear that in the next sections of this chapter I report uniquely on the research activities that I independently decided to execute in my capacity of PhD candidate for my own research agenda.
Part of the results of the design and research activities, especially as regarding the outputs of the requirement analysis protocol, had been used by the team coordinating the development of the WeGovNow platform to address some contingent issues in the project. The outputs had also been partially documented in one of the project deliverables as a technical report [Lupi & Antonini 2017, see publications list at the end of this chapter]. However, protocol, results, and findings still remain outputs of my research activities, and not project outputs. My professional collaboration in the project provided to me the opportunity of testing and validating my methods in real settings with a real problem and stringent constraints, but it did not determine my research activities. In this sense, it is worth repeating that my research is practice-based and not work-based research. It is grounded on my design practice within the projects used as case studies, but not directly related to the professional duties of my position in those projects (see Chapter 6, section 6.7).

8.3.1.a Service Design applied to Urban Governance Mechanisms

One of the primary characteristics of **governance mechanisms** (differently from governmental procedures) is to be **invisible,** but also **fluid** and **contingent**. They are usually profoundly dependent on the political situation, organisational and personal relationships, emerging temporary communities of interests, and so on. How governance mechanisms are constructed and implemented in a city or in a specific domain of local activities is something that usually remains untraced. These mechanisms are frequently known to the involved parties only (and often partially), except in the rare cases in which comprehensive policies are put in place to make these mechanisms more transparent.

To some extent, cooperative urban governance mechanisms are not new at all. On the contrary, they constitute the conventional way of managing a city and supporting its development for millennia, even beyond or behind public discourses proposing alternative representations such as a totally centralised management of the city. Other than in urban research, it can be easily experienced the fact that almost all local activities, projects, initiatives rely on the cooperation among local governments, public agencies, non-profit organisations, businesses, donors, residents, professionals, culture and research sectors. As extensively examined by Schragger [2016], precisely these **multi-lateral unstable (power) relationships are the essence of city dynamics and urban governance mechanisms. Nevertheless, they remain invisible, contributing to the perception of the city as a complex and impenetrable ecosystem**. Current e-government technologies do not address or support or make visible or more easily implementable these fluid cooperative urban governance mechanisms. We-gov technologies are expected to fill, at least partially, this gap.

In this case study, a **service design orientation** helped in discussing paradigmatic changes in urban governance mechanisms. This orientation also facilitated envisioning new ways for technologies to support these changes. The adopted orientation focused on:

- **Mapping the actors** involved in different processes, their roles, responsibilities and competences

- **Defining rules, actions and protocols** in different organisations or domains of activities conceived as socio-technological systems

- **Identify the "touchpoints"** when, where and how different actors or flows of activities cross each other within a specific process

- **Outlining the organic relationships among actors, context, actions and processes**, that constitute the "blueprint" to guide, verify or implement a service

- **Describing the "journey" of different types of technology users** involved in the processes under analysis, by taking into account the specific scope and capabilities of each digital tool composing the we-gov platform to be assembled.

Actors maps, system maps, touchpoints matrix, service blueprint, user's journey are all very common service design tools [Stickdorn et al. 2018]. They resulted particularly appropriate in the case study of WeGovNow because specifically aimed at **tracing intangible or invisible connections in visible forms** and navigating the **complexity of human and technology interactions across different contexts**.

It is important to highlight that the **concept of "service" had been used here as a metaphor**. The metaphor of rethinking resources, interactions and transactions "as-a-service" is nowadays applied to indicate a flexible

and evolutive way of providing and accessing to certain types of solutions for specific needs or problems, instead than defining static solutions[11]. The institutions (and assets) concurring to local development actions are resources, and the framing of urban cooperative mechanisms as-a-service simply indicates that these mechanisms are provisional solutions, reconfigurable case by case. Technology is the medium to enable the dynamic configuration, implementation and provision of these urban cooperative governance solutions working literally as an infrastructure [see Pipek & Wulf 2009].
Differently from the actual design of a specific digital service in the public or private sector, in this case, the goal was not to improve the experience of the customers accessing a service[12]. The definition of urban cooperative mechanisms supported by the WeGovNow platform was aimed at understanding how to *"infrastructure"* through technology:

- the communication and self-organisation among different city stakeholders
- the sharing of public responsibilities into collective actions
- the throughput legitimacy in local development processes.

In this sense, **service design techniques had been instrumental in connecting the design of a specific system (the WeGovNow platform) to the design of open solutions to wicked problems (multistakeholder city governance) through a systemic design approach**[13].

The Service Design tools described above had also been used to collectively reason on problems and options for implementing new technology-mediated cooperative governance processes in collaboration with the municipalities and the development teams involved in the project. As a result, **these service design tools infrastructured the co-design[14] of the WeGovNow platform by "materialising" governance processes and "abstracting" the features of the platform components** at the same time.

In the next section, I am going to specify better the characteristics and activities of the co-design process in the case study of WeGovNow. Here, I briefly outline the relation between service design and urban planning/design, and interaction design, to make clearer the explanation of the process.

[11] Examples of the metaphoric use of the expression "as-a-service" can be "mobility-as-a-service" [Jittrapirom et al. 2017], "security-as-a-service" or "sensing-as-a-service" [Zaslvsky et al. 2013]. They are originated by transferring the concept of "software-as-a-service" to new domains. The initial concept referred to moving from static software solutions (that clients buy, install, maintain and owned indeterminately) to the access to the software through subscription options [Dubey & Wagle 2007].

[12] [Steen et al. 2011] define service design as "process of planning and organising people, infrastructure, communication and material components of a service, with the goal of improving the service's quality, the interactions between a provider and its customers, and the customers' experiences" by rephrasing the elaboration of [Mager 2008].

[13] Peter Jones, an important reference for systemic design approaches, distinguishes different "domains" and "contexts" of design. The design of systems, services and products (defined as Design 2.0) is connected to the design of complex social system (defined as Design 4.0) through the intermediate step or domain of the design of organisational changes for social purposes (defined as Design 3.0) [Jones & Kijima 2018].

[14] The expression "Participatory Design" and "Co-design" are frequently used interchangeably in the literature because they both implies the involvement of "participants" to a project or a research in contributing to the design of something. Participants can be the prospective users only, or more extended cohorts of stakeholders. The motivations and goals of their participation can vary case by case. However, in the CSCW or HCI or IS research communities there is a tendency to carefully distinguish between what constitute participatory design and other forms of user engagement into the design process [see also Chapter 7, section 7.3]. In this chapter, I am going to refer to the type of engagement of the municipalities staff and the development team as a co-design process. This choice is motivated by the intention of highlighting the openness to a multiplicity of viewpoints in the refactoring process, according to one of the most important characteristics of the co-design of public services highlighted by [Bradwell & Marr 2008]. In the field of design, a common definition of "co-design" is the one given by Sanders & Stappers [2008] that indicate a series of activities along the design process to support "collective creativity", mainly for the generation of ideas and solutions to problems or for the design of something, as restated also by Stein [2014]. The contribution of each part involved in the process is indeed originated by the fact that they are "experts of their experiences" [Sleeswijk Visser et al. 2005].

8.3.1.b Service Design in City Planning and Urban Transformations

The **integration of methods and approaches drawn on service design in the domain of urban planning** had been proposed by Walling and Horelli as a way to:

1) **designing the** ***"infrastructure of everyday life"*** **in cities** (moving beyond the traditional boundaries of urban planning[15])
2) creating a bridge between local contexts and planning practices, often perceived as operating in separate areas subjected to politics
3) **involving multiple stakeholders in reinforcing social and operational structures at the local level**
4) leveraging on new technologies to implement new solutions for local issues by enhancing social and cultural capital [Walling & Horelli 2010].

The theoretical roots of this proposal are traced back to planning practices driven by critical social theories aimed at interpreting and acting on the power relationships between public and private actors in the city [Forester 1993]. However, other important references supporting the integration of service design in planning are identifiable in collaborative planning approaches. These approaches postulate the engagement of place-based communities, but also the transformative orientation of planning practice as projected toward innovation in structuring decision-making processes and actions of city organisations at the local level [Healey 1997, Innes & Booher 2010].

Service design methods applied to community projects and local initiatives had also been recognised as an effective way of supporting pluralistic and opened forms of engagement [Frögård 2016, Salinas et al. 2018]. This position is based on the idea of the irreconciliation of social forces into the public arena [Mouffe 2000], mitigated by the pragmatic attempt in the domain of planning of combining *"direct informal actions and institutionalised practices"* to actively support negotiation and dialogue among different stakeholders [Hillier 2002].

Interestingly, in the last years and especially in Italy, **service design approaches are becoming a common way to implement co-design processes aimed at involving local communities to rethink roles, mission, actions of local governments, public agencies, residents, and business sector, especially on topics of shared interest for the collectivity. Several experiences and pilot projects in many Italian cities** [see, for instance, Berni 2018, Lissandrello et al. 2018, d'Alena et al. 2018, Di Dio 2018, D'Elia 2018] that a few years ago would be defined as collaborative planning practices are nowadays frequently structured as service design processes. This trend is strongly motivated by the need of **providing concrete outputs and clear directions[16] along with participatory processes focused on intangible goods and complex emerging urban phenomena.**

These experiences did not include or explore the design of technologies to infrastructure cooperative governance mechanisms or the design of technology-mediated services for multi-stakeholder actions in the

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[15] As explained in Chapter 2, conventional urban planning practice is focused on the management of land use and physical resources in cities. It does not include even the strategic planning of services or governance issues, even though widely recognised as essential to address contemporary challenges of urban development [Ahern et al. 2014]. On the contrary, progressive or radical approaches, and the practices frequently called "city planning", are focused on social processes, policies, collective problems investing mainly human activities. Thus, community, social, education, housing, mobility services are frequently the object of design, transformation, public debate. The adoption of service design approaches had been also suggested to reform and make more flexible and adaptative the traditional planning practice focused on land use management [Salinas et al. 2014].

[16] Differently from participatory practices in the design of technology systems, a recurring problem in participatory practices in urban planning is the difficulty of producing tangible outputs as results of the participation. Addressing this issue is usually considered essential by urban practitioners to reinforcing trust dynamics among the involved stakeholders and keeping the level of engagement high and constructive.

city. However, they provide a disciplinary, cultural and operational background for the activities associated with the case study of WeGovNow. Indeed, **the choice of adopting a service design orientation is related to the challenge of investigating city dynamics under a we-government paradigm** [see section 8.2.1]. At the same time, this choice positions **my work close to these emerging practices in the Italian context** (considering that two of the sites involved in the WGN project are two Italian cities).

8.3.1.b Service Design in Technology Systems Design

As regarding the relationship between services and technologies, the design of **Information Systems** had been explicitly oriented for decades to reflect on **existing services and processes** or on the way to engineer or **improve existing services** [e.g. from Wemmerlöv 1990 to Beverungen et al. 2017]. The combination of service design (intended as the creation of completely new services) and technology design remained though underexplored in this domain of research and practice[17].

Outside the range of technologies serving specific organisational purposes or domain of activities that is usually covered by Information Systems and CSCW, the major engagement in service design approaches and methods had been showed by the practitioners working in the domain of Interaction Design. Their experimentations and continuous practice progressively readapted part of the common methods and tools in service design to the design of technologies by extending the object of design from the interactions with a specific tool to the digital and physical experience that technology is aimed to support [Benyon 2014]. Triggered by the advent of ubiquitous technologies (that force the understanding of interactive systems in their context of use), this evolution and integration of the Interaction Design practice is still on-going [Homlid 2007], while it already contributed to standardise human-centred approaches in the design of technologies [Benyon 2014].

As regarding the research in the domain of Interaction Design, and broadly in HCI, there had been attempts to advocate and promote the advantages of introducing service design approaches as meta-framework for the design of interactive systems better integrated in the ecosystem of other everyday digital technologies and aimed at producing value for all the classes of users of digital services [Forlizzi & Zimmerman 2013]. However, so far, academic research in HCI had been limitedly responsive to these calls because of a certain difficulty in mapping the potentialities of service design approaches (still seen mainly as marketing-driven more than systemic in its nature) in the consolidated lines of research of this domain [e.g. see Yoo et al. 2019].

Looking at the practice (instead than research) of Interaction Design and Service Design, in this case study I tried to practically balance their differences in applied research activities. As systematically described by Holmlid [2007], these differences concern approaches (analytical in Interaction Design *vs* explorative in Service Design), representations (depictive *vs* enactive or symbolic), outputs (virtual *vs* physical and sometimes virtual), dimensionality (temporal *vs* spatial), scope (use *vs* change), and target (mass customers *vs* organisations). **The proposed hybridisation consists in incorporating a systemic perspective, that is the specificity of Service Design, in the analysis, design and evaluation of interactive systems that is the focus of Interaction Design.** I also considered that Interaction Design practice still struggle in consciously exploiting the lessons learned in the past from multi-actor participatory design approaches associated with technology development [Holmlid 2009]. To this regard, the study of participatory design approaches, co-design techniques, and the extensive experience gained with the first case study and related reflections (see Chapter 7) facilitated a conscious transfer and proactive adaptation.

[17] Nevertheless, there are chances of advances in this direction due to growing interest in the topics of the co-design of services across organisations, as remarked also by the annual conference on Design Research on Information Systems entirely dedicated to this topic. At the time of writing, references were not available yet. See: https://desrist2020.org/

8.3.2 STRUCTURE OF THE PROCESS

In the case of the WeGovNow platform (abbreviated in WGN), the definition and experimentation of a hybridised approach in between Urban Planning and Interaction Design drawing on Service Design tools had been motivated and supported by the limits of conventional techniques for the elaboration and communication of the system requirements from target users to system designers and developers (e.g. *"personas"* and *"scenarios"*, see sections 8.3.2 and 8.3.3). Indeed, from a practical point of view, the two major operational challenges to be addressed in assembling the WeGovNow platform were:

1) understanding what features were required from every single component and what features should characterise the integrated platform as a whole
2) defining these features in collaboration with the officers of the Public Administrations involved in the project by focusing on a WeGovernment paradigm and not on their direct organisational needs.

The main obstacle to address these challenges was a substantial and procedural misalignment between:

a) the way software developers expected to structure and organise the development tasks to be accomplished for assembling the platform
b) and the way public officers elaborated their expectations toward the platform concerning the management of urban development initiatives.

For the latter group, it was difficult to understand how approaching tools that already existed but were not familiar to them. In addition, it was extremely tricky formulating their specific needs by taking into account the existent tools or how such tools could be expanded, instead than expressing generic wishes about generic technologies for their activities.

For the former group, it was difficult to establish limits and competences of each platform component in the subprojects promoted by the three municipalities involved in the project. It was also critical to understand how to organically compose the roles of the different components to assess the type of development tasks and the required effort.

This kind of misalignment is emblematic of ordinary issues to be addressed in building a communicative and operational bridge between the *"makers"* of city technologies and the *"actors"* that will operate in the city having to integrate these technologies in a complex system of procedural, normative, and social constraints. This kind of communication deadlock can result in conflicts and lack of mutual trust and commitment on both sides due to the unclear situation about the respective responsibilities in project stagnation and future progress.

The primary and contingent goal of the design process analysed in this chapter was precisely solving this communication deadlock and addressing the need for building the operational bridge between development teams and municipalities. Thus, the following analysis covers the activities undertaken from the moment in which the development coordination unit decided to directly intervene for clarifying the platform requirements[18] to the finalisation of the requirements as result of the negotiation process between

[18] Preliminary requirements had been collected by third parties at that time, but the communication deadlock originated exactly because the preliminary requirements were misaligned with the flows of administrations and development teams (see section 8.2.2).

development teams and municipalities[19]. The research goal pursued along the process was investigating how to handle existing tool to make them potentially supporting cooperative practices for local development actions by refactoring their core functionalities.

The design and research process had been structured as a dual-track process: service design activities and platform components refactoring. The first track included the co-design and generalisation of *"service scenarios"* envisioning future technology enabled WeGovernment processes. This workstrand had been developed in collaboration with the municipalities of Turin and San Dona' di Piave, and only indirectly with the London Borough of Southwark. In parallel, the second track involved first the analysis of the different tools to be integrated in the WeGovNow platform and then the active negotiation of the final requirements with the different development and technical support teams by referring to the services scenarios.

The two parallel tracks had a point of convergence in the combined assessment of the service scenarios and technical feasibility of the platform solutions to support those services (see Fig. 8.2). The combined assessment created the premises to generalise and extend the service scenarios to a broader set of potential applications of the platform (to increase its potential impact), and facilitated a transparent definition of the platform requirements, shared among multiple project partners. The generalisation of the service scenarios and the open negotiation of requirements constituted essential elements to identify a common ground among different stakeholders having different levels of commitment, active engagement and operational centrality in the project (metaphorically represented as distinct non-harmonised sinusoids in Fig. 8.3).

The next two sub-sections will provide a more detailed description of each workstrand.

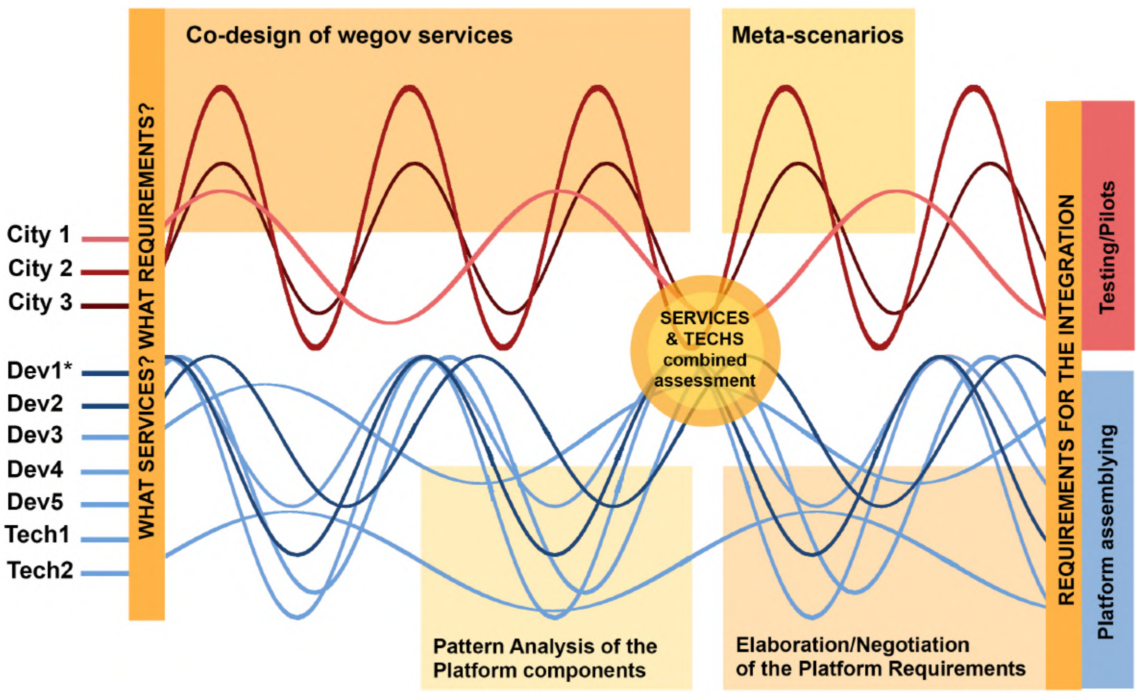

Fig. 8.3 Design and research process in the WeGovNow case study

[19] Differently from the first case study, the analysis is not extended to the actual development of the platform or to the following phases of the project. In this chapter, I focused the chapter on the evaluation of existing tools against practices and visions for a cooperative urban governance, according to the research design, as well as purposes and focus of this work.

8.3.3 CONSTRUCTING THE SCENARIOS FOR WEGOV SERVICES

8.3.3.a. Analysis of the preliminary requirements

The first workstrand started with the **analysis of the preliminary requirements** collected by third parties (respect to municipalities and development teams) involved in the project as partners for the requirements elicitation. The list of the preliminary requirements is reported on the public deliverables of the WeGovNow project "D.2.2. WeGovNow Use Cases v.1" and "D.2.3. WeGovNow Use Cases v.2".

These preliminary requirements had been elaborated by third parties relying on two popular methods widely used in software development to translate users' needs in actionable inputs for developers by following the principles of user-centred system design [Norman & Draper 1986]. These two methods, briefly introduced below for clarity, are called *"Personas"* and *"Scenarios"*.

The term "Personas" indicate fictional characters representing in an organic form a set of recurrent personal characteristics of specific groups of typical users of a certain product or digital system. The profile of these fictional characters usually includes **plausible knowledge, skills, abilities, goals, motives, concerns of each group of users** and make them vivid by associating to them a projection of a person with a face, name, occupation and other marginal or contextual information [Pruitt & Grudin. 2003, Nielsen 2013]. The techniques to develop a set of representative personas for each project can vary enormously, going from light-weighed approaches to systematic data analysis on large populations, especially in the case of a multiplicity of user groups [Coorevits et al. 2016, Miaskiewicz, T., & Luxmoore 2017] such as mass-oriented systems (e.g. operative systems, editing tools, e-mail management tools, and so on) [Grudin & Pruitt 2002, Pruitt & Grudin 2003, Grudin 2006]

The use of Personas had been introduced decades ago by Cooper [1999] to address multiple issues preventing the implementation of an actual human-centred design of technologies. Among these issues, we can find the need of overcoming a mechanistic interpretation of the concept of roles in engineering digital systems, especially for organisational purposes. In that kind of settings, Personas help to consider also other factors impacting on the use of technology and the actions of individuals, beyond the formal protocols modelled in the system [Miller & Williams 2006, McHaney 2008]. Another issue addressed by the use of Personas is the frequent disconnection of development teams from a real contact or understanding of the users for which they are designing and developing specific products [Ma & LeRouge 2007, Dotan et al. 2009, Billestrup et al. 2014]. In that case, imaginary characters can also help to create a common ground between technical and non-technical professionals or between designers and prospective users [Nielsen 2011], but their guidance in the design of systems remain limited because Personas could be still abstract or misleading or distracting from the purpose [Matthews et al. 2012], or even problematic because possibly orienting toward stereotypes [Marsden & Haag 2016]. Despite these criticalities, the use of Personas became extremely popular because easily adaptable to several configurations of human and material resources devoted to user research in system development projects.

The use of Personas is often combined with the use of **Scenarios**, a technique formalised almost in the same period by Carroll [1995, 2000] and then widely adopted across various domains of research and practice in Informatics. Scenarios are intended in these domains[20] as **narrative descriptions of the functioning of a technology system in typical situations related to its use**.

[20] In other domains, such as policy development and planning the concept of scenarios is intended as organic integrated description of context, actors and actions, having or not a narrative component.

According to Carroll [1999], the development of scenarios is meant to facilitate the design process itself and the iterative reflection on the pursued design choices, helping to analyse also complex situations with a level of detail sufficient for establishing the more appropriate response of a system considering multiple point of view on the interactions between users and systems. In addition, scenarios provide support to thematic analysis and generalisation of the technical and non-technical inputs during the design process, and they can be used to dialogue with prospective users and other stakeholders involved in the process. Basically, the construction of scenarios provides a more comprehensive understanding of the needs to be addressed in comparison with use cases limited to the description of the interaction between users and systems [Alexander & Maiden 2005], balancing the need of standard formal way to transfer the understanding of context and user in inputs for the design and engineering of technology systems [Benyon & Macaulay 2002]. The utility of scenarios is though directly linked to their specificity. Their appropriate and meaningful use should be oriented to highlighting the major criticalities of problematic situations for framing and contextualising parts of solutions in very particular settings [Bodker 1999]. Scenarios, in their conventional formulation, can hardly help to envisage future complex situations and overall solutions.

a. *Preliminary Requirements derived from Personas*

At the beginning of the WeGovNow project, four personas had been outlined by third parties relying on the inputs gathered during meetings with residents conducted in the London Borough of Southwark [see D.2.2. WeGovNow Use Cases v.1]. These four personas were:

1) *"a hipster cyclist"*, IT expert
2) *"a dyslectic woman"*, non-IT expert
3) *"a woman moving into her newflat with her husband"*, IT expert
4) *"a single-parent mother with four children"*, non-English native speaker and non-IT expert.

These four characters highlighted the importance of considering users with different levels of digital literacy and special needs concerning the accessibility of the platform contents. All of them represented users interested to get involved at a personal level with local authorities because motivated by civic engagement interests or for obtaining local information to independently address their contingent issues. Two considerations should be made explicit to this regard.

Differently from ten or twenty years ago, **nowadays usability and accessibility concerns in web-based applications can be easily addressed** by following existing standards for web-based interfaces, good practices (e.g. supporting multilanguage contents or integrated automatic translation), design recommendations and frameworks developed to facilitate formally correct and consistent interface design (e.g. the visual language "Material" developed by Google and including tools, resources, adaptable examples, https://material.io/). Still, it is important to keep in mind the need of creating accessible and usable digital products, especially for complying with the legal obligations of public interest platforms required to be as inclusive as possible[21]. However, general requirements about usability and accessibility do not cover or support the specific endeavor of assembling a multi-component platform, clarifying how each component should be refactored in this direction.

Secondly, the scope of the WeGovNow platform was rethinking the relationships between local government and civil society, fostering **new types of cooperative practices between public sectors,**

[21] Italian laws: https://www.agid.gov.it/it/design-servizi/accessibilita-siti-web
British regulations: https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps
EU directive on web accessibility: https://ec.europa.eu/digital-single-market/en/web-accessibility

businesses and third sector organisations. Thus, the focus on users as individuals did not allowed to explore, describe, and transform in operational inputs constraints and requirements to enable these practices through the new platform to be assembled. In addition, the focus on individuals as "customers" of a governmental platform reflect more the old e-gov paradigm than the new wegov paradigm. The goal of establishing new governance models at the city level requires to deal with the actors who operate in the city and have impact on the management of urban services and spaces through their actions. These actors are necessarily structured social entities, both formal and informal [see also Chapter 5]. As mentioned also in the previous section, organisations and communities are the main social structures to be considered in cooperative urban governance mechanisms.

From a practical perspective, it is not new that personas have a limited utility for developers, in comparison with professionals engaged in marketing operations and optimising the digital experience for end-users [Matthews et al. 2012], but not in the production of a new working digital system. In addition, while the use of personas is widely recognised useful for commercial applications and technologies intended for personal use[22] [Grudin 2006], the application of this technique for technologies supposed to be adopted at an organisational level obfuscate many other considerations which usually have priority [Rönkkö et al. 2004]. For instance, preventing liability risks, organisational structure, responsibility chains, management of internal and external communications. At the city level, and in platforms supposed to support inter-organisational cooperation, these elements become extremely important. In conclusion, very limited inputs for the platform design[23] came from the four personas.

b. *Preliminary Requirements derived from Scenarios*

As specified above, the list of the preliminary requirements had been also elaborated by using scenarios and use cases derived from them. In the WeGovNow project, the expression ***"service scenarios"*** is used to indicate the **narrative description of online services provided by the digital platform, enriched by elements portraying the context of use of the platform**. A set of use cases is derived or extracted from each service scenario. A **use case is the description of a particular tacks that the user has to perform according to the scenario, and it corresponds to a specific interaction of the user with the system** [D.2.2. WeGovNow Use Cases v.1, D.2.3. WeGovNow Use Cases v.2].

The preparation of the service scenarios has been autonomously managed by the staffs of the three municipalities involved in the project. The project referents of the three cities had been called to imagine a set of online services expected from WGN platform or building them in collaboration with local stakeholders. The service scenarios were expected to be rendered in a sort of canvas to be filled with:

- a list of involved stakeholders and their role in the specific scenario
- an illustrative *'day in the life'* description of service utilisation
- a selection of relevant use cases in the scenario indicating user's role, task to be perfomed, preconditions, the expected result, functional and non-functional requirements associated with the use case

[22] So far limited examples covered the elaboration of Personas associated with the modelling of the characteristics of entire groups in close settings. See Matthews et al. 2011, and Judge et al. 2012 for the concept of Collaboration Personas.

[23] Eu projects have a quite regular structure organised around standard clusters of activities, work packages, including "engagement", "development", "testing", "evaluation", "project management", "dissemination". There are not "Design work packages" in EU projects. Design tasks are implicitly incorporated and spread across other activities. In projects such as WeGovNow, explicitly aimed to design a new digital system, software development tasks are supposed to cover also the design process (but with substantial issues from a practical and contractual point of view).

- the innovative aspects of the scenario compared with the current situation, as well as a pre-assessment of the advantages and disadvantages associated with its implementation.

The list of the preliminary requirements derived from the first scenarios elaborated from the municipalities (see section 8.4 for their description) included requirements such as *"The WeGovNow platform should be fast"* or *"trustworthy"* or *"intuitive"* or *"with a low perceived workload"*. However, these **requirements were quite generic, not actionable**, not necessarily related to the kind of technology support provided by the platform[24], difficult to assess, and **extremely subjective and context-dependent**.

The list of requirements derived from the use cases included items such as *"The WeGovNow Platform should provide interactive maps"* or *"The WeGovNow spatial interfaces should allow users to edit/add/delete data" or "The platform should be connected with social media".* The critical issues with these types of requirements was that they described **features already included in the platform components**, without providing inputs for their effective integration or even for building meaningful online services to support cooperative governance processes. Indeed, for instance, four out of the five front-end components had map-based interfaces. It was obvious that the final platform should include a map-based interface of some kind. The point was clarifying what kind of map-based interface and for what purposes. Similarly, all components to be integrated in the WGN platform were web 2.0 tools. Thus, they allowed the generation and visualisation of user-generated contents, that of course were editable by default, as well as some form of connection with external social media platforms. Again, working mostly on consolidated tools, they included already helpdesk, registration protocols, data management systems, and so on.

c. Main issues and limitations of the Preliminary Requirements Based on Personas and Scenarios Outputs

The intent of these observations is not polemical or critical toward the professionals that elaborated the preliminary list of requirements. On the contrary, I want to highlight that following the "rules" of conventional techniques (personas and scenarios) in unconventional situations (moving from e-gov to wegov paradigms) can lead to results below the expectations. These tools allow to perfectly meet the most common expectations in other cases, such as for commercial applications, but they are not effective in this case. Thus, understanding how to address the problem of technology-supported cooperative governance is a matter of explorative research and not just everyday professional practice for the following five reasons.

1) For instance, one of the practical recommendations for effectively using scenarios is **starting from users' narrative without focusing on specific technology solutions.** This recommendation is useful in the design of new systems to avoid approaching prospective users searching for confirmation of already hypothesized solutions, keeping opened all the possible options. Conversely, the peculiar characteristics of the WeGovNow project was to integrate distinct tools already existing into a new modular platform supporting new services that the single components alone could not support. Therefore, in this case, the definition of the integration requirements could not be elaborated independently from what was already there: working tools, widely tested, and even commercialised (e.g. Liquid Feedback or Improve My City). The methodological problem was how to balance refactoring of existing tools and technology innovation at a higher level.

[24] Examples. The quality of the response of a platform often depend on the quality of the internet connection. Google maps is one of the best rooting application, but in the desert or on a mountain its response can be slower than expected. The trustworthiness is not of the platform, but possibly related to the contents published on the platform. So, dependent on people and not technology. To some extent, technology can help with management mechanisms for moderating the publication of contents to reduce risks. Remembering that the same mechanisms can also promote censorship and/or user disaffection.

2) Another principle of good professional practice in participatory user-centred design is that users are the major experts of their domain of activities. This point of course remains true also in such a complex situation such as in the WeGovNow project. But it was also true that the staff of the municipalities was not trained nor in the use of the platform components or in the construction of effective service scenarios (meaningful or effective both for them and the development teams). In addition, the public officers, knowledgeable on their organisations, were called to also express the needs of their reference communities and other stakeholders, with understandable difficulties. Lastly, three different cities with three different socio-cultural, economic and political contexts were involved. While the platform was supposed to meet their specific needs, on the other side the municipalities were called to reason on the possibilities of setting a common ground and replicable solutions transferable in other settings as well. While acknowledging the **autonomy of users to self-determine their needs** is important, accompanying them to navigate the complexity of a multi-component and multi-site project is the way to enhance their potential contribution to the final output. The novelty of such project and its complex geometry had to also copy with the lack of other examples and guidelines to be followed.

3) The choice of an **analytic tool such as *"a day in a life"*** (i.e. the description of typical day-to-day situations from the perspective of users aimed at highlighting the use of a specific service or system) is quite common in the design of digital and non-digital services and products. However, the WGN platform was intended to primarily support the cooperation among local government, businesses, and civil society in local initiatives and projects. Differently from making online purchases or booking a restaurant, these cooperative dynamics are developed over timeframes that can take months, or even more, to conclude a single action (e.g. selecting a public project to be implemented). Urban changes and local processes are indeed evolutive. Thus, the identification of criticalities and opportunities for future online services, and their related requirements, necessitates to take into account different temporalities for different subjects. Focusing on the moment in which a single user decides to access the platform for consulting the available information or sharing some contents tell us very little about the dynamics of the action involving the user and the expected or more appropriate use of the platform in that case.

4) The **service scenarios** leading to the preliminary requirements were intended as representation of the **online services provided by the platform**. As mentioned above, the standard approach in information systems development is focusing on the platform instead than on the context. However, the service scenarios defined by the municipalities staff mixed elements related to the implementation of online services with the running of existing or prospective offline services. Indeed, technologies aimed to support inter-organisational cooperation at the city level cannot ignore the embodiment and practical implications of the correspondence between online actions and legal, social, cultural, organisational norms. Thus, the services scenarios do not provide the opportunities of identifying and mapping issues for the future adoption of the platform in relation to existing protocols and constraints. In this case, the challenge was focusing at the same time on the online and offline services in the context.

5) The **definition of paradigmatic use cases** is a way to bridge the narratives of personals and service scenarios with the development tasks for implementing the platform. But in a multistakeholder platform such as WGN, each use case can differ in relation to various target groups (e.g. public officers, citizens' organisation, cultural institutions, schools with minors), even the simplest ones such as the interaction with helpdesk options. This setting requires to elaborate, at the same time, meta-use cases and their multiple instantiations to verify their feasibility, compatibility, and consistency across different components.

Summarising, the global assessment of the preliminary requirements pointed out:

- the strong limitations of conventional techniques for the requirement elicitation in the extraordinary case of WeGovNow
- the difficulty to extract meaningful requirements to orient the development activities
- the issues of defining these requirements by taking into account the fact that the WGN platform was aimed to support complex social interactions at the city level, even more than technology-mediated online interactions.

8.3.3.b Co-Design of Technology-supported WeGov Services and Meta-scenarios

To move forward in the definition of the requirements for the integration of the given components of the WGN platform, I proposed to approach the problem by:

1) considering existing tools as a starting point to reason on their refactoring and extension
2) accompanying municipalities staff to revise and enrich their scenarios
3) thinking to technology-supported actions along urban processes lasting months or years
4) moving the attention toward WeGov services instead than online services provided by a wegov platform
5) studying paradigmatic use cases, and their value at a general level or for specific segments of users and applications.

These five points addresses the shortcoming identified in the preliminary phase, but also instantiate a service design orientation according to the perspective discussed in section 8.3.1.

The service design process developed on these five points had been carried out in collaboration with the staff of the municipalities of Turin and San Don' di Piave. Scenarios and needs of the London Borough of Southwark had been considered, even though their instances had been mediated by the partners that curated the collection of the preliminary requirements. The scenarios elaborated in the preliminary phase (and integrated over time) constituted the starting point for the co-design process focused on WeGov Services. They are listed below in Table 8.1.

Table 8.1 Themes addressed by the municipalities involved in the WeGovNow project

Trial sites	Scenarios	Themes
London Borough of Southwark	▪ Scenario 1: Cleaner greener safer neighborhoods through civic proposals ▪ Scenario 2: Highway scheme scoping initiative ▪ Scenario 3: Young People's Employment Pathways	▪ Neighbourhood renewal, gentrification management, social housing crisis ▪ Infrastructures development and mobility ▪ Job opportunites and social inclusion
City of Turin	▪ Scenario 4: Participatory design of an area for teenagers and young people in Dora park ▪ Scenario 5: Hortus conclusus in Dora Park: social gardening and co-management of public spaces ▪ Scenario 6: Iron Valley: Open air museum and industrial heritage of Turin ▪ Scenario 7: Parco Dora Shopping Mall and community's projects	▪ Citizens engagement ▪ Management of green areas ▪ Management of the industrial heritage ▪ Management of public spaces
City of San Dona' di Piave	▪ Scenario 8: The wine cellar as new innovative business network ▪ Scenario 9: The Bank of Creativity ▪ Scenario 10: Collaborative service in an ageing community ▪ Scenario 11: Urbact Local Groups for energy efficiency	▪ Public/private partnership in local development initiatives ▪ Management of social services ▪ Ageing population issues

In a first phase, the co-design activities focused on **extending and rebuilding the preliminary scenarios** taking into account the vision and aim of developing a cooperative governance model in city management operations. They included a series of on-site visits to understand how the staff of the municipalities carried out their work and discussing with them constraints, needs, risks, and desiderata associated with digital technologies for opening up and fluidifying public administration protocols. During these visits, I associated observations with in-depth interviews to single and groups, according to a well-known field technique called contextual inquiry [Holzblatt et al. 2004]. However, the interviews were primarily aimed at filling the gaps in the scenarios and collectively reflect on potential solutions for establishing wegov services. The potential solutions necessarily took into account the responsibilities and legal framework for the actions of the public administration respect to other actors. Indeed, the co-design process was explicitly "adoption-oriented" in its principles.

These activities had been complemented by a series of **training sessions** with the municipalities staff to deeply understand the logic and use of the platform components. These training sessions provided the common ground for discussing together about the features already existing in the platform components, but also:

- potential alternatives in case of critical issues emerging from their use or misuse
- chances for reusing existing features in new ways
- new features considered essential for implementing new services
- unnecessary or duplicated features that could be eliminated.

Building on the acquired competences and shared language to refer to both wegov services and technology features, we proceeded toward **mapping the fragmented daily use cases in steps of full services processes,** intended as processes involving multiple actors over time, with changing roles and goals phase by phase. In line with the goal of the project, we further **mapped the workflows of the defined wegov services with specific actions and capabilities of the platform components**.

A series of **workshops with local stakeholders**, external to the municipality staff directly involved in the co-design of services, helped in refining the description of the processes and the lists of requirements from alternative perspectives (including the ones of stakeholders non previously mapped). Indeed, these workshops were aimed to present the different tools to local organisations and discuss with them the applicative scenarios envisaged for their future application in wegov processes.

After a few iterations to refine each single scenario, we moved forward shaping **general patterns of use of the WGN platform**. For instance, one of the scenarios was focused on the relationships between a specific non-profit organisation and the municipality concerning the agreement for the management of public spaces. At this step, the co-design focused on understand how to generalise this scenario in a schema adaptable to the needs of a wide range of non-profit organisations, for instance, or to other forms of cooperation concerning public spaces. While in the previous steps I discussed with each municipality only the scenarios elaborated to address their priorities at the city level, the communal reflection in the generalisation phase had been opened to all the scenarios. They included the ones elaborated by other municipalities in order to understand their transferability across different places and organisational settings. Working iteratively, we managed to cluster similar workflows and services in a set of four we-government processes (meta-scenarios), common to the three municipalities and potentially covering an indefinite number of future applicative scenarios.

The central goal of the service co-design was to model urban processes oriented toward a cooperative governance of city management and defining the solutions for the appropriate integration of digital technologies in these processes. This required to match the flows and touchpoints of different actors and activities in each process with the capabilities of the tools intended to support these processes, harmonising actions and technology support into a legible, consistent, and flexible journey online and offline.

The schema of the wegov services and the general patterns of use of the WGN platform constituted the basis for the **combined assessment of the services to be provided (online and offline) and the operational aspects of assembling the WGN platform.**

During a project technical meeting, the requirements emerged from the co-design activities had been discusses, evaluated and negotiated with the development teams of project technical partners (see section 8.3.3). The results of the technical evaluation had been discussed again with the municipalities during **validation sessions** going through the list of requirements one by one and the proposed solutions. I conducted 2 validation sessions for Turin and 2 for San Dona' di Piave, obtaining the indirect validation for Southwark.

This last cycle ended up with the final requirements based on the combined evaluation of the technical feasibility of the solutions supporting new wegov services, and the institutional acceptability of the platform [see Lupi & Antonini 2017, technical report][25].

[25] The municipalities later tested the integrated platform in some pilot initiatives. Reporting on the implementation of the requirements and the testing of the platform is beyond the scope of this chapter and this work.

8.3.3 DESTRUCTURING THE COMPONENTS OF THE WEGOVNOW PLATFORM

The second workstrand focused on the options for refactoring the technology components to assemble the WGN platform.

8.3.3.a. Platform components

The core components of the WGN platform included[26]:

- Liquid Feedback (https://liquidfeedback.org/)
- FirstLife (https://www.firstlife.org/)
- Community Maps (https://communitymaps.org.uk), combined with Geokey (https://geokey.org.uk/)
- ImproveMyCity (https://www.improve-my-city.com/)
- Trusted Marketplace.

The platform was completed by auxiliary components, such as a unified user's authentication module, a common landing page to access all components, and tools for the management of data (spatial data, open data, user-generated data) [see also https://wegovnow.eu]. Following, I sketch their peculiar functionalities respect to the families of technologies seen in Chapter 4[27].
LiquidFeedback is an online discussion and voting platform. Differently from most of the applications having similar goals and applied in urban settings for public engagement (see Chapter 4, section *4.3.2.a and 4.3.2.b)*, **Liquid Feedback have been designed to support structured discussions and facilitating the aggregation of proposals in the collaborative construction of improved proposals having a large consensus or meeting wider needs**. The platform allows the opening of multiple digital spaces for proposals collection, discussion and voting. Users can share a totally new proposal or a competing one. Users also can support an initiative, propose specific improvements, made a public assessment describing the level of agreement with the proposal or other users' suggestions, endorse the changes made to the proposal. The mechanism managing the visibility of proposals is oriented to ensure that even minoritarian initiatives can be easily accessible to users and not obscured by the ones more engaging. The history of the proposal and its variations are visible to all users, as well as the supporters and other materials shared by the initiators. As regarding voting functionalities, Liquid Feedback provides the opportunity of having preferential votes, or rather listing the given options according to the user's preferences instead than voting yes or not. The voting itself is structured as a process of discussion, voting, verification and publication of results, or according to other phases required by specific applications. In addition, users can delegate other users to vote on their behalf on specific issues or themes if unable to vote directly.

FirstLife is a civic social network, developed at the level of working prototypes and widely tested in several projects, as discussed in detail in Chapter 7. It was conceived as **a location-based social network** (see Chapter 4, section 4.3.4.b), publicly accessible such as global social networks (section 4.3.4.b), and oriented to **support the self-organisation of events, group's activities, local initiatives, information campaigns, community news hubs** (see also sections 4.3.3.b, 4.3.4.a, 4.3.4.c). A map-based interface and geo-referenced contents enabled also crowd-mapping initiatives.

Geokey and Community Maps are two combined tools **supporting formal and informal groups to create spatial representation on maps of their topic of interests and related contents** (see section 4.3.3.a). GeoKey

[26] Please, visit the indicated websites for screenshots of the platform components.
[27] For their typological framing, see Chapter 4 of this thesis. For a full description of the various platforms, see D3.1: Consolidated System Architecture, D3.3: First Release of WeGovNow Platform Prototype, D3.5: Final Release of WeGovNow Platform Prototype

is the tools to create the data structure for a community mapping initiative (i.e. data sources, categories, icons, contribution options, contribution rules, etc.) to be carried out by using the other tool, Community Maps, already described in Chapter 4.

ImproveMyCity is a **reporting platform** following schema and logic of this class of technologies, as described in Chapter 4 (section *4.3.1.b)*. ImproveMyCity is a commercial application designed to be integrated in the workflows and processes of public administrations, similarly to SeeClickFix.

The Trusted Marketplace was intended as an application to **facilitate the exchange of good and services among citizens.** It was meant to incorporate functionalities and features recurring in civic crowdfunding and sharing platforms (see sections 4.3.3.c, 4.3.3.d). Differently from other components, this tool was not developed already at the beginning of the project.

OntoMap (https://ontomap.ontomap.eu/) is another tool for a map-based visualisation of geographical information, both generated by users or imported from open data portals (see section *4.3.2.c)*. Differently from the other components, **this tool visualises also the semantic relationships among different data on the platform relying on a formal ontology of urban entities and types of data**. In the WGN project, the working prototype of OntoMap is framed as *"auxiliary component"*, while the other platforms described so far are the *"core components"*.

The integration of these different components was intended to result in a sort of city dashboard rendering last updates on local initiatives, proposals under discussion or for voting, on-going regeneration projects, thematic information, and opportunities related to services, resources, people in the city. Differently from the model of urban dashboards seen in Chapter 4 (sections 4.3.1.a, 4.3.1.d), the focus was on people's activities. An interesting aspect of this case study was precisely the opportunity to examine a unified platform, incorporating the functionalities of almost all the families of web-based technologies outlined in Chapter 4.

8.3.3.b Patterns analysis of the platform components

All the components described above were characterised by different level of "readiness"[28], intended as maturity of technology in a scale going from research concepts, to systems under development, until consolidated technologies already tested in real-world environment. The majority of the platform components were fully defined in their functionalities because having the status of advanced working prototypes or commercialised products, with the exception of the Trusted Marketplace. Thus, the design process focused on the so-called phase of *"post-design"* [Sanders & Stappers 2014], to study how aligning technology and its potential applications for the intended targets of users.

The distinction between ***"technology solution"*** and ***"technology product"*** is essential to understand the steps of this process.

- A **technology solution** can be seen as a set of capabilities linked to the properties of specific technical components, their assemblage and the ecosystem of other technologies to which they are associated with.

[28] European normative defines the technology readiness levels. See: "Technology readiness levels (TRL), HORIZON 2020 – WORK PROGRAMME 2018-2020 General Annexes, Extract from Part 19 – Commission Decision C (2017)7124"

- A **technology product** is instead a specific "packaging" of a technology solution, in which the capabilities of technology are customised on the needs of a specific segment of users and clients, and often limited to a specific applicative domain.

For instance, Liquid Feedback is a voting platform in which the capabilities of the technological solutions of that platform (such as balancing mechanisms for minority proposals, cooperative construction of proposals, deliberative process in multiple phases) are not necessarily limited to one specific setting or framed in a rigid schema. Indeed, Liquid Feedback is widely used both in business environment and in the public sector, for public deliberations or internal decision-making process. The platform functionalities are tailored case by case by customising the instantiation of the platform according to the pursued goal. Other platforms are more strictly tied to a specific scope because of the business choices of the company distributing the product. For instance, ImproveMyCity is a digital product for collecting citizens reports on street issues. However, the same mechanisms enabling citizens reporting potholes and broken benches can be used also for different purposes in a different schema, as explored in the co-design of wegov services.

After the analysis of the preliminary requirements and in parallel with the co-design of wegov services, **the design and research process concerning the platform components focused on analysing their functional logic.** This analysis had been aimed at distinguishing between:

- **capabilities of each component**, beyond their current uses in the main promoted applications (flexible or versatile)
- **constraints due to the configuration of the components seen as products (**difficult to modify).

For each component, I examined the list of functionalities and features by looking in detail to the:

- **internal connections among functionalities and features**[29]
- **implicit and explicit rules of interaction with each functionality**
- **link between forms of interaction and enabled actions in terms of online-offline connections**
- **repetitions and overlapping between features in different components**
- **potential complementaries or contrasts between feaures in distinct tools**
- **underlying schemas and compositions of the map-based and media-based interfaces**
- **semantic associated with each features in a specific tool, and consistency or differences in others**
- **assumed roles of users within each component and potential variations due to the integration in the propsective platform.**

The output of this analysis was a **set of typical patterns of use enabled by each component** based on the mapping of unique and repeated features across different modules.

Once isolated the typical patterns, they have been discussed with the referents of the municipalities involved in the co-design of the applicative scenarios. In this second stage, **a set of use cases for each applicative scenario had been collaboratively analysed in relation to the typical patterns of use of each platform**. For instance, Community Maps and FirstLife both enable users to create and contribute in crowd-mapping campaigns. However, the use cases concerning the two tools differ because their features and functionalities differ. In one case, users' groups can autonomously set their categories for contents, in another they could benefit from the mutual visibility and integration of multiple mapping initiatives under a common classification schema extended by the use of tags. In distinct scenarios, one option can be more effective than another or they could be combined in sequence or in parallel.

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[29] A feature is the specific tool provided by a platform for performing a certain task on the platform. A functionality is the modality to performing that task. Example. "Editing a text" is a functionality, the text editor board is a feature, and it could be configured in various ways.

This **mapping between typical patterns of use of the platform components and the applicative scenarios related to wegov services provided a comprehensive picture of the potentialities of the integrated WGN platform**. In addition, this process outlined **functional and non-functional requirements to orient the development tasks for the components' integration**, based on a deep understanding of the existing tools and the reflection on the implications of specific design choices in the context of the three cities.

8.3.3.c Negotiation of the platform requirements

The compliance of future wegov services with the protocols of current services was the key concern for the municipalities involved in the project and, on their side, this element drove the framing of the problem of elaborating the systems requirements for the WGN platform. On the side of the development teams, different types of concerns were predominant.

First of all, the key issue was to understand exactly what kind of features were expected to be implemented for the integration of the platform components. Beyond these operational concerns, it was clearly considered essential to **balance the development efforts among the involved teams**. These teams belonged to different companies and institutions, working independently (but in a coordinated way) with pre-assigned resources (working time, dedicated staff, budget). In this setting, it was not socially acceptable to overcharge some teams pushing, for instance, toward the homologation of their tool with other tools (leading to extra work for one of the parties involved). At the same time, every partner was expected to actively work and readapt its tool without assuming conservative positions (leading to less or no work for the involved parties).

In addition, **all the platform components were expected by their developers to have comparable weights in the final WGN platform**, and adequate representation of this point in the applicative scenarios as well. Indeed, the goal of the WGN project was to prototype a modular platform potentially adoptable by other European municipalities, that could ask for customisations, including the option of taking only some components instead than all of them. Thus, it was crucial to demonstrate the utility of each component in wegov processes for increasing the future chances of distributed benefits for all the partners that invested in the platform development.

Against this background, **the combined assessment of the scenarios for wegov services and the forms of technology support provided by the WGN platform** had been set by:

- defining the **scope of WGN platform**, intended as the boundaries between what is included or not in the capabilities of the platform, consistently with the wegov paradigm
- **covering the full lifecycle of wegov services**
- **maximising the potentialities of existing solutions** supporting the generalisation of use patterns and exploiting the mechanisms of the consolidated components
- **prioritarising new solutions and features that could be used across different types of scenarios** in multiple trial sites, especially for the components still in a phase of open development.

The combined assessment on the side of the development teams had been perfomed during a dedicated two-days technical meeting with the representatives of all the technical partners in January 2017. In the following seven months, further adjustments had been iteratively made due to the joint assessment of the proposed solutions with the involved municipalities, until the general project meeting at the end of August 2017. The continuous negotiation and refinement of the platform requirements had been carried out in collaboration with the development coordinator of WGN working in my same research groups at the Department of Computer Science of the University of Turin.

The combined assessment had been supported by two tools: the stakeholders/actions grid and the actions/requirements grid, both legible for municipalities and technical teams, even though more useful for the second ones. The combination of the two tools allowed to map systems requirements and urban actions in a dynamic way.

		Phases of the process			
		Phase A		Phase B	
Stakeholders		**Mapping of public services and sharing of public information** Mapping of public services for the ageing and frail population with all the related information: location, opening times, target population, type of services, application procedures, etc. Representation of aggregated data including demographic, economic and social information (existing in digital archives) associated to specific areas, such as neighborhoods or suburbs.		**Collaborative monitoring and data integratio** Integration of published data with feedbacks of platform users (platform) Periodic update of offical and crowdsourced information Reporting of critical situations concerning the elders and frail co	
Class of Stakeholders	List of organisations/ communities	Actions: Identification code of the action (A01, A02, A03, An + description)	Component involved + development status	Actions: identification code of the action (B01, B02, B03, Bn+ description)	Co
Municipality (Municipality, Municipal departments, etc.)	M01_ Social services & housing municipal department	A01_standardization of existing datasets including demographical, epidemiological, economic and social information on a geographical basis for the import on the platform A05_Editing or updating of data	A01: #none - rejected? A05; GK-CM? (Open)	B01_Monitoring of feedbacks on the official data notification B02_Activaton of response protocols to reports about social issues B03_Interdepartmental coordination for response protocols	
	M02_ICTs municipal department	A01_standardization of existing datasets including demographical, epidemiological, economic and social information on a geographical basis for the import on the platform A02_Automatic import of existing datasets on the platform A03_Visualization of each dataset on the map, aggregated at different scales (e.g.: neighborhoods or city) A04_Visualization of multiple connected datasets A05_Editing or updating of data	A01: #none - rejected? A02: GK - OM ? (Open) A03: #FL (in progress) + GK? (Open) A04; GK-CM? (Open) A05; #FL (Open); GK-CM? (Open)	B04_Export and analysis of data (to know which official data are incorrect or inaccurate B05_Assessment and validation of unofficial data relevant to integrate municipal open data	
Local Authorities (example: Health authority, education authority, environmental authority, etc.)	LA01_Local Health Autority	A01_standardization of existing datasets including demographical, epidemiological, economic and social information on a geographical basis for the import on the platform	A01: #none - rejected?	B06_Monitoring of feedbacks on services B03_Interdepartmental and interorganization coordination	
				B07_Integration of data with missing or additional	

Fig. 8.4 Extract from the strakeholders/action grid of one of the four meta-scenarios

The **stakeholders/actions grid** [see Fig 8.4.] is a synthesis of different services design tools such as the stakeholders map, touchpoints matrix and users' journey. It is structured by rows for different classes of stakeholders and types of organisations and communities involved in the applicative scenarios, and binate-columns to organise their actions phase by phase along the process of wegov services. Each couple of columns indicate the identifier for each action and its description, but also the platform components called to support that action and the development status of the corresponding features. The main advantage of this tool is the synoptic overview of the involved stakeholders along the process, their roles and their actions, showing the expected type of user and form of technological support required to the WGN platform.

Actions	Requirements	Related Features	Proposed solutions	Components involved	Validation	Status	Priority
Identification code of the action (**A01, A02, A03, An**) + description	Identification code of the requirement (**RQA01, RQA02, RQA03, RQAn**) + description	Identification code of the feature (**FT1, FT2, FT3, FTn**) + description	Identification of proponent for alternative solutions + description	Identification code of the component involved: • FirstLife: **FL** • LiquidFeedback: **LF** • ImproveMyCity: **IMC** • Geokey: **GK** Community maps: **CM** • Ontomap: **OM** • Cross-component: **CC (id conmponents involved)**	Identification code of the status of validation process §WP2 + identification code of trial sites **§WP2_TO** (Torino) **§WP2_SD** (San Donà di Piave) **§WP2_LN** (Southwark, London) #WP3 + identification code of the component involved **#WP3_FL, #WP3_LF, #WP3_IMC, #WP3_GK, #WP3_OM**	State of development of the feature • **Done**: the feature already exists in the component • **In progress**: the development or the adaptation of the feature is on-going • **Open**: accepted, but to be scheduled • **Rejected**: the feature requested is incompatible with the setting of components, budget or technological constraints, or the project goals	Evaluation of the priority • **HP: high priority** The feature is general, requested by all the trial sites, and needed to test the prototype in the service scenario. • **LP: low priority** The feature is not requested by all the trial sites and there are alternative features that can be used to test the prototype in the service scenario
A01_standardization of existing datasets including demographical, epidemiological, economic and social information on a geographical basis for the import on the platform	RQA01a_Tool to speed up the standardization of heterogenous data RQA01b_Format to be imported compatible with the format of existing files and currently used by the Municipality officers (CSV o GeoJason)	FT01_undefined/out of scope		None	§WP2_SD	Rejected	LP
A02_Automatic import of existing datasets on the platform	RQA02a_The import keep metadata: categories, descriptions, etc. RQA02b_The import can be done periodically by municipal officers (different time intervals for different type od data) RQA02c_The import can be automatized connecting the platform to the existing digital archives of the municipality RQA02d_Automatic creation of a project from a dataset	FT02_Importer		GK? Ontomap?	§WP2_SD	Open	HP? - to be verified if it could be a shared action, LN - manual importer?
A03_Visualization of each dataset on the map, aggregated at different scales (e.g.: neighborhoods or city)	RQ03a_Data visualization optimized to be comprehensible for not expert users (icons, colours, lists) RQ03b_Selection of data associated to a specific area RQ03c_Filtering of information based on categories, properties, or periods	FT03_Map Viewer	FL: geographical indexing system aggregating spatial units and information	#FL GK?	§WP2_SD §WP2_TO	In progress	HP - to be verified with LN
A04_Visualization of multiple connected datasets	RQA04a_Consultation of distinct datasets at the same time RQA04b_Selection of information associated to the same area but coming from distinct datasets (e.g. demographic						

Fig. 8.5 Extract from the Actions/Requirements grid for wegov services

The **actions/requirements grid** [see Fig 8.5] provides the list of actions and derived requirements with their identification code and description, but also the associated features, the kind of solution proposed by the municipalities or the development team to meet the requirements, the involved components. Moreover, the grid includes the validation feedbacks from municipalities and technical partners, the status of advancement for the proposed solution (or alternatives), and the priority level.

The assessment of each requirements and related solutions relied on qualitative judgments taking into account factual information (for instance, the description of feature, interactions, effect, and uses in the main use patterns) and value information (related to the impact on people perception of the kind of proposed solution, in terms of utility, sustainability, impact on adoption chances.

On the side of the development teams, the specific functional requirements of components had been evaluated considering:

a) the scope of the involved components phase by phase in the service scenario in relation to real-world urban actions and processes
b) the possible alternatives to each use cases, based on existing mechanisms or on the redistribution of tasks among components
c) the reuse of existing collateral tools available (included or not in the platform, e.g. social networks)
d) the balance between development costs and benefits for users in terms of cause-effect relation of the requirements with the implementation of the scenario (i.e. sine qua non criterion)
e) the number of occurrences of similar requirements across different scenarios and in multiple phases of each kind of process (giving priority to the more needed features)
f) number of expected end users and stakeholders interested in a specific feature
g) technical feasibility within the project technological framework given the constraints of the used languages and tools.

The results of this process are presented and discussed in section 8.5, while the wegov scenarios are analysed in section 8.4.

8.3.5 RESEARCH ACTIVITIES INTERTWINED TO THE DESIGN PROCESS OF WEGOVNOW

The research activities within the design process of WGN accompanied the two workstrands described in the previous sections. Considering the methods selected for this study (see Chapter 6, section 6.4), the research activities can be divided into:

- analytical and applied activities aimed at investigating the contexts of the project and defining logics and patterns to intervene on the WeGovNow platform components (Research for Design)
- empirical and theoretical research activities aimed to deeply understand the local processes to be refactored through we-gov technologies. They had been carried out by actively involving the staff of the municipalities adhering to the project and the development teams (and by applying Action Research methods based on the use of service co-design techniques, Research through Design and Grounded Theory)
- methodological research aimed at defining and implementing the experimental protocol for the combined assessment of the requirements for the integration of the platform components within the WeGovNow platform and into cooperative urban governance processes (Research Through Design[30]).

Research activities oriented to support the platform design had been carried out within the co-design process of wegov services, and as design research[31] activities autonomously performed. These last activities consisted of studying the platform components and their potential transformations in terms of interfaces, interactions, and functionalities to address the needs of the various service scenarios (contributing to answering RQ2).

Action Research methods framed at high-level the collaboration with the project partners. As anticipated in Chapter 6, section 6.7, in this case study, the application of action research methods can be defined as a “Bilateral Action Research”. Indeed, the classical iterative flow of action research (diagnosis and definition of the problem, planning, acting, observing, reflecting) had been split in two and readapted to the contingency of a design process. The two involved parties were respectively 1) the municipalities and 2) the technical partners.

In the first case, the problems were focused on contingent and urgent issues in the governance of the city expected to be potentially addressed through new technologies such as the one considered for WGN. In the second case, the problem was the rationalisation of the software development tasks for the integration of the platform components into a unified platform. The planning phase covered the definition of specific strategies to minimise the changes in current administrative protocols and in the consolidated tools, respectively in the two cases. Then, as regarding the municipalities, the acting-observing-reflecting phases had been iteratively repeated to construct the applicative scenarios within the service design process. In parallel, the developed teams worked to execute the preliminary tasks for the integration of the platform components. After the combined evaluation of the service scenarios against the WGN platform scope, the second action research flow restarted with the elaboration of multiple specific plans and actions for each platform component based on the negotiation of the requirements, their assessment in coordination with the other team and the expectations of the other partners. The combined evaluation of the service scenarios worked as a point of synchronisation of the two AR flows and as a starting point of a second major iteration

[30] In this case, the artefacts driving the research were at the same time the platform components, and the Requirements Grid used as dialogue tool in the combined assessment of the service scenarios and technology solutions.
[31] The expression “design research” refers here specifically to the exploration of the design space into the design process. Thus, activities focused on the definition of solutions, their limits, their potentialities, analysis of other examples, and so on.

for the municipalities. This second iteration was based on the new situation defined by the solutions proposed by the development teams and the need for refining and expanding the service scenarios through generalisation[32]. The Action Research flow on the side of the municipalities resulted particularly useful to address RQ1 and RQ3.

Research through Design methods, or rather the systematic investigation of the effects and implications of introducing a design object in the context, had been deeply intertwined both with the two flows of Action Research and the progressive stratification of the knowledge on multi-stakeholder, multi-purpose, multi-scale digital environments relying on the application of grounded theory methods.

The WGN platform in its materiality (anticipated by the existence of the platform components) highlighted specific issues, constraints and conditions to make the use of web-based technologies potentially acceptable to support urban cooperative governance mechanisms (contributing to answering RQ4). These issues, constraints and conditions would not be observable or discoverable without having a specific object, the platform, to reason on the delegation of power, agency, throughput legitimacy, stakeholders' relationships, and other aspects discussed in section 8.6. In addition, the artefact constituted by the Requirements Grid for the combined assessment of service scenarios and technology solutions enabled to uncover both human frictions and operational paths to connect the two perspectives of city stakeholders and technology makers (contributing to answer RQ5 and RQ6).

The core models presented in Chapter 5 helped in deepening the analysis relying on Research Through Design and Grounded Theory methods, to progress the conceptualisation related to:

- The representation of users, in particular at the two layers of organisations and communities (contributing to answering RQ1)
- The interdependences among city activities in various functional domains such as housing, mobility, social services (contributing to answering RQ2)
- The boundaries of the intervention space for technologies aimed to support urban cooperative governance mechanisms in local development processes (contributing to answering RQ3).

The insights and findings extracted from the set of these research activities consolidated and refined the findings associated with the first case study, but also furtherly extended the understanding of the relationship between web-based technologies and city dynamics in different settings, contexts and domains of activities (see Chapter 10).

8.3.4.a Data Sources*

The data* sources[33] used to support the research activities[34] include all the public deliverables of the project, available on the website of the European Commission at the links

[32] In section 8.4, I am going to explain why the generalisation of the service scenarios was extremely important in the WeGovNow project.

[33] Analogously to Chapter 7, I will refer to the materials used in the research as data* and not data. These materials do not include raw data, but complex elaboration of contextualised or abstract knowledge and wisdom of the participants in the process [See Chapter 7, section 7.3.4.a].

[34] As already specified in Chapter 6 (Section 6.7.3, Research ethics), I have not used data or materials belonging to third parties. I used only materials personally produced as part of my independent research activities aimed at analysing and conceptualising the elements emerging from the experience matured in the WeGovNow project. In addition, I used the public deliverables of the project, grey and academic literature on the trial sites, and publicly accessible documents. Thus, I do not expose reserved or protected information, or data of every type owned by third parties, or data subject to authorisation for their use.

https://ec.europa.eu/futurium/en/wegovnow and on the project website at https://wegovnow.eu/library/project-reports.html . In particular:

- D1.1: Consolidated Conceptual & Methodological Framework v.1
- D1.2: Consolidated Conceptual & Methodological Framework v.2
- D2.2: WeGovNow Use Cases v.1
- D2.3: WeGovNow Use Cases v.2
- D2.5: Local Validation Trial Report v.1
- D2.6: Local Validation Trial Report v.2
- D3.1: Consolidated System Architecture
- D3.3: First Release of WeGovNow Platform Prototype
- D3.4: Second Release of WeGovNow Platform Prototype
- D3.5: Final Release of WeGovNow Platform Prototype (with the Technical Report on the requirements analysis reported in this chapter as an Annex of the deliverable).

In this chapter, I am not going to report on the implementation of the WeGovNow platform as the result of the further development and integration of the platform components. I am not going to report either on the platform testing in some pilot initiatives in Turin, San Dona' di Piave and in the London Borough of Southwark. Thus, I have not considered as data* sources the contents collected through the WeGovNow platform in those occasions or other documents related to the development and testing of the platform.

Beyond the deliverables listed above, the data* sources for this case study included:

- Fieldnotes of the 4 contextual enquiries (2 in San Dona' and 2 in Turin) and 6 interviews conducted with the municipality staff of Turin and San Dona' di Piave

- Personal notes from 8 meetings for co-designing and validating the preliminary applicative scenarios and the meta-scenarios with the municipalities of Turin (5) and San Dona' di Piave (3)

- Personal notes of the 2 skype calls with the project partners acting on behalf of the London Borough of Southwark as regarding the interpretation of their scenarios and the validation of the meta-scenarios

- Notes taken at the 4 stakeholders public workshops, 1 project meeting, 1 technical meeting personally attended from 2016 to 2017, plus notes of the interviews at the development coordinator after 2 project meetings and 2 technical meetings not personally attended

- Notes on the analysis of the platform components and testing sessions

- Screenshots, pictures, schemas of the platform components interfaces (available also in the final project deliverables)

- Presentations prepared for 4 training sessions to the use of the platform components for the municipalities staff (personally prepared and conducted)

- Working documents prepared by me to facilitate the activities in the co-design and validation sessions

- Grey literature and public documents triangulating the information collected during meetings and workshop, or integrating the background elements of the applicative scenarios.

Additional data* sources are:

- the four Stakeholders/Actions and Actions/Requirements Grids of the meta-scenarios, iteratively integrated along the validation process (graphic and textual artefacts)

- the public version of the platform, in its subsequent releases in 2017 and 2018, as tool and object of discussion and reflection (online digital artefacts).

8.3.4.b. DATA Generation Activities*

Analogously to the first case study, the research accompanying the process for assembling the WeGovNow platform had been a practice-based research carried out while I was collaborating to the design of the platform solutions. Thus, part of the data* generation activities had been related to specific activities done aside or in partial overlapping with my professional collaboration in/with/for the platform development coordination team. Nevertheless, the elaboration of research findings related to this work remained independent from intertwined activities. My research agenda determined type, nature, and use of the data* sources in my work, and more specifically on what aspects of the project I focused my attention.

The **types of activities leading to the generation of data*** included: public workshops and public demos, one-to-one meetings, interviews, training and testing sessions, group meetings and co-design sessions, contextual enquiries.

The **techniques and tools applied for the generation and co-creation of data*** included: document analysis, open interviews, field observations, workshops facilitation techniques, working documents on the analysis of the platform components, requirements grids to represent the applicative scenarios and the related requirements.

The **type of data*** included mainly texts and notes from oral colloquiums, as for instance detailed descriptions of local protocols regulating the interaction between the municipalities and other local stakeholders. They also included PowerPoint presentations, screenshots, graphical representations of applicative scenarios, spreadsheets and tables.

The **participants to the activities** from which data* had been generated included representatives of the project partners, both municipalities and technical partners. To preserve the anonymity of participants and do not expose their organisations, no names are mentioned in the following analysis. I will refer generically to the municipalities staff or to the development teams. Other participants in the activities included local stakeholders directly or indirectly related to the applicative scenarios under discussion, involved in public demos and public meetings, but not in the co-design process. It is important to mention that the municipalities staff explicitly declared to act also on behalf of the area-based communities targeted by the project, because of their mission of operating in the public interest for them.

8.3.4.c DATA analysis*

The first cycle of data* analysis proceeded according to the two major tracks of design activities.

During the co-design process of the applicative scenarios with the municipalities of Turin and San Dona' (and indirectly London), I analysed the data* collected after each workshop, meeting or interview. At this stage, I identified the critical points highlighted by the partners, analysed their implications for the process and also operatively planned the next steps in the flow of activities. The information relevant for the design of the platform (especially in the last phase of generalisation of the applicative scenarios in service models) were also regularly discussed with the development coordinator. The person covering this role was in daily contact with the other development teams. Together, we iteratively assessed the feasibility of potential solutions emerging from the co-design process.

In parallel, I analysed the platform components by testing them, studying their interfaces, type of allowed interactions and internal logics by using the platforms in themselves and the related screenshots as data*sources. The characterisation of the web-based technologies with urban applications reported in Chapter 4 provided the basis in this step. The iterative negotiation of the requirements for the further development of the platform components and their integration helped in reflecting on the implications of each design choice from the perspective of the software developers.
A second cycle of analysis of all the data* sources for this case study had been performed at the end of my direct involvement in the process. At this point, I focused on exploring and understanding the connection between the two flows of the previous analysis and the specific objectives of my investigation on multi-stakeholder, multi-purpose, multi-scale web platforms. This second cycle of analysis produced integrative notes (or memos) associated with the collected data*sources. But it also resulted in a critical assessment of the findings emerging from the first case study against the settings outlined by the second one and the identification of new elements specifically related to the "reuse" of existing technologies, the constraints of cooperative governance mechanisms, the contingencies of a projects involving an extended cohort of technical and operational partners.

Lastly, I analysed the collected materials again twice to prepare this dissertation: a longitudinal analysis on WeGovNow reported in this chapter, and a transversal analysis of this case study and the other two for Chapter 10. The longitudinal analysis focused on:

- Clearly structuring and communicating the WGN **design process** through meta-design reasoning (reported in this section)

- Examining and discussing the **applicative scenarios** generated during the process by clustering them in a limited set of themes and analysing their characteristics in relation to the core models presented in Chapter 5 (see Section 8.4)

- Outlining the different sets of **requirements for the development of the WGN platform**, under the light of the constraints highlighted by the municipalities called to potentially restructure their cooperative governance protocols and the technical partners divided in between consolidating or innovating their tools (see Section 8.5)

- Organising the **lessons learned from the field and the insights from practice** by applying grounded theory procedures (see Section 8.6)

8.4 APPLICATIVE SCENARIOS OF AN URBAN COOPERATIVE GOVERNANCE PLATFORM

The applicative scenarios discussed for the first case study of a City-Mirror-in the Making focused on the coordination of urban activities independently carried out by different stakeholders operating in the city context (see Chapter 7). This case study provided instead the opportunity to closely analyse the **mechanisms for enabling offline and online cooperation among city stakeholders in local development actions**.

While coordination, cooperation and collaboration dynamics are usually interpreted in a fluid way, for the purposes of this work they had been distinguished on the basis of the concordance of goals and objectives, as well as considering the sharing of resources, responsibilities, risks, and benefits among the involved parties (see Chapter 1, section 1.1.4, and Chapter 5, section 5.4). To this regard, I recall that cooperation mechanisms are defined in this dissertation as the **constructs to compose a set of activities independently carry out by different agents to achieve a shared objective, but not necessarily the same goal** (in other words, the results of actions, joint actions included, have different outcomes, impact and relevance for each agent and its operational domain).

The aim of the WeGovNow project was to support a wide range of social forces working together to improve the local governance through shared projects, policies, initiatives. Thus, the applicative scenarios associated with this case study mainly concern the **forms of technology support to the cooperation among city stakeholders oriented toward common achievements dependent on their joint commitment**.

8.4.1 CONTEXTUALISING THE SERVICE SCENARIOS

Some contextual elements are needed to fully understand nature and motivations of the specific forms of cooperation envisaged in the three municipalities involved in the project, as well as the general expectations coming from a cooperative urban governance platform. These elements can be easily associated with the key themes of the applicative scenarios developed for the WGN platform [see table 8.1], summarised in:

- neighbourhood renewal, infrastructures development and mobility, job opportunites and social inclusion for the **London Borough of Southwark**
- management of green areas, industrial heritage, and public spaces for the **City of Turin**
- public/private partnership in local development initiatives for the **City of San Dona' di Piave**

The current challenges into the three municipalities related to these topics are all the results of plans, strategies and processes started in the early '90s. Nowadays, these operations need to be completed revised under the light of the deep changes in society, economy, and technologies that were impossible to foreseen three decades ago. A different framework worsened side effects and the unsustainability of policies elaborated in other times.

In the London Borough of Southwark, the only option considered for the neighborhood renewal at the end of '80s was to rely mainly on estate refurbishment companies and privates to face the terrible conditions of deprivation into social housing complexes [ref.book] However, one of the main causes of current social conflicts and stagnation in that area can be precisely correlated to that choice, because the management of social housing by privates increased rental rates and gentrification pressures [ref.b2].

In Turin, the General Plan of the City approved in 1995 (and based on analysis made years before) envisioned a transformation from a heavy industry-driven city to a new development model based on innovation, technology, culture and services. This vision led to prioritise the problem of many dismissed industrial sites, choosing to convert a significant part of them into new service hubs and green areas by using major public investments. Many interventions had been partially successfully concluded, as the case of the Dora Park, but nowadays the maintenance costs of these large public spaces are unbearable for the Public Administration of the city. In parallel, there is a lack of private initiatives to elaborate feasible exploitation plans that can benefit both the local community and their promoters. At the same time, the focus on infrastructural transformations left a side the social and demographic problem of a predominant low-qualified workforce (in a declining industrial city now almost without manufactures) and an aging population that remained marginal in the city transformation process. Especially, in the proximity of the regenerated areas where entire settlements hosted the families of factory workers.

In the Eastern Veneto, where the municipality of San Donà di Piave is located, the collapse of the industrial model based on large production sites linked to the economic crisis of the '80s generated a local proactive response based on the massive proliferation of new family-run businesses. This new economic model established an unprecedented level of wealth in Eastern Veneto among the highest in Europe, well-distributed between entrepreneurs and employees and without significant social marginalisation rates. Nevertheless, this economic model widened the gap between private and public sectors in terms of medium and long-term strategies for the local development. Their mutual indifference led to a two-track governance of the territory based on "self-sufficient industries" and public administrations expected to do not be "too interventionist". The new economic crisis started in 2008 hit the area of the Eastern Veneto more than others, specifically because of the intrinsic fragility of a very fragmented productive system not ready to the challenges of the competition in a global market. The municipalities in the area, San Donà di Piave included, found themselves in the difficult situation to face social issues new for that area (unemployment, poverty, social fragility), the demographic decline due to massive emigration, the need for new public-private networks to strengthen the community resilience, and the challenge of overcoming decades of general distrust toward the capacity of intervention of the public sector.

The size and administrative structure[35] of the three municipalities are other important factors impacting on their vision of cooperative governance models. As mentioned also in Chapter 6 in relation to the research design of this case study, while the London Borough of Southwark is a large municipality of about 320.000 inhabitants nestled into a metropolitan city of 8.7 million of inhabitants, San Donà di Piave is a small city counting just 40.000 residents in a predominantly rural area. In between, there is Turin, a medium size city of 880.000 inhabitants.

In the case of **Southwark**, the goal of establishing new protocols for a **cooperative governance seemed to be mostly oriented to sustain the self-organisation of citizens in a complex unknowable relational context to reach self-determined low-scale objectives and personal priorities**. This approach of the London Borough of Southwark can be understood by considering that economic development strategies and general policies are over-determined by the role of London as a global city and by the multi-level administration structure, in which a Borough have a very limited economic and political independence. Thus, the focus of cooperative governance mechanisms is on area-based communities to activate bottom-up changes that

[35] The context of analysis included Italy and the UK. These two countries have completely different systems, legislation and regulations for the management of the relationships with non-public actors at the city level. In addition, in the Italian system, every city is relatively autonomous in setting urban management protocols (except for the State-dependent budget), with significant difference from a city to another. One of the main objectives of the co-design process had been exactly reaching an overall consensus on the protocols not varying across different contexts to enable the generalisation of the forms of technology support to different kinds of processes. In the UK, the autonomy of cities and sub-units is considerably limited in comparison with Italian municipalities, with the exceptions of London and Manchester.

could impact on the well-being perceived at the local level, and secondarily benefit back the Borough/City Council as well.

The municipal administration of **San Donà di Piave**, as well as other small cities in Italy, is completely aware of the direct responsibilities of the public sector in providing answers to the community needs by creating the better conditions to develop and implement new policies. Italian municipalities have a strong autonomy in deciding the future of their territories and they are relatively independent to perform all the needed actions to reach the related objectives (remaining within their administrative budgets[36]). However, the main constraint remains the lack of economic resources, especially to implement radical changes or for investments in experimenting alternative service provision models. In that context, the quest for a new model of **cooperative governance over the city transformation is mostly oriented to find joint goals between public and private sectors to establish the administrative conditions to act on one side, and the means to implement the planned actions relaying on the deep territorial roots of local companies on the other side**.

The **City of Turin** is characterised by a net dualism between the administrative structure and the political government of the city, especially in the last years. The two parts have distinct agendas, plans and projects, but a strict operational interdependence as regarding the approval and implementation of action protocols. The administration manages only the city of Turin and it is basically stable over time, while the political side is in charge also of the Province of Turin and it is subjected to electoral changes in the city of Turin and in the other municipalities in the province. In this context, the autonomy to decide the future of the city is partial, compared to small cities, and it is the result of a continuous negotiation between the administrative sector and the political government of the city to meet different set of needs and perspectives. In addition, private actors in Turin have a key role in the urban management, as well as a myriad of civil society organisations. The **cooperative governance tends to be intended in this setting as a potential set of protocols to distribute the responsibilities over the city transformations among different actors**.

The role envisioned for new technologies according to these interpretations of the cooperative governance varies greatly in the three cities, and in particular the projections of a We-Government platform over the themes of community life, social issues, economic development and urban management.

The **London Borough of Southwark** already has its own portal to inform and communicate with the residents in the area, and different communities linked to different districts of Southwark and social housing complexes have their own community portals. A **We-Government platform can be seen as a neutral field** to support new forms of cooperation between local authorities and communities, or rather as an **instrumental medium to find new ways of dialoguing despite their contrasts, conflicts, factions, and territorial divisions.**

The **municipality of San Donà di Piave** imagined a **We-Government platform as a support system for innovations processes**, that must be constantly accompanied in an offline dimension and amplified by documenting these processes in a virtual space that could enhance participation, knowledge sharing and two-sides transparency.

In the **City of Turin**, a **We-Government platform** had been charged by apparent high expectations framing this kind of **technology as an external and autonomous solution to local problems**, which should independently emerge from the competition with other tools and ongoing initiatives in a fragmented social and institutional context.

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[36] Municipal budgets are based on the share of national and regional taxes, but mostly local taxes and incomes from urban transformations.

8.4.2 GENERALISATION OF THE SERVICE SCENARIOS

Finding new solutions to the issues linked to the social housing renewal into the inner city, developing strategies for a long-term sustainability of public investments on public spaces, and the need for new public-private partnerships in urban development initiatives are the starting points of the three different clusters of objectives that each municipality brought into the WeGovNow Project. Starting from them, the applicative scenarios initially developed had been iteratively discussed along the co-design process and extended to identify commonalities and recurrent elements in the various contexts. In other words, trying to find a common ground despite differences. As a result, the preliminary service scenarios[37] listed in Table 8.1 had been extended and generalised in four meta-scenarios (see Table 8.2) illustrating the main modalities and opportunities for multistakeholder cooperation in urban governance.

Table 8.2 Correspondence between preliminary scenarios and meta-scenarios

S(ID)	Scenarios	Meta-scenarios
1	Cleaner greener safer neighbourhoods through civic proposals	M2_Co-management
2	Highway scheme scoping initiative	M1_Co-design
3	Young People's Employment Pathways	M4_Co-production
4	Participatory design of an area for teenagers and young people in Dora park	M1_Co-design
5	Hortus conclusus: social gardening and co-management of public spaces	M2_Co-management
6	Iron Valley: Open air museum and industrial heritage of Turin	M1_Co-design
7	Parco Dora Shopping Mall and community's projects	M3_Co-organisation
8	The wine cellar as hub for high-quality agri-food	M3_Co-design
9	The Bank of Creativity as new innovative business network	M3_Co-organisation
10	Collaborative services in an ageing community	M4_Co-production
11	Urbact Local Groups for reactivating the historical city centre	M2_Co-organisation
12	Sustainable mobility and energy efficiency	M2_Co-management

The first meta-scenario covers the **co-design processes in projects driven by the public administration**[38] involving other stakeholders at the local level. The same pattern describes the articulation of the central activities in the following situations:

- community engagement in developing a plan for mobility infrastructures at the neighbourhood scale (S2_Highway scheme scoping, London)
- participatory design of a new area reserved to and equipped for the activities of teenagers and young people in one of the major parks of the city (S4_Dora park, Turin)
- involvement of the public in defining cultural offer and contents of an open air museum to enhance the industrial heritage of the city (S6_Iron Valley, Turin)
- collective rehabilitation and transformation of an abandoned public building in a space reserved for new activities of public interest (S8_The wine cellar, San Dona' di Piave).

[37] Each applicative scenario corresponds to a set of specific scenarios modelled for different stakeholders, for a total of about 60 scenarios. Here, I report the general scenarios uniting the perspectives of a plurality of stakeholders.
[38] I refer generically to public administration to indicate both the political and administrative organs of the local government.

The second meta-scenario concerns the **co-management of public spaces, urban commons and shared resources** between public administration and other city stakeholders. Specific cases discussed in the WGN project include:

- the co-management of a green area for social gardening and community activities (S5_Hortus conclusus, Turin)
- the collective care of public spaces through the implementation of civic proposals for a cleaner, greener and safer neighborhood (S1_Cleaner-greener-safer, London)
- the public mobilization for adopting sustainable mobility choices to reduce the energy consumptions and emissions of the entire city seen as a commons (S12_Energy Efficiency, San Dona' di Piave).

The third meta-scenario regards **initiatives and programmes co-organised by public and private sectors**. Examples developed in this case study are:

- the structured efforts of the management of a shopping mall to encourage and sustain socially relevant activities within its open areas, in partnership with non-profit organisations and public bodies (S7_Parco Dora Shopping Mall, Turin)
- the establishment of new economic models supporting creative industries at the local level by setting up commercial, educational and recreational activities in regenerated spaces (S9_The Bank of Cre-activity, San Dona' di Piave).
- the concerted actions between muncipality, retailers, hospitality providers, and cultural services for reactivating the historical city centre and its commercial streets (S11_Urbact Local groups, San Dona' di Piave).

The fourth meta-scenario envisions the **co-production of local services** through the development of complementary strands of activities between different types of city stakeholders. Analysis and reflections focused on:

- social services targeting in particular the ageing population, but also unempolyed people, low-income inhabitants, migrants (S10_ Ageing Community)
- youth employment support oriented to facilitate the access to training and job opportunities for all young people (S4_Young People's Employment Pathways)

8.4.3 CO-DESIGN OF PUBLIC ADMINISTRATION-DRIVEN PROJECTS

8.4.3.a From the field

The **objective** recurring in the scenarios of **co-design processes in projects driven by the public administration is structuring substantial and continuous forms of engagement to set up and implement collective actions on the basis of transparent rules and procedures in decision making processes**. As seen before, these aspects are central in the concept of throughput legitimacy [Scharpf 1999, Bekkers & Edwards 2007, Schmidt 2013]. Certainly, in the co-design process of the examined applicative scenarios, the attempt was to outline **feasible and acceptable alternatives** to public participatory processes oriented to gather inputs from people (input legitimacy) keeping their involvement extremely limited.

Indeed, the recurrent problem of public participation processes in cities is that they could appear as "*nothing more than rituals designed to satisfy legal requirements*" [Innes & Booher 2004]. At the best, according to the popular ladder of citizen participation outlined by Arnstein [1969], these processes can be seen as sort of public therapies or attempt to placate local stakeholders allowing them to publicly construct and express their positions (see also to this regard the concept of polyarchy in Chapter 5). The trajectory to define new strategies for avoiding these shortcomings is envisaged in the combined involvement of individuals (as citizens) and structured social formations (organisations) that actually have major interests, power, and ability to influence, overcome, or ignore the outcomes of public participation processes [Innes & Booher 2004], as we explored in the WeGovNow project. These strategies consist specifically in **new political practices between public administration and societal organisations** [Hajer & Wagenar 2003].

The co-design of the applicative scenarios incorporated in this first meta-scenario let to emerge that the major frictions to innovate public participation in urban transformations are connected exactly to the mismatch between political and administrative city structures, as regarding their perspectives and competences over these processes that have an intrinsic political nature. The implementation of substantial participatory processes implies different risks and benefits for the two sides of local governments.

As a political level, the chances of positive outcomes of the public engagement in urban transformations outweigh the low risks of facing protests or counteractions of some actors implicitly or explicitly marginalised or opposed in the process. Even in the case of poor adhesion to the promoted initiative, the process in itself can be used to demonstrate political willingness to open the city governance. Even though the population is not ready yet (or seem so), the opportunity to participate can be presented politically as a starting point. For instance, referents representing the political side of the local government in the pilot of San Dona' Di Piave positioned themselves in favour of radical innovations because bringing potential benefits internally (for the public administration) and externally (for the city as a whole), that technology can further amplify.

Looking instead at the administrative side of the local government, examined particularly in the city of Turin, risks appear predominant for public officers in comparison with potential benefits for them, their administration or the city. While the activities of the political and administrative sides of local governments are interdependent, designated administrators are usually called to follow participatory processes, ensure their compliance with local regulations, and personally respond of mistakes and issues within their department and above, both with administration and councillors. However, substantial and continuous participatory processes in urban transformations are not yet supported by clear protocols in place. For instance, as regarding simple operations as self-constructing urban furniture, but also more complex situations as agile forms of public procurement that could be necessary to keep up with the variable outcome of co-design processes. Digital technologies can be seen in these situations as problematic exactly because they amplify the exposure (and then the risks) associated with the experimentation of unconsolidated protocols. These unconsolidated protocols push responsibilities toward small segments of the public administration, and technologies potentially favour internal unwanted conflicts.

Considering these two perspectives, *"feasible and acceptable alternatives"* pointed toward **forms of technology support aimed at ensuring the application of clear explicit rules for the engagement and, at the same time, a *"modulated transparency"*, adjustable in different ways along the co-design process and its progression, to protect the most exposed users, the administrators.** The failure to address these concerns can automatically lead to a failure in the adoption of the platform by the local government. In this meta-scenario, **cooperation dynamics should be primarily supported inside the local government,** even though it could seem counterintuitive if talking about public participation open to citizens and local organisations.

So far, I reported on the underlying objective of this meta-scenario from the double perspective of one class of stakeholder. Moving to the goals, I extend the view also to other stakeholders. The **overall goal for the local government in the co-design of projects is building new infrastructures and facilities** in the city that better meet needs and priorities of residents and organisations affected by the future transformations. As emerging from the fieldwork, **establishing these needs and priorities is the most difficult part of co-design processes** because of the possibility to follow the instances that are better articulated (by some stakeholders) instead than the ones that are the most urgent, with disappointing results for government and local communities.

The **goals of the co-designers and co-implementers** (residents, non-profit organisations and local businesses[39]) are required by the local government to be aligned in some way to the ones of the local government. Conversely, in the workshops with local stakeholders, the participants external to the local government repeatedly stated that their goals in being part of such processes were influencing and impacting on the outcomes of the public decisions affecting their area of residence or work. From an operational point of view, this means **adhering to the process and opting for more or less intense forms of engagement in relation to the chances of maximising the specific benefits and strategic advantages coming from the participation in itself, in direct forms (responsibilities/compensation in the implementation phase) or indirect forms (connections, visibility, temporary coalitions for other purposes).**

This kind of considerations, emerging also in the experiences of Innes & Booher [2010] in multi-stakeholders collaborative planning processes, highlight how motivations and objectives significantly differ for each actor involved (or excluded) by public participation processes. At the same time, these considerations challenge the WGN technology designers to find concrete **appropriate solutions supporting meaningful, purposeful and pluralistic forms of engagement, possibly mitigating dysfunctional collective and organisational behaviours.**

Another essential aspect resulting to be determinant in the applications of the first meta-scenarios was the definition of the **communities directly benefiting from the interventions to be co-designed**. These kinds of participatory processes tend to look at the area-based communities living in the proximity of the interventions[40]. However, the intended users of new infrastructures or facilities (such as a highway or a new museum, park and social hubs) go beyond the ensemble of residents in a neighbourhood.

Thus, the WGN platform was called to address this tension between residents directly affected by urban transformations and groups of interests spread all over the city and beyond. Every stakeholder asked for differentiated forms of engagement that could take into account the impact of the outcomes of the co-design process over individuals and organisations, but at the same time also their ability to contribute by defining the needs and priorities to be developed. However, **consensus on the fairness of these differentiated forms of engagement was difficult to attain**. For instance, from a political perspective, spatial proximity to the area of intervention was a convenient criterion, finding its correspondence with electoral constituencies. On the contrary, the strategic value of certain facilities and their potential for the development of the city suggested to give priority to the instances of functional group of interests, independently from their localisation. From an administrative perspective, the reliability of the subjects involved in the process was instead determinant, leading to prioritise organisations representing communities or able to take substantial responsibilities in the implementation process.

[39] Interestingly, other stakeholders such as contractors and sub-contractors interested in building new infrastructures and facilities have been not considered as interested parties by the municipalities involved in the WGN project. Their choice is considered a private matter of the local government managed according to public procurements state laws.

[40] A collateral aspect is related to the homogeneity of communities living in the area of transformation with neighboring communities. For instance, the Dora Park is surrounded by an area regenerated a few years ago and hosting a population that is wealthier and younger of neighboring areas (e.g. Lucento), that conversely are undergoing a long phase of demographic and property decline. This invisible separation was a further element of tension in the scenario of building a new area for young people in the Dora park.

8.4.3.b Outputs of the service co-design

The process describing the meta-scenario of the **co-design of projects driven by the public administration** (and the related wegov services) is articulated into five macro-phases [see table 8.3]. Following they are described in relation to the specific role played by each platform component to address the needs, expectations and constraints communicated by the stakeholders involved in the research and design activities. In particular, I tried to highlight the main touchpoints among different actors mediated by the platform components into the synthetic narrative of ideal type situations.

Table 8.3 Meta-scenario 1 – Co-Design of Public Administration-driven projects: type of services provided by the WGN components

PROCESS PHASES	*FIRSTLIFE*	*LIQUID FEEDBACK*	*GEO-KEY-COMMUNITY MAPS*	*IMPROVE MY CITY*	*TRUSTED MARKET PLACE*	*ONTOMAP*
CALL FOR PARTICIPATION	Making public and accessible information about the call	Sharing and enforcing the rules of participation in the process	Providing context analysis and visualisation of open/public data concerning the transformation area			
CO-DESIGN	Enabling the collaborative documentation of offline activities and integration of online activities		Supporting the preparation of distinct groups proposals (as maps)			
DISCUSSION AND DECISION		Setting the online for open discussion about the proposals developed during the offline activities and by groups and their selection through voting options				
CALL FOR CONTRIBUTIONS	Publishing news, requests, and updates related to the call for tender				Gathering interests and potential contribution of local business and professionals to the selected project	
FOLLOW UP	Collecting contents about the activities and experiences involving administration and local stakeholders in the project			Gathering reports and managing issues in the transformaiton areas		Exploring data aggregated by topic, area, user or class of users, time interval throughout the process and at the end

Phase 1: Call for participation

This kind of processes starts with the local authorities defining the guidelines for the project to be developed and **launching a call for participation in the design process**. Calls are virtually opened to citizens as individuals, but frequently oriented to activate partnerships with non-profit organisations and local businesses operating in proximity of the project area or interested in the project theme. The priority is **giving visibility to the call at the local level** in order to increase the chances of engaging area-based communities, and to limit the attention of non-interested parties and non-local communities toward the call (for unincentivising comparisons, potential conflicts, destabilising intrusions in the process).

The **WGN platform addresses the divergent needs** of the public administration associated with this phase. In particular, by allowing public officers to inform citizens about the new co-design initiative sharing geo-referenced contents (news, documents, media) on **FirstLife**. These contents are visible on the area of intervention and virtually more accessible to the intended audience than a link in one of the hundred pages of the municipal websites. In addition, users can ask questions and clarifications and receive real-time answers by other users and by the public administration. The information on the call are complemented by open data and public data visualised on **Geo-Key/Community Maps**, and the system of rules for participating in the co-design process structured within **Liquid Feedback**. Respectively, the two tools facilitate the exploration of data available in the area of intervention and provide a clear framework for the involvement in the initiatives (criteria, timing, methods, steps, contribution options, evaluation approaches). Both tools allow users (communities and other stakeholders) to start thematic discussions about the project (on the basis of thematic maps and shared documents) and collecting preliminary inputs for the activities.

Phase 2: Co-design activities (online and offline)

Co-design initiatives for local transformations usually rely on a combination of face-to-face events and online activities. Workshops are organised by one or more departments of the municipality, sometimes in collaboration with local partners (e.g. community associations). The co-design activities developed during the workshops can be structured in one or more cycles, progressively oriented to define the functions and then components and design of the area. The online activities are meant to extend and complement the offline participation, but not to replace it.

Workshop activities can be documented by using **Geo-Key/Community Maps** to generate groups maps for distinct proposals collectively developed. Indeed, Geo-Key/Community maps provides basic drawing tools (shapes, lines, icons, pictures) to sketch users' inputs for the transformation of the area and locate activities, services, interventions to be implemented (without requiring users to have technical skills to make plans or more elaborated maps). **FirstLife** instead enable the creation of geo-referenced discussion groups for each proposal in a common space. The various groups and proposals become opened to the public for comments, photos, posts, but also easily explorable through tags-based search (e.g. finding all proposals described by a certain keywork and see their list, proponents, locations, while in Community Maps they remain distinct maps). The multiple groups attending the workshops, as well as facilitators, public officers, and local partners can use **FirstLife** to upload reports and collective plan the participatory workshops by using the entities called "events". In this phase, the **WGN provides a space for the collective storytelling of the co-design process, developed on multiple interlinked tracks across two tools.**

Phase 3: Discussion and selection of proposals

The central part of public-driven co-design processes is **discussing and selecting the proposals emerging in the generation activities**. To this regard, it has been considered fundamental distinguishing the forms of participation (online, offline, mixed) in this phase also on the platform. On one side, supporting individuals and organisations engagement in this kind of initiatives requires to enhance the value of attending offline activities in terms of perceived impact over the process (e.g. *"why spending my evening in this way if everyone else can arrive and destroy what we made?"*). On the other side, the quality of potential contributions shared by online users is not related to their attendance of offline workshops, but mostly dependent on their experience of places and perspectives on the projects. Indeed, working and personal reasons often exclude wide target groups (e.g. professionals, caregivers, young people) from offline participation, but their insights and proposals should be appropriately valued and incentivised.

To pragmatically approach this critical impasse without creating discriminations among users, the **WGN platform is called to support users to cooperate in developing, refining or transforming the projects seeds established during the offline activities**. In this way, workshop participants can set the general lines of discussion and be motivated to contributing online too. At the same time, final projects can benefit of new contributors to make single proposal more solid, sustainable, integrated, and potentially getting higher score/votes. **Liquid Feedback** functionalities support public opinion formation, debating, and cooperation on concurrent proposals, by tracing the evolution of each proposal over time until the voting phase through transparent versioning options. Liquid Feedback enable also an iterative evaluation of proposals and their alternatives to progressively select the most appropriate edits and transformations to improve the final outputs.

Phase 4: Call for contributions & call for tender

Once one of the proposals developed by the participants in the process has been selected, its implementation relies on **conventional calls for tender or be opened to contributions from communities and organisations willing to cooperate**. The two different options can be also integrated at different levels, having a call for tender related to the preparation of the technical project and heavy works, and a call for contributions opened to local suppliers, resident associations, businesses or professional that want to sponsor one or more component of the project or even participate in self-building them (e.g. minor works such as furniture, decorations, green arrangements). While calls for tender are regulated by administrative protocols and they are required to be managed within usual channels (e.g. deed of notoriety, affidavit, etc.), open calls for contribution in nature (skills, time, products, sponsoring) allow more flexible management options.

In this phase, the **WGN platform** works in parallel to other administrative and technological channels, **amplifying the reach of the calls and improving the transparency of public procurement procedures.** Both political and administrative concerns can be conciliated by sharing news, milestones, public audits, contractors' selection criteria and so on, while sticking on the regular protocols to avoid competencies conflicts and mismanagement risks. As regarding calls for contribution, the WGN platform can support the **creation and coordination of local groups** willing to participate in place-making initiatives related to the project (through **FirstLife**), but also facilitate a **dynamic matchmaking** between needs or requests related to these initiatives and resources and expertise available at the local level through the **Trusted Market Place**.

Phase 5. Follow up of the project

The follow up phase in co-design initiatives driven by a public administration presents peculiar challenges. Funds allocation quite often does not cover follow-up activities supporting public officers or external facilitators to keep their connection with the participants or to produce a structured assessment of the process to inform the following ones. Unexpected events (e.g. change of political agenda, budget cuts, new local or national regulations, delay in delivery or works starts) can impact on the timeline stated or discussed with partners and communities. Uncertainty about the progression of the project implementation at the end of face-to-face meetings and workshop can generate distrust in the process and its promoters, making more difficult to have a successful engagement in further initiatives in the same area or in other location (for comparison and by establishing a precedent). In the cases in which promoters manage to update participants on the implementation of the selected proposal, it is still difficult to maintain a minimum level of engagement and proactive interest in the project in itself and its local development goals.

A platform such as **WGN** is intended to be integrated in supporting cooperative governance models in continuity and this element is meant to sustain **the sustainability of its use independently from specific and discontinuous initiatives**. To this regard, updates on the project progresses can be easily shared both by public officers and other local partners or participants involved in the implementation phase (by using **FirstLife**, where they can add events, stories, news) as part of ordinary activities. Similarly, **OntoMap** can provide aggregated data from all the platform components at any time and available for all the involved stakeholders. These data segmented on the basis of specific topics, areas, classes of users, time interval, type of sources can support self-assessment and a collective elaboration of lesson learned from the process, both inside or outside the public administration. **Improve My City** can instead be used to collect citizens' reports during the execution of public works in the project area, engaging people in monitoring issues and progresses keeping a dialogue channel with the administration.

8.4.4 CO-MANAGEMENT OF PUBLIC SPACES, URBAN COMMONS AND SHARED RESOURCES

8.4.4.a From the field

The second meta-scenario concerns the **co-management of public spaces, urban commons and shared resources** between public administration and other city stakeholders. The differentiation of these three kinds of resources reflects only their **different ownership schema**. Public spaces formally belong to the ensemble of citizens of a State (not only the city or the neighborhood where they are located), but they are managed by local competent authorities acting as owners of specific spaces and regulating the conditions for their access, use and transformation. Shared resources usually indicate natural resources (air, water) or other resources (in this case the city as a whole entity) not under the ownership or management of specific subjects, but technically freely usable by anybody. Lastly, urban commons can include both tangible and intangible goods, belonging to the collectivity of a neighborhood, district, or city that can be entitled in toto or in groups to access, use, and transform that resource for its own purposes. Considering that, especially in recent years, the expression urban commons is frequently associated or even used as synonym for public spaces and the idea of the city as a commons is gaining popularity, the discussions with the project partners around the three analysed scenarios S1, S5 and S12 focused on the **status of urban commons** and their governance.

Potentially every tangible or intangible resource in a city can be considered as an urban common: monuments, infrastructures, parks, but also peculiar institutions regulating city life. Nevertheless, because of the different ownership schema mentioned before, only a small set of city resources can be made available for local communities and organisations. From the perspective of local governments, establishing cooperative governance models for the co-management of urban commons is a way of devolving responsibilities and practical duties. The main issue in this kind of settings is devolving responsibilities (and often costs) in the short or medium term, without losing the right to act as owner in the long term using the good temporarily declared as a commons at a later moment that is the most convenience for the administration or the city, possibly according to the principle of the public interest.

For groups of residents and non-profit organisations, the objective of proposing to co-management of urban spaces and facilities in cooperation with the public administration or other agencies is attempting to take advantage of opportunities in parallel to the "concession" mechanisms, entailing the payement for the use of public resources for the purposes of a specific organisation. It must be also considered that non-profit organisations operate as social enterprises, in competition with other kind of businesses.
However,

The ambivalence of goals and objectives of all the parties involved in the co-management of commons is made extremely conflictual because of multiple level of public discourse. The key challenge in providing technology support to the co-management of urban commons is enabling these multiple levels of discourse, within the framework of "elastic forms of cooperation" based on the uncertainty of these processes and the evolution.

8.4.4.b Outputs of the service co-design

The process describing the meta-scenario of the **co-management of public spaces, urban commons and shared resources** is articulated into three macro-phases [see Table 8.4].

Table 8.4 Meta-scenario 2 – Co-Management of Public Spaces, Urban Commons, and Shared Resources: type of services provided by the WGN components

PROCESS PHASES	*FIRSTLIFE*	*LIQUID FEEDBACK*	*GEO-KEY-COMMUNITY MAPS*	*IMPROVE MY CITY*	*TRUSTED MARKET PLACE*	*ONTOMAP*
COMMONS IDENTIFICATION	Crowd-Mapping campaigns of commons		Structuring the official catalogue of commons			Data aggregated by topic, areas, user (perceptions, values associated with commons).
AGREEMENT DEVELOPMENT	Enabling group formation based on spatial proximity and broadcast communication	Supporting the collaborative development of proposals, their selections and terms of agreements				
CO-MANAGEMENT AND MONITORING	Storyboarding the commoning experience and coordinating commons-related initiatives at scale			Reporting issues related to commons to the authorities and the groups managing the commons	Extending the group managaging the assigned commons with people having specific competences	

Phase 1: Identification of urban commons

The starting point for the municipalities interested to activate and support commoning practices is the **survey of public resources that can be available for local organisations willing to step in their management**. At the same time, the publication of official catalogues of commons can benefit third sector and citizens groups to orient their projects in the medium and long term. To strengthen this complementarity, it is important for **local communities and organisations to integrate the official list of commons with the resources, spaces, and activities that they consider of public relevance**, as well as updating and enriching official information.

In this phase, **Geo-Key/Community Map**s is the tool for structuring the official catalogue of commons and build an easily accessible map-based visualisation. It allows the staff of the PA to decide the structure of information (categories, descriptive field, nature and characteristics of multimedia contents, authorisations to contribute) as if it was a new project, but also to automatically import other datasets or catalogue previously prepared. The result is providing an analytic representation of commons and their complete informative cards. In parallel to that operation or subsequently, **FirstLife** can be used to enable crowd-mapping campaigns to identify other urban commons in a lighter way, but also to build multi-facet representation of commons (both official and community-defined) with concurrent descriptions and narratives that could help to better understand the intrinsic value given to specific commons [see also Chapter 7, section 7.4]. **OntoMap** can support the exploration by themes, areas, keywords of heterogeneous data associated to the same spatial entities on both platform and to switch from a crowdsourcing environment to an institutional one. In this phase, the **WGN platform provides all the stakeholders cooperating in the mapping operations with meaningful and actionable aggregation of information**.

Phase 2: Development of civic proposals and agreements for their management

Norms and regulations for the transfer of rights from the local government to private entities (non-profit or business) concerning the temporary use of public resources (spaces, assets, buildings) differ across countries and cities. However, the service co-design focused on the two central actions of **supporting the formations of groups of people and organisations interested to manage some commons** and **developing the agreements for their concession in a transparent, inclusive and constructive way.**

FirstLife and LiquidFeedback are the tools respectively linked to these two types of actions. **FirstLife** can support the formation of groups thanks to the option of sharing initial proposals, calls for participation and news in broadcast, identifying on the map the commons object of interests, and facilitating the aggregation of people living or working in the same area (on the basis of proximity connections among users and interaction with the same entities in the same areas) or attending the events taking place in the selected commons. **Liquid Feedback** instead offers to the Public administration the option of setting up a new discussion session reserved to the collection of proposals for a specific space, or a type of agreement (such as pact of collaboration or others) or a class of spaces (such as primary schools in a certain district). In Liquid Feedback, local groups and individuals can share new initiatives or contributing to the development of the ones already shared, integrating suggestions, support to merging concurrent lines, and actively negotiating the terms of the agreement in a public discussion space. Voting options can be used in key decision points, if public officers or representatives of interested groups consider them necessary to expedite the process. In this phase, the **WGN platform can smooth the definition of the agreements between multiple stakeholders cooperating to enhance the value of under-used urban commons.**

Phase 3: Co-management of spaces, monitoring and reporting.

Once a certain space or asset is temporarily assigned to an organisation or a structured group responsible for its management, it becomes important to document this experience to ensure possible renovations of the agreement on the basis on the generated value and impact. At the same time, leaving a trace of the interventions on urban commons can benefit communities involved in activities and events to create a sense of ownership and proactive engagement. Lastly, demonstrating the positive outcomes of commoning practices incentive the Public Administration to support them, despite the burden of remaining accountable for supervising the appropriate use of public resources and extraordinary maintenance. In cities experimenting new commoning regulations, several projects of co-management of spaces and assets run at the same time. Conventional tools such as websites or social media pages dedicated to the single initiatives do not addresses the underlying needs of all the stakeholder involved because of their limited capabilities and the fragmentation of information. Differently, the kind of technology-supported services required in the running phase concern **facilitating synergies among managing groups and external actors (local communities and organisations, other managing groups of commons) and the effective articulation of joint operations between PA and managing groups.**

FirstLife can facilitate local synergies by allowing the creation of online coordination groups supported by a place calendar. The same tool can also work as a crowdsourced repository of media documenting the commoning experiences building a storyline of each project and a storyline of commoning experiences at the city level. The **Trusted-Market Place** is called to support the exchange of resources and services among managing groups, or between each managing group and external actors. **Improve My City** can be used for reporting issues on public spaces and malfunctioning in the building or area used by the groups managing the area, sending alerts to the public administration or to the managing groups according to the type of report. In addition, this tool could be extended to manage requests and authorizations for the use of public spaces and other resources connected to the commons in co-management. The overall function of the **WGN platform in the running phase is enabling multiple forms of cooperation one-to-one, many-to-many, one-to-many, many-to-one in a light way**, by relying on the same simple tools combined in flexible configurations.

8.4.5 CO-ORGANISATION OF PRIVATE INITIATIVES FACILITATED BY THE PUBLIC ADMINISTRATION

8.4.5.a From the field

In the third meta-scenario, the public administration is called to perform a role completely different than in co-design of initiatives driven by the local government or in the co-management of urban commons with local partners. In this case, the emphasis is on the vision of the public administration as *superpartes* among private interests and entitled to proactively harmonise them in the public interest.

The workflow of the coordination of private initiatives is a generalisation of the following scenarios: "The Wine Cellar as a local innovative business network" and "Dora Shopping Mall and IPERCOOP". In San Donà di Piave, the applicative scenario is focused on the Wine cellar, a building under rehabilitation that will host local food producers for The main goal of the project id to define a new collaborative business models for the stakeholder that are going to use that space and opened it to the community. In Turin, the applicative scenario involves as main actors the company managing the Dora Shopping Mall and the

Ipercoop, the supermarket inside, characterized by a growing attention toward the community through initiatives and projects hosted in their public spaces. The second scenario cover only the last part of the entire workflow defined by the first one. Both can be extended to the other spaces managed by private actors that want to contribute in community activities.

In this case the primary cause of conflict is the visibility of coalitions, among different organisations on the territory and between these organisations and local authorities […].

8.4.5.b Outputs of the service co-design

The process describing the meta-scenario of the **initiatives and programmes co-organised by public and private sectors** is articulated into five macro-phases [see Table 8.5].

Table 8.5 Meta-scenario 3 – Coordination of Private Initiatives Facilitated by the Public Administration : type of services provided by the WGN components

PROCESS PHASES	FIRSTLIFE	LIQUID FEEDBACK	GEO-KEY-COMMUNITY MAPS	IMPROVE MY CITY	TRUSTED MARKET PLACE	ONTOMAP
BUSINESS MODEL DEVELOPMENT		Enabling the collaborative definition of the terms of joint initiatives, in particular the managing model				
LOCAL NETWORK ACTIVATION	Mapping of interested and potentially interested actors		Structuring sectorial information and launching ad hoc surveys			
INTER-ORGANISATIONAL COORDINATION	Supporting the self-organisation of events and thematic groups			Integrated reporting systems in public and privates spaces		
NETWORK CONSOLIDATION	Living archive and Activation points of the involved actors to engage external parties				Searching for collaborations, volunteers, partnerships, resources and services.	Exploring data aggregated by topic, area, user or class of users, time interval
PERIODICAL OPEN CALLS		Merging and combining different proposal to support synergies			Launching call for ideas and partnerships	

Phase 1: Collaborative building of the business/managing model

At the beginning, the Public Administration act as facilitator of the aggregation of resources and/or people to implement project and initiatives for the local development, in an economic and social perspective. To this end, the Public Administration identifies companies and local organisations managing or operating in the same space and involve them in new regeneration projects and/or business initiatives. Their active involvement can be supported through the **WGN platform**, where **multiple organisations can publicly**

discuss with the Public Administration and among them the terms of the governance models to be put in place.

This discussion can take place in **Liquid Feedback**, where initial proposals can be collected, the ideas receiving the higher support can be collectively developed (through integration of suggestions, review, and recomposition of concurrent proposals), alternative or concurrent proposal can be assessed in multiple steps, keeping trace of the evolution of the project or business model. In this sense, the **WGN platform operate as a platform for the composition of the different interests** of the involved parties aimed at making possible their cooperation into a common schema.

Phase 2: Local network activation

In the kind of applications covered by this meta-scenario, the definition of rules come first, before any other action and not necessarily relying on extensive information. Once established the rules of engagement and mutuality, the planning of future operations can benefit of the **construction of a common knowledge base** on the topic of relevant interest for the network promoting the project by relying on the **WGN platform**.

Similarly to the previous two service lines, **Geo-key/Community Maps** and **FirstLife** can serve complementary activities: a) constructing an archive of sectorial information potentially divided in subprojects independently managed by distinct organisations, and b) enabling an open mapping of businesses and privates connected to the network, giving visibility to their activities, stories, services, relationships.

For instance, in the scenario of the Bank of Creativity, the goal was creating a network of local creative industries cooperating in sustainable ways to maximise the benefits coming from sharing the same space and operating in the same area. In this case, thematic information about different industry sector can help to have a census of creative professionals, but mostly important mapping the network of producers, suppliers, and side businesses can support the elaboration of new joint strategies (e.g. optimising logistics of delivery and auxiliary services). Similar considerations are also valid in the scenario of a huge shopping mall covering an extensive area of the city and connected to neighboring commercial areas, and for the purpose of orchestrating the cultural and commercial reactivation of a city center with a declining attractivity.

Phase 3: Inter-organizational coordination

To facilitate multiple organisations (businesses, cultural organisations, public bodies) in composing their activities under their agreed schema and purpose, the **WGN platform is called to provide support to the dynamic reattribution or roles and responsibilities over time and in a distributed way**, as well as organising the access to shared resources such as common spaces through reservation options.

The combination of the consolidated functionalities of **FirstLife** with **ImproveMyCity** can provide this kind of service in the form of a unified control panel where everyone can read what is happening and what is planned in a specific area (public groups, events, news on FL), and having a clear picture of the organisations managing the operations, responsible for addressing potential issues.

Phase 4: Network consolidation and growing

In the consolidation phase of the network, the **WGN platform can be used to extend the involvement of local actors, both as passive recipients of the activated services and initiatives, but also as prospective new partners.**

FirstLife can support light forms of engagement such as sharing contents by using groups, new, events, but also collaborative and distributed stories about products and services. In this way, it can work as an archive of past, present and planned activities. The **Trusted Market Place** can instead enable the contingent research of collaboration, volunteers, partnership for projects calls, resources and services.

At the same time, **OntoMap** become useful for the Public Administration (and potentially for other stakeholders) to identify the strand of activities needing a stronger public support, inputs to revise the common schema, and build programmes to attract external funds (e.g. EU funds).

Phase 5: Periodical calls for ideas/projects

The consolidation/extension phase can be boosted through periodical calls for ideas/project or even public contexts supported by the WGN platform. In this framework, the **Trusted Market Place** can facilitate the matchmaking between different expertise and assets among organisations interested to present a proposal. **Liquid Feedback**, similarly to the previous scenarios, enable the collaborative construction of proposals and their selection through multiple voting options (within specific groups or opened, on alternative of the same proposals or among competing proposals, with yes/no options or preferential voting).

8.4.6 CO-PRODUCTION OF SERVICES BETWEEN PUBLIC AND PRIVATE SECTOR

8.4.6.a From the field

The meta-practices of the co-production of services between public and private sectors is a complex scenario where the Public Administration has the role of initiator of a process aimed to create an integrated system of services in a specific or crossing domain. The main goal is to involve privates, businesses, professionals, and the third sector in sharing knowledge and skills in a common digital space to cooperate in real world, consolidate their networks and work synergistically with public offices.

The workflow of co-production of services is a generalisation of the following service scenarios: "Collaborative services in an ageing community". In San Donà di Piave, the applicative scenario is focused on social service having as target groups the ageing population, but also, etc. The same process could be transposed in other branch of city services, such as the ones dedicated to education, job placement, environmental services, etc. Considering the WeGovNow platform as a tool to support an extensive engagement path, the implementation of this kind of scenario can take months, especially for the phase 3 and 5 […].

8.4.6.b Outputs of the service co-design

The process describing the meta-scenario of the **co-production of local services** is articulated into five macro-phases [see Table 8.6]. Its level of complexity is significantly higher than in the previous meta-scenarios both for the necessary malleability of the process and the partial harmonisation of a multitude of related organisational and business's needs. The WGN platform in this case is called only to facilitate the synchronisation of distinct workflows and not to directly support them.

Table 8.6 Meta-scenario 4 – Co-Production of Services Between Public and Private Sector: type of services provided by the WGN component

PROCESS PHASES	FIRSTLIFE	LIQUID FEEDBACK	GEO-KEY-COMMUNITY MAPS	IMPROVE MY CITY	TRUSTED MARKET PLACE	ONTOMAP
ASSESSEMENT EXISTING SERVICES PROVISION	Mapping of public facilities based on modular and flexible cards		Representation of aggregated data of the social and economic context			Analysis and exploration of heterogenous sources through their semantic aggregation
NEEDS ASSESSEMENT	Gathering crowdsourced contents and exploration by temporal and spatial filters			Collecting reports and manage the requests of intervention by level of priority and involved providers		
AGGREGATION COMPLEMENTARY OFFER	Aggregating contents in open gorup maps and through bottom-up relationships among entitities.				Joint call for actions, call for partnerships, call for projects, vacancies, directs requests for resources.	
DEFINITION OF NEW TARGETS AND SERVICES		Collective elaboration of community goals, strategic actions and priorities for implementing the co-production of services.				
CO-PRODUCTION OF SERVICES	Entry point for discussing and coordinatins local activities among distributed operators or sub-groups				Match-making offers-requests for collaborations, skills, resources on a spatial, temporal, thematic basis	

Phase 1: Assessment of the existing provision of local services

Structuring the co-production of services in critical sectors requires at the beginning to overcome internal barriers to the sharing of information and its fragmentation by supplier (public administration department, public and semi-public agencies, external contractors, independent providers). In phase 1, municipal authorities envisaged to mapping public offices and facilities associated with one of more sectors of city services considered interdependent. The **WGN platform serves as aggregator and unified portal of public information currently fragmented in multiple portals, web pages, tools and municipal archives**. The cooperation is at the beginning envisioned primarily among sectors and department of the public administration.

The Municipal staff will use the platform to make available for the public the representation of aggregated data of the social and economic context including demographic, economic and social information (existing in digital archives) associated to specific areas, such as neighborhoods or suburbs. In parallel, an active content creation will reorganise the basic information about facilities and services, such as location, opening times, target population, type of services, application procedures, etc. The first part of activities can be supported by **Geo-key / Community Maps** allowing the development of thematic maps on the basis of existing surveys and institutional information, and **OntoMap** facilitating the exploration and analysis of heterogenous sources through their semantic aggregation. Then, **FirstLife** can help to overcome the limitation of standard institutional portals and associated web-GIS (e.g. rigid data structure, centralisation, information obsolescence) by enabling a mapping of public facilities based on modular and flexible cards, that can be updated over time, independently integrated by public officers and other stakeholder following involved in the process.

Phase 2: Needs assessment

The content creation effort of the first phase provides the baseline for activating a cooperative monitoring and data integration (institutional and crowdsourced from organisations and communities providing and accessing local services). The integration of information about the provision of local services in one specific domain or in related one is planned as cooperatively done by platform users previously familiarised with the platform (through face-to-face training sessions) and recognised as interested parties (e.g. through memorandum of understanding). Supported by local communication campaigns, also citizens can contribute to the needs assessment by sharing additional contents on the map and use the platform to request timely intervention in critical situations. The expected result is the use of the WGN platform as a **dynamic archive of evolving services available for all platform users**, and not only for administrators and policy makers in the public sector. The scope of this archive is enabling a continuous assessment of the users' needs in one of more sectors of local services. Consistently with the acknowledgement that these needs can also be subjected to rapid changes, unplanned events, extraordinary situations, the WGN archive is integrated with an online and fast **reporting systems to send intervention requests to the main service providers or to the public administration**.

These functionalities are supported respectively by FirstLife and Improve My City. **FirstLife** is considered for gathering crowdsourced contents, but mostly important for their exploration by using temporal and spatial filters to see how the offer of local services evolved over time and in different areas. **Improve My City**, detached from the most common use of collecting complaints about urban infrastructures and furniture, is instead reframed in its purpose to collect reports and manage the requests of intervention by level of priority and involved providers. These interventions can concern elders, frail members of the community, or other sensible social matters that are relevant for the providers of social, education, and assistance services. The requests work as an alert, discretely reported (not publicly), to facilitate service providers in being aware of local emergencies and issues under their competence. The two combined tools allow an iterative assessment of available services and impact of public and private actions/interventions at territorial level.

Phase 3: Aggregation of complementary offers

The mapping of the existing offer of local services (e.g. social services, health, education, employment support, housing delivery) and the collective and iterative needs assessment can support the definition of joint plans, strategies, and operations among city stakeholders independently engaged in providing such services or providing complementary/auxiliary services. Public and private institutions, professionals, business, third sector organisations can use the **WGN platform:**

- **to defining their areas of intervention and make it known to third parties**
- **to coordinate their operations with other providers active in the same area**
- **to documenting local initiatives, projects and events implemented in the city**
- **to representing their collaboration/territorial networks.**

FirstLife allows users (specifically organisations) to create group maps aggregating different entities such as places, events, news, sub-groups, reports. These group maps, visible to all users, structure platform contents accordingly to organisations or specific projects, programmes, services. In addition, one of the functionalities called "initiatives" allows users to create bottom up relationships among different entities making possible to visualise and integrate over time networks of collaborations at the local scale. The **Trusted Market Place** can support instead to identify and reach other organisations through joint call for actions, call for partnerships, call for projects, vacancies, directs requests for resources.

Phase 4: Definition of new targets and services

Once the platform is integrated in the city life as a tool for establishing decentralised and cooperative governance models between public administration and local stakeholders, the co-production of services could be strengthen by periodically launching public consultations on the **WGN platform to define strategic goals for local communities and joint programmes for local services or other cross-domain topics**.

These exercises of community visioning and service design at the city scale can be supported by a tool such as **Liquid Feedback.** In these extraordinary actions, this component enables users from a plurality of organisations and within/across communities in:

- Assessing the available services and impact of previous initiatives and projects
- Discussing online about visions and strategic goals for the community, with a prioritisation among concurrent programmes and projects to implement them
- Collaboratively building proposals for the implementation programmes within or across organisations and communities
- Facilitating the opinion formation about proposals and alternatives by providing a space to clearly expose their constraints, opportunities, answering to common concerns and validating specific solutions
- Identifying and selecting the proposals with a wide support from local stakeholders to be implemented year after year
- Publishing the results of the decision-making process and its development.

Phase 5: Co-production of services

The WGN platform is called to support the **proactive self-organisation of new services or new arrangements between public and private/non-profit sector**. At this point, differently from the preliminary phases oriented toward the promotion of a systemic change through a wide engagement, the platform is meant to provide operational support for the implementation of new services jointly defined by two or more stakeholders in a specific range of activities (e.g. engagement of local schools in job placement programmes, on-call health professionals teams in holidays periods).

To this purpose, tools such as **FirstLife** and **Trusted Market Place** can be used by any temporary aggregation of local organisations to set up these arrangements, independently from the public administration, or in collaboration with community representatives and public agencies.

FirstLife provides:

- geo-referenced groups as an entry point for discussing and coordinatins local activities among distributed operators or sub-groups
- bulletin boards of groups and organizations showing activities, projects, events to which they collaborated or promoted in a selected interval of time
- the feature "initiative" to represent local networks involved in providing specific services or adhering to specific framework and projects
- events and stories to switch from offline activities to an online collaborative storytelling of the city system in the domains of social, education, health services.

Trusted Marketplace can help to:

- matching of users/organisations publishing requests of collaborations/resources with other users/organisations that can offer them
- collecting skills/resources cards for local organisations, integrated with the organisation's bulletin board
- searching requests on a temporal, spatial and thematic basis
- updating on the status of requests.

8.5 REFACTORING E-GOV TOOLS IN WE-GOV TOOLS

The analysis of the applicative scenarios for the WGN platform highlighted how each component can play different roles along urban cooperative governance processes. In this section, I focus instead on how specific design choices, interpretations and revised use patterns can facilitate the transition of consolidated e-gov tools into WeGovernment instruments. I am going to discuss these aspects starting from the main requirements gathered during the design and research process.

8.5.1. CLASSES OF REQUIREMENTS

The service design process allowed to extract, analyse, cluster, and address four classes of requirements:

1) **External requirements**, concerning the expectations about the dissemination and communication of the platform to involve end-users (local organisations and residents) on the platform
2) **Unspecific non-functional requirements**, associated with general expectations about the functioning of the platform as a technological tool
3) **Specific non-functional requirements** about the overall setup of the platform and the internal coherence of the assembled components
4) **Specific functional requirements** based on the implementation of the scenarios through the combination of the platform components.

External requirements brought to light legitimate concerns related to the impact of the project, but not inputs for the development of the single components or the assembling of the unified platform. For instance, this type of requirements included statements such as *"the platform must be promoted and used by a large public"* or *"the municipal staff should be trained in using the platform"*. The required actions of such requirements pertain to the preparation of marketing strategies, dissemination operations, communication policies, and training resources by competent organisations, but are not directly related to technological challenges.

Unspecific non-functional requirements were associated with basic principles for the design of technology systems which are mostly already addressed in best practices, common protocols, development frameworks and standards in use for web-based technologies. They included generic requirements such *as "the platform should be easy to use"*. Considering that usability is always conventionally referred to specific target users and to a specific purpose that a system is called to fulfil, the concept of usability in an urban governance platform opened to a quite diverse range of users and activities needs to be approached pragmatically and holistically, looking at improving orientation and feedback mechanisms for different kind of users and use patterns. Other unspecific non-functional requirements included *"the platform should be safe"* or *"transparent"* or *"accountable"*. Again, this type of requirements calls for improving the legibility of the processes supported by the platform, clear policies for the management of data excluding their inappropriate exploitations for secondary purposes, and reliable mechanisms to connect the actions on the platform with the responsibilities of individual and collective users. These aspects can be addressed by complying with data regulations and best practices, as well as improving the communication strategies associated with the platform adoption by focusing on the most common concerns of several groups of users. Still, they do not imply specific constraints for the development of the WGN platform.

On the basis of these considerations, the analysis focused only on specific functional and non-functional requirements for the WGN platform that could actually provide elements to orient the design process.

Specific functional requirements included the inputs to revise, integrate, and extend a part of the functionalities of the platform components and inputs for their integration based on the need to enhance the complementarity of different tools and limit the duplication of features. A significant part of the specific functional requirements were cross-scenarios and cross-site, or rather recurring in multiple processes in every municipality involved in the project. Specific functional requirements (the most significant listed below in table 8.7) were directly associated with the kind of operations that could be implemented by the technical teams and independent by exogen activities of dissemination, training, communication.

Specific non-functional requirements included all the inputs to improve the overall perception and functioning of the platform as a coherent unit composed by different tools. This class of requirements, while not strictly needed to make the single components supporting the applicative scenarios, were instead indispensable to support the daily use of platform by reaching high-standard quality levels of effectiveness, efficiency, responsiveness to the expectations and automatisms of various user targets. These requirements, expected to be meet in the finalisation of the platform before its deployment, were mainly related to the visual coherence of components in terms of colours, position and recognisability of recurrent elements, type of interaction for similar features.

Table 8.7 Grid providing some examples of the requirements specific to the platform, specific to a component or unspecific. In green, development activities. In blue, requirements that will be addressed in the preparation of the instantionations for the single municipalities. In red, the class of requirements which will be not addressed (Source: Lupi & Antonini 2017, Technical report WGN)

	Specific to the platform	Specific to a component	Unspecific
Functional	• Export data • Notifications Organisations	• Import data • Rules of public calls • Search for requests	• Usable • Reliable • Intuitive
Non-functional	• Documentation • Standards • Support users	• Usability • Accessibility • Look and feel	• Communication • Advertisement • Training

The next two sections will present, respectively, the specific functional requirements for the refactoring of the single components (indicated as **"longitudinal requirements"**) and the specific and unspecific functional requirements of the unified platform resulting from the assemblage of the components (indicated also as **"transversal requirements"**). It is important to mention here that the requirements discussed below are the results of the research and design process, but several contingencies related to the management of the development allowed to implement them only partially. However, as specified at the beginning, this chapter does not cover the implementation stage of the platform because not essential in relation to the scope of the research[41].

[41] To see to what extent the requirements had been instantiated, please, explore the three city platforms accessible at https://wegovnow.eu or the project deliverables. Unfortunately, as it frequently happens in short-medium term projects, technical support to the access and use of the developed tools is not necessarily provided after the end of the project. Some components of

8.5.2 REPURPOSING OF THE PLATFORM COMPONENTS: LONGITUDINAL REQUIREMENTS

The longitudinal requirements extracted for each component of the WGN platform had been derived directly from the analysis of the scenarios and meta-scenarios,and discussed with technical and not technical partners (see also Tab. 8.8). Here, these requirements are also illustrated under the light of the **wegov principles** and the elements of the core models presented in Chapter 5, especially as regarding the **conceptual reframing** of the tools to be integrated into the unified platform and the **forms of support of the individual components to cooperative practices in programmes, projects and services** […].

Table 8.8 Summary of the actions, integrations and new features for each component, involved in the processes of the meta-scenarios. (Source: Lupi & Antonini 2017, Technical report WGN)

	CM/GK	FL/OTM	IMC	LF	TM/OTM
Actions	- surveys -group map -group plans -sharing plans	- local groups - events -crowd mapping - monitoring - dissemination	- reporting - accountability	- proposals - contributing - decision - rules	- collaborations - monitoring - dissemination - group making
New Features	- importing plans - Importing surveys	-exporting data -exploring data -area calendar	- zone to units - boundaries -public / private management - private reports	-call description	- exporting data - search - recommendation
Integrations	-to initiative	- all initiatives - all plans - all activities	- from map	-group plans - from map -from calendar	- notifications - initiatives - groups - initiatives

8.5.2 ASSEMBLING THE WGN PLATFORM: TRANSVERSAL SYSTEM REQUIREMENTS

From the perspective of the development of the platform, the requests of new features falling within the scope of the project were far less predominant than expected. On the other hand, the sensibility of stakeholders and municipalities was strongly focused on the cost of introducing a new tool in their activities, and on meeting the expectation of their end users.

There are multiple reasons for those results:

the platform or their functionalities or their local instantiations for the three municipalities became progressively unavailable during 2019 and 2020. Their descriptions and screenshots are still available in the project deliverables on the project website.

1) Municipalities are directly responsible of the engagement of end users and of their internal staff in the project, therefore it is critical that the platform does not jeopardize their credibility nor the introduction of the platform within their procedures is welcomed as an extra burden.

2) The integration of consolidated e-gov technologies provides already consolidated methodologies, lessening the need to develop new solutions.
3) Building a platform from stand-alone components makes the construction of a uniform identity of the platform very costly and complicated. Those difficulties are very evident also for the municipalities and stakeholders, driving their attention toward the problem of uniformity, interoperability and identity of the platform.

The features and requirements in common among trial sites and service scenarios deserved particular consideration in terms of cost/benefit evaluation of the development effort. Moreover, features and requirements about the adoption of WeGovNow platform were critical for the success of the project itself.

The potential adoption of the platform was indeed linked to:

a) Interoperability with existing tools: the possibility to interconnect WeGovNow platform with existing software through the adoption of standards
b) Connecting with existing authentication services used by other local services.
c) Unify the mechanisms to access to guides and FAQs of each specific component
d) Single helpdesk for WeGovNow platform
e) Organisations accounts, users from an organisation should sign their contents as their organisation sector (e.g. Dept. of social services of the municipality of…)
f) Custom monitoring of entities, the possibility to set up notification preferences at entity level to receive emails about the updates.
g) Import project data, from csv loading both metadata and records
h) Exporting datasets, a form where to specify time interval, location, topics to export data platform wise, with additional setups regarding the inclusion of comments or other related contents.

a) Interoperability with Existing Tools

The interoperability with existing tool had been addressed though the choice of common standards for the tools to be assembled (e.g. REST APIs, GeoJSON format for spatial data, RDF triplestore for ontologies of entities).

This requirement had been a priority to demonstrate to all development teams and municipalities that integration was possible and relatively cheap in terms of development, opening the way for addressing other requirements such as integration with authentication systems, data import, data export, without requiring any other specific development.

b) Connecting with Existing Authentication Services

WeGovNow had its own native authentication server (UWUM) for the registration of users and enabled the use of two more registration system connected to social media platforms (Google+ and Facebook). On the other hand, municipalities and big organisations involved in the deployment of the platform already had their own authentication systems for end users and their employees. The requirements pointed out the need to connect WeGovNow also to local authentication systems, in order to enable end users to use the same "official" account already used for all other local services.

c) Unified Access to User Guides

Each component to be assembled in the WGN platform had its own documentation and method to provide tutorial and user support: integrated as part of the tool interfaces (such as Liquid Feedback), as pdf, in an external web site, etc. This requirement was not entailing the need for a unified documentation, but to provide documentation in a unified and reliable way to end users though a common mechanism for accessing the documentation, the same method regardless the specific component. The light approach envisaged to extend the component configuration with a link to support web resource (pdf, a web site, etc.) The introduction of this reference was aimed at extending the navigation bar and introducing a contextual "help button" in the right corner to show the support resources of the current component.

d) Single Helpdesk

Every instantiation of the WeGovNow in different municipalities would have required one single helpdesk for all components. This requirement is supported by the best practices and guidelines. The platform helpdesk was meant to provide a single first level support which will report the technical issues to single technical teams of each component involved in the issue resolution. This requirement, as others, was part of the need for interlinking the new platform with existing systems at trial sites and technical support.

e) Organisation Account

This requirement came from the municipalities, but it could be extended to formal organisations. Indeed, it was related to the consolidated custom of publishing contents "under the umbrella" of an institutional account in structured organisations. It was critical for formal organisations to give a proper frame to their employee contents, and to control the information flow. From the perspective of employees, it was critical to be protected "under the veil" of the institutions avoiding personal responsibility. The expected outcome was to have contents posted by organisations, supporting the internal structure of the organisation and the traceability of contents within the organisation (avoiding shared accounts).

There were multiple approaches that could be used to make the WeGovNow components setting an organisational account. However, the technical evaluation indicated that most suitable solution should have been designing an ex-novo feature based on the native mechanism of one of the consolidated components (post-assemblage). The most suited component had been identified in LiquidFeedback, since it provides authentication functionalities, but also the Trusted Marketplace could provide this feature as part of the user setup.

f) Custom Monitoring of Entities

From the perspective of local authorities, it was extremely important to manage key steps or key information such as a public call. An effective management requires to: 1) monitor the evolution of specific contents such as a project proposal, 2) keep the quality of notification low in number and focused the enable an effective use of the platform by municipality staff. Thus, the notification system was required to support both digests about locations or themes and punctual updates related to specific entities.

Each component had already its own notification system, but the Trusted Martketplace component was expected to support end users in managing the overall notification setup exploiting the user's profile settings in the authentication system. To support notifications at entity level, the integration of a notification system had been proposed also for the OntoMap to trace edits and changes made users with explicit reference to the modified entities in order to build cross-component fine grain notifications, assuming the consistency of references between components. To support the consistency of references, the WeGovNow components could rely on linked data provided by OntoMap or the InputMap.

g) Importing Data

Even though WeGovNow instances for the trial sites would have provided already a relevant set of local linked open data, the platform was expected to support the autonomous intervention of municipalities and other local actors in importing new datasets: open data, projects plans, proposals, etc. The municipalities asked to be enabled to load datasets in a semi-automated way from in the most common format of spreadsheet (.csv, .xls). In most of the cases, data were geospatial datasets, supported by GeoKey, FirstLife and OntoMap. The choice had been linked to the different type of information and features provided by the platform. Geokey was the most appropriate choice for automated import to input a project plan or surveys. Differently, FirstLife was a better fit to collect contributions, initiatives and other contents. About importing open data, it was not realistic to provide automated tools for ontology alignment.

h) Exporting Data

In order to monitor and report about project and activities, it is expected to be enabled to use the filtering capabilities of WeGovNow to extract datasets, for instance about specific topics, time frame, locations, etc. The export of data should be executed by organisation and municipality staff. Currently, component data can be retrieved via API but about platform wise data there is not a solution ready. Nevertheless, quering OntoMap linked data or from OntoMap logger could be a starting point if we manage to build a crawler which to resolve deep links.

i) Landing page

The landing page, another auxiliary component, was intended to be as a sort of city dashboard rendering last updates on local initiatives, proposals under discussion or for voting, on-going regeneration projects, thematic information, and opportunities related to services, resources, people in the city. Differently from the model of urban dashboards seen in Chapter 4 (sections 4.3.1.a, 4.3.1.d), the focus was on people's activities. This was an ex-novo component of the WGN platform.

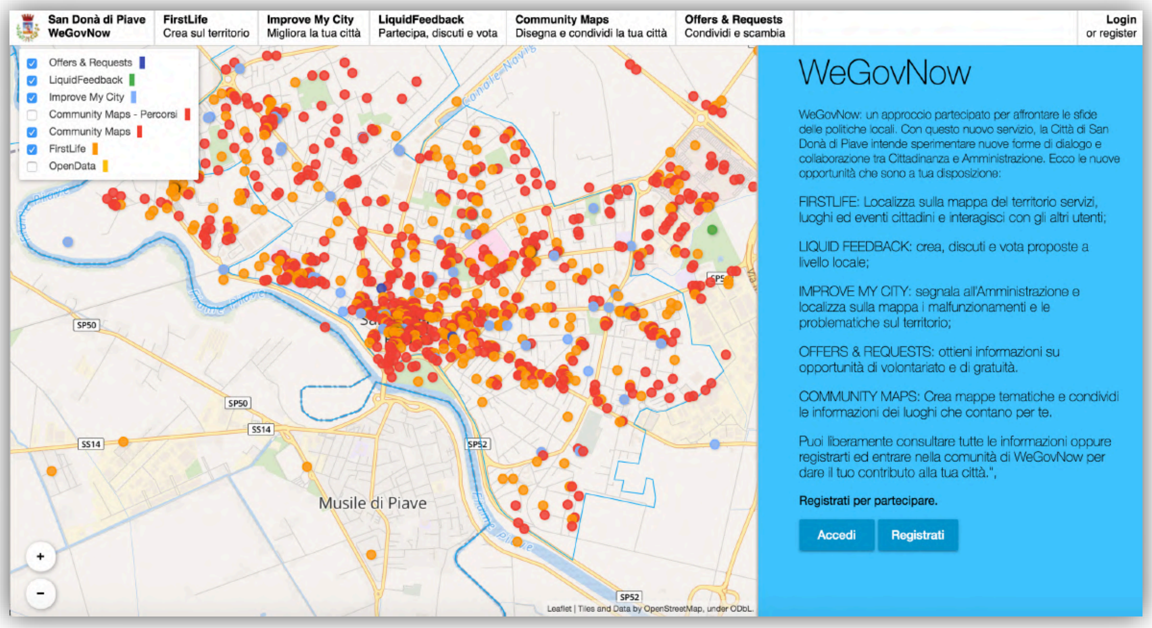

Fig. 8.6 Screenshot of the landing page of WeGovNow for the municipality of San Dona' di Piave (IT) – (https://sandona.wegovnow.eu/#/, screenshot taken in 2018).

8.6 A COOPERATIVE GOVERNANCE PLATFORM AS A CITY MIRROR. PRELIMINARY ANSWERS TO THE RESEARCH QUESTIONS

RQ1: *What users' characteristics should be represented on a City Mirror for offering to the city stakeholders a better understanding of the social context in which they operate?*	The applicative scenarios developed for this case study highlighted the importance of **visualising the boundaries among communities**, event when not corresponding to administrative perimeters. Indeed, **urban transformation could require the definition of alternative way to indicate the interested communities and identified the subjects impacted by those transformations**. As regarding the private-public partnerships, or multi-actor cooperative dynamic, a priority was to clearly represent the **differences in competences or responsibilities**. This was particularly critical in the cases in which **more than one actor belonging to different classes of stakeholders performed similar kind of actions** (e.g. maintenance of public space, provision of social services).
RQ2: *What factors should be considered for matching the specificity of the city context and the patters of local development actions with the unspecificity of the online environment defined by a City Mirror?*	This case study provided the opportunity of examining applicative scenarios covering a wide range of topics and in cities characterised by social, cultural, economic, and institutional context extremely different. The balancing between specificity of the operational framework of city stakeholders and the environment provided by the cooperative governance platform relied on the **modelling of a set of flexible modular processes covering the logical articulation of goals and steps along cooperative initiatives, but allowing for their combination and segmentation.**
RQ3: *What type of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a city mirror in comparison with other existing tools?*	The WGN platform instantiated a model of **technology oriented to support the entire development of local processes and multiple actions strands** driven by different actors in a shared online environment. The composition of multiple tools in a modular platform can allow to select and use the most appropriate functionalities case by case and in relation to the contingent goals of the actors involved
RQ4: *What types of social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?*	The collaboration with the municipalities involved in the project let to emerge the **conflicts between the administrative and political sphere of actions of local government** that, if unaddressed, hinder the chances for the adoption of a platform, while intended to be multi-stakeholder. Indeed, the engagement of the local government is a strong incentive for non-profit (particularly interested to the co-management of commons) and business sector (aware of the opportunities coming from cooperative governance models).

RQ5: *What types of approaches could be applied in the design process for balancing the functional and non-functional requirements associated with the different perspectives and goals of city stakeholders?*	The project involves multiple development teams, working on different technology systems, and multiple municipalities, working accordingly to different priorities and protocols. The approach designed and implemented for creating synergies among the conflictual goals of both sides entailed a **double strand of planning, decisions, and actions, aligned around the holistic understanding of the processes to be supported and the constructive dialogue on the alternatives definition of services and related technology solutions**.
RQ6: *What criteria should be considered for evaluating the correspondence between the platform functionalities and the expectations of the city stakeholders to be supported in their actions?*	A critical aspect for the potential adoption and integrability of the platform in real settings included the possibility to distinguish between the capability of the platform (in terms of provided functionalities) and the actions required to make the platform in use and not related to the platform functionalities (e.g. dissemination, marketing). To this regard, evaluation criteria included: the **connectivity with existing tools** (both institutional or informal) to facilitate the spread of the platform with limited effort; the possibility to opt for a **"partial adoption"** or "selective adoption" limited only to some components; the level of **adaptability and configurability of the platform functionalities to the existing decision making processes** (evolving over time and requiring evolving settings).

8.7 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 8 to the three outcome spaces outlined in Chapter 2, Section 2.7. Analogously to the previous chapters, the contributions of Chapter 8 are synthetically described in the table below.

Table 8.10 Mapping the chapter contributions with the outcome spaces of the TD framework

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 8
SYSTEM KNOWLEDGE	THEORETHICAL CONTRIBUTION	
	METHODOLOGICAL CONTRIBUTION	[SECTION 8.3] This chapter analyses the use of service design methods experimented in application related to city planning and urban transformations, as well as their potentialities for system design currently explored in the domain of Interaction Design Practices. Building on this analysis, the main methodological contribution presented in this chapter is two-fold. On one side, I elaborated and tested the **hybridisation of standard service design tools with the inputs coming from their adaptation in urban and informatics disciplines to refactor web-based technologies having city applications.** On the other side, I proposed to **extend the usual scope of service design methods to the modelling of cooperative governance mechanisms in urban settings**. A secondary methodological contribution of this chapter concerns the presentation of an example of **"Bilateral Action Research" as a double parallel process of independent framing of the problem, formulation of potential solutions, planning and implementation that involves two groups of subjects having distinct visions, needs, roles, priorities in addressing a joint problem**. In this case the two groups were the municipalities staff and the development teams called to imagine how to assemble the WGN Platform. Pursuing a bilateral action research in such a complex setting allowed to expedite the identification of feasible solutions to the common problem (using service design tools as a bridge in the two parallel processes) and, at the same time, provided more meaningful inputs to deeply investigate and represent the instances of both groups.
	EMPIRICAL CONTRIBUTION	[SECTION 8.4] The main empirical contribution of this chapter is the presentation, analysis and discussion of a **set of applicative scenarios envisaging new models of cooperative governance among city stakeholder following the WeGovernment paradigm**, as well as the practical **strategy for their generalisation in meta-practices** that can possibly cover a wider range of other applicative scenarios. The specific uses of web-based technologies such as the components of the WGN platform are also integrated to enrich the description of these WeGov Services.

TARGET KNOWLEDGE	FOR RESEARCHERS	
	FOR TECHNOLOGY DESIGNERS	[SECTION 8.3, 8.5] The two practical contributions of this chapter for technology designers are: a) the discussion of the **intrinsic limitations of techniques such as Personas and Scenarios**, widely used for the user-centred design of commercial applications, but less appropriate to provide insights and inputs to orient the design of multi-stakeholder systems, especially in complex and possibly conflictual domains such as the governance of city development b) the **approach to the refactoring of multi-component systems based on the abstraction of the functional logics of consolidated technology products** to maximise the reuse of existing functionalities under a new semantic framing, to enhance the complementariety and sinergies among different tools, and to minimise the development efforts for the definition of new features and their integration into a unified platform. c)
	FOR URBAN PRACTICTIONERS	[SECTION 8.2, 8.4] This chapter **connects the we-government paradigm to the theories and approaches framing cooperative urban governance principles**, highlighting their common base in the emphasis on the quality of a continuous public engagement, a central issue for urban practitioners. The forms of this technology-supported engagement of city stakeholders in negotiated and cooperatively implemented local development actions are exemplified by different types of programmes, projects, and initiatives going from urban renewal, to social services policies, to public-private partnerships in support of local manufactures.
	FOR CITY STAKEHOLDERS	[SECTION 8.3, 8.4] The report on the difficult design process to define scope and application of a WeGovernment platform enlightened the importance of consciously and explicitly **reflecting on the way the negotiation of public and private competencies, agency over places and resources, and conflicts of interests should be enabled or expressed or mitigated in a digital environment** supposed to address the needs of a diverse range of stakeholders in different socio-political and cultural contexts.
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNWOLEDGE	USERS	[SECTION 8.2] **Communities**, as well as public and private **organisations**, had been considered and investigated in this case study as **involved parties in shaping the governance mechanisms at the local scale and collective users of a WeGovernment platform.** The relationships among users to be represented on the platform had been oriented by the principle of the **throughput legitimacy** along the entire design and research process. This case study allowed also to reflect on the **issues of making explicit risks and benefits for all the parties involved in activating cooperative dynamics in city management.** The difficulty to render the constraints to actions is one of the causes **hindering the chances of combining the efforts** of city stakeholders toward compatible objectives. Potential **transformation paths** in the design of technologies for cities derive precisely from moving **beyond the relationship one-to-many** (Government to Citizens) characterising e-gov technologies, and **toward many-to-many relationships** among structured social entities entitled/enabled by resources, capacities and competencies to **negotiate their roles online and offline** in local development processes.

	CITY	[SECTION 8.2,8.4] This case study focused on the delicate equilibrium among **concurrent representations of the city resources** associated with different geographical contexts and organisational settings. In particular, the analysis of current practices and meta-practices to establish future wegov services highlighted how the **values driving the local actions over these resources** are strictly dependent on the **nature and strength of the relationships among city stakeholders**. Differently from technologies devoted to monitor the urban fabric, wegov technologies face the challenges of **"monitoring" directly and indirectly the fluctuations of these values and social ties**, opening alternative t**ransformation paths** in the design of technologies for cities.
	TECHNOLOGY	[SECTION 8.2, 8.5] The plan for refactoring and assembling a set of e-gov technologies into a **unified platform for WeGov Services** imposed to compare, harmonise and combine **different visions of the role of technology**. These visions covered a wide spectrum going from digital platform seen as **democracy amplifier** to **channel for local transactions**, from **enabler of distributed actions** to **evidence generator**. **Transformation paths** in the design of city technologies intended to support cooperative governance models in cities originates from **leaving opened the possibility for specific tools or combination of them to cover all these roles (and more) in the medium and long term.**

PUBLICATIONS

The following publications include part of the contents or the concepts presented in Chapter 8 (while in a preliminary form) or are related to this case study.

- Lupi L., (2019) ***Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development**,* IASDR 2019, Manchester, United Kingdom.

- Lupi L., (2018). ***Mirroring the City. Toward Web-Based Technologies to Support City Stakeholders in Local Development Actions***, Extended abstract at the Swiss Inter- and Transdisciplinarity Day 2018 – Inter- and Transdisciplinarity in a Digital World, Lausanne (CH).

- Lupi L., Antonini A., (2017). ***Technical Report – Expanding the WeGovNow Platform: Requirement Analysis and service scenarios****.*

- Lupi L., Antonini A., Boella G., Schifanella C. (2017). ***We-planning: participatory process to develop a digital platform for a collaborative governance of city services***. II Conference on Urban e-planning research, Lisbon (PT).

- Lupi L., Antonini A., Boella G., Schifanella C., Sanasi L., (2016). ***Back to public: rethinking the public dimension of institutional and private initiatives on an urban data platform***. 2016 IEEE International Smart Cities Conference – IEEE ISC2, Trento, Italy.

- Lupi L., Antonini A., Boella G., Mason E., (2016) ***Real society in virtual space: a platform to share responsibilities in urban regeneration processes***, in G. Colombo, P. Lombardi, G. Mondini (edited by), 9th International Conference on Innovation in Urban and Regional Planning INPUT 2016, Conference Proceedings Book "e-agorà/e-ἀγορά for the transition toward resilient communities", Turin, Italy.

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CHAPTER 9.

BUILDING A
CITY DATA OPEN PORTAL

have died in wars. We will remember them.

CHAPTER 9. OVERVIEW

Chapter 9 explains the process for **defining an alternative to the Open Data portal** of Milton Keynes, projected toward the creation of a City Data Open-Portal, and **new forms of production, use, and interaction with data** aimed at transforming publicly available information into operational sources for the local actions of city stakeholders. This case study provided the opportunity to explore how to challenge the current roles of city stakeholders in the local data ecosystem and better support their needs and activities by **rethinking the model of a consolidated type of web-based technologies**, the open data portal. The evolutionary proposal of MK:InsightX system and the model of the Open Portal is a third example of ***"City-Mirror-in-the-making"***, intended to reflect the nature of social relationships and actions built around data in the city.

Analogously to Chapters 7 and 8, Chapter 9 is organised into seven sections, as follows.

- Section 9.1 summarises the **essential characteristics of MK:InsightX** considered for the research design and the construction of this case study.
- Section 9.2 contextualises the path for rethinking the model of data portal at the city level in relation to the **underuse of open data and the major concerns associated with an unprecedented availability of urban data**.
- Section 9.3 explains the **structure of the design and research process** as a synthesis of the lessons learned from the complex history of the open data portal of Milton Keynes, present information needs and future trajectories for the redesign of data-related technologies for the city.
- Section 9.4 describes the **applicative scenarios** in which open data, and city data in general, had been connected or could be connected to local actions in various domains of city activities, and how these scenarios informed the development of the MK:InsightX concept.
- Section 9.5 outlines the three **sets of incremental design solutions** to rethink scope and functionalities of city open data portals by addressing in a systemic way issues and conflicts across the process of generation, management and use of city data, as well as in reference to the fluid roles of city stakeholders in the local open data ecosystem.
- Section 9.6 formulates the preliminary answers to the **research questions** (stated in Chapters 3 and 4) based on the design and research process of MK:Insight 2.X.
- Section 9.7 indicates the **chapter contributions** accordingly to the outcome spaces of transdisciplinary research.

Connection with the previous chapters. The case study of MK:InsightX incorporates part of the lessons learned from the previous case studies (Chapters 7 and 8) and focused the investigation on understanding how to build the rules for defining a shared space among multiple stakeholders operating on a specific and intangible resource: city data. The core models described in Chapter 5 guided the analysis of the case study, developed according to the research methods and techniques introduced in Chapter 6.

Connection with the following chapters. The research activities associated with this case study deepened the understanding of the role of technology as an intermediary in social relationships among city stakeholders, furtherly elaborated in Chapter 10. The strategy adopted for the participatory exploration of the challenges associated with the use of city data and data technologies contributed to the elaboration of the assessment framework reported in Chapter 11*.

CHAPTER 9. DETAILED TABLE OF CONTENTS

9.7 Chapter Highlights

Publications

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9.1 SYNOPSIS OF THE CASE STUDY MK:INSIGHT.X

The case study reported in this chapter is about building a city data portal opened to the contribution and collaboration among city stakeholders in the generation and use of city data. This case study is associated with the **development of three design concepts to rethink the open data portal of the city of Milton Keynes** (UK), MK:Insight.X. As introduced in Chapter 6, section 6.5, the case study of MK:Insight.X was an independent research initiative oriented to strengthen and renovate the long-term partnership between university and local government on data policies and technologies. The main goal of this initiative was **identifying potential alternatives to the current design solutions adopted in open data portals, demonstrated to be ineffective in fostering new collaborative practices and innovation processes for policies and services led by the availability of city data.**

The framing of the MK:Insight.X initiative as case study of *"City-Mirror-in-the-making"* is outlined in the schema below [Fig. 9.1], summarising the various aspects of the project considered in the multi-case study strategy (see Chapter 6, section 6.3).

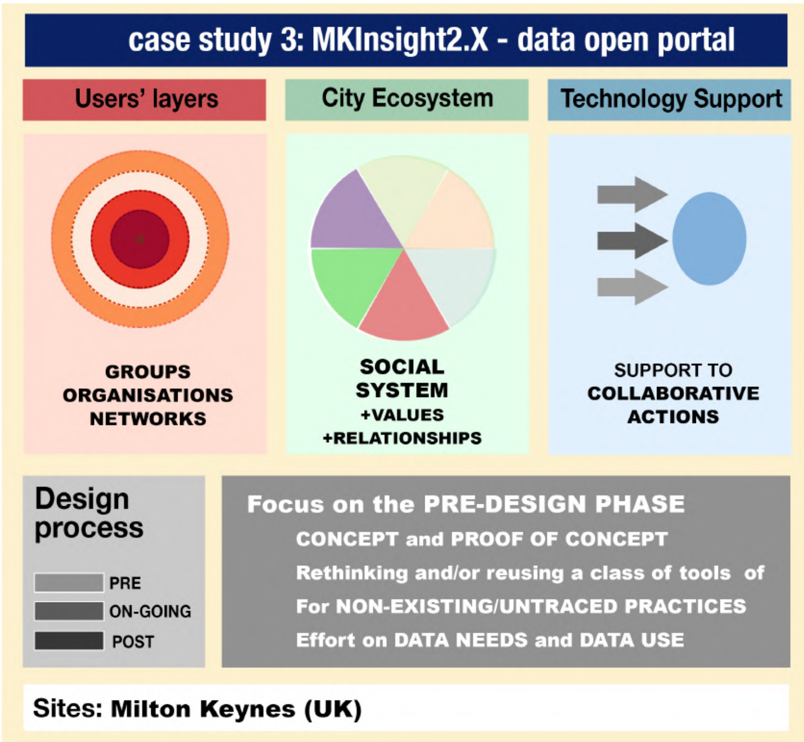

Fig. 9.1 Synopsis case study 3

This third case study provided the opportunity of investigating:

- representation, roles and actions of **groups, organisations and networks** in the city data ecosystem where data are generated, managed and used in local activities
- interconnections and interdependences between the nature of city data and the relationships among city stakeholders interacting through/with/on them, and composing the **social system** of the city.
- the role of technology **to enable potential forms of collaboration to generate public value from city data**
- strategies and protocols to **connect the understanding of needs and constraint** associated with data **to the elaboration of a trajectory for transforming city data portals.**

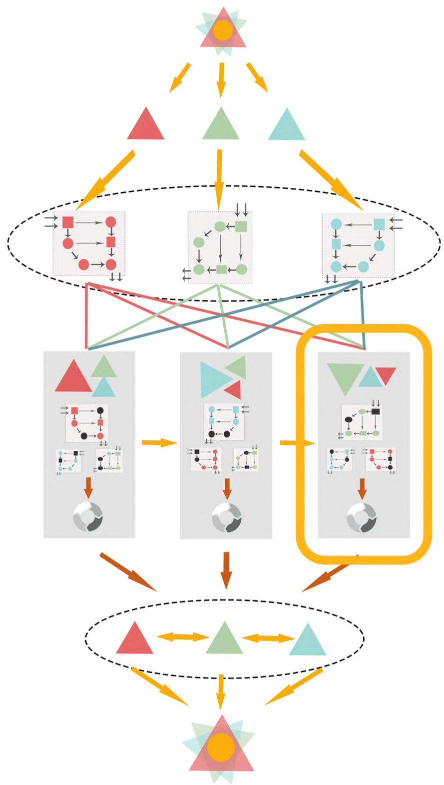

Fig. 9.2 Mapping of the third case study in the TIDS protocol

Within the TIDS research protocol, this third case study is another **instantiation of the core models** of the User, City and Role of technology (see Fig. 9.2) aimed at extending knowledge and understanding on the problem of connecting technologies and local development actions by supporting city stakeholders in their activities and relationships.

9.2 CITY DATA, OPEN DATA PORTALS, AND CITY MIRRORS

In this section, I am going to provide some background elements to contextualise this case study in relation to the current debates on the datafication of cities[1]. This debate is centred on the growing demand for making data a driver of social change and development in cities, overcoming the existing barriers and shortcoming in the access and use of these resources.

9.2.1 ISSUES, CONFLICTS AND ASPIRATIONS AROUND CITY DATA

The production of data in urban environments is constantly increasing over the years. This trend is fed by the deployment of smart city technologies and a generalised awareness of the value of data as *"engines for the new economy"* [Abella et al. 2017]. Nevertheless, the unregulated collection and exploitation of data

[1] Among the disciplines considered as roots for this study, the topic of the datafication of cities and its implication for local governance and development are mainly addressed in the fields of Urban Studies and Information Systems, respectively with a focus on democratic risks in the first case and the benefits of data-related technologies to the innovation in organisations (in particular, the sector working on e-gov technologies) in the second case. However, the design-oriented approaches pursued in this chapter drawn more on urban design and planning in terms of constructing practical "solutions for the coexistence" of competing goals in cities, and on Interaction Design and CSCW to translate urban principles into orientation for the design of interactive systems for the access and use of data.

produced in cities (following indicated as "city data") are fostering the rise of significant political and social concerns [see Barns 2018, Kitchin 2014]. Indeed, **data are not only economic resources, but also a source of conflicts in the relationships between government and citizens, technology providers and users-clients, organisations capitalising the access to information and people excluded from the benefits generated by their own data.**

National governments and supranational authorities are increasingly worried about the manipulation of information on social media and the destabilising consequences of this phenomenon at a local and global scale. Local governments are starting to question their dependence from the services provided by the major ICT global corporations, that still are the primary beneficiaries of the value generated by city data. Activist groups and intellectuals already brought to light fears and risks linked with the progressive setting up of a surveillance society, contributing to sensitise the civil society on the issues of privacy and equity in the access and use of data [Martínez-Ballesté et al. 2013, Sadowsky & Pasquale 2015, Van Zoonen 2016].

The efforts done so far to face these political and social problems have been mainly focused on contrasting the indiscriminate commercialisation of data. The most significant example of policies in this direction is the EU General Data Protection Regulation. The GDPR[2] represents a substantial change in the privacy protection of European citizens accessing or traced by digital systems. At the local level, institutional initiatives such as *"Data as Commons"* promoted by the municipality of Barcelona[3] are a sign in the direction of empowering citizens to consider data as a shared resource to improve city services. Another example is the *"TADA Manifesto"*, elaborated by activists in Amsterdam[4], and focused on defining the ethical uses of data that respect the principles of transparency, privacy control, inclusiveness and openness to local communities.

It is important to highlight that these types of **initiatives are oriented to contrast the negative consequences of the availability of data on individuals, not addressing the structural problems and root-causes linked to the production and use of city data in terms of inequalities and unbalanced power relationships between who exploits data and who is exploited for data and through data**. These initiatives are focused instead on limiting the risks of privacy violations and the public exposure of sensitive information at the level of individuals only.

Critical approaches to smart cities are trying to expand the focus of the debate on city data from privacy issues to systemic and structural issues. In early works on these topics, the two major issues associated with city data concern:

1) the **manipulation of data**
2) the **indiscriminate use of data to control social phenomena or group**s.

Bowker [2014] argues that **city data can help to understand social problems and economic fragilities**, actively operating to address them. At the same time, he points out that **data can also be used to negate the existence of these problems, with the effect of consolidating urban inequalities that persist in the real city**. This position is supported by other recent works [e.g. Taylor & Richter 2015, Shelton et al. 2015, Leszczynski 2016] highlighting the manipulation of data as the result of situations in which one or more organisations have the resources for influencing the process of data collection and analysis, as well as the opportunity of directly benefiting from the data manipulation.

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[2] GDPR. Available online: https://eugdpr.org/ (accessed on 20 July 2019).
[3] Data as Commons. Available online: https://ajuntament.barcelona.cat/digital/en/digital-transformation/city-data-commons (accessed on 30 May 2019).
[4] TADA Manifesto. Available online: https://tada.city/en/home-en/ (accessed on 20 July 2019).

Lyon [2014] critically analyses the social and political consequences of the availability of data in terms of their **capability to predict future events**, based on inferences from data on past and present phenomena. However, he highlights that data are always partial representations of a situation and their relevance to outline a future status of affairs should be carefully pondered because the **fluid nature of the present imposes taking decisions going beyond what we know about past events**.

Leszczynski [2016] underlines that **city data can be actively used for preventing social disorders and controlling the generation of specific types of information accessible to the public**. To this regard, Leszczynski warns from the risks of timely and disproportioned reactions to data flows generated on social media relying on the inputs coming from the analysis of past events. These reactions can be oriented indeed to suppress social conflicts or political oppositions considered dangerous from the perspective of law enforcement authorities, but not necessarily from the one of the civil society and in a democratic context.

Considering more ordinary situations, Finch and Tene [2013] underline that **the availability of fine-grained data can easily support the use of data with discriminatory intents** by insurance companies, banks and mortgage agencies, often with severe social consequences if systematically replicated at a large scale. This indiscriminate use of data is notably facilitated by the lack of *"smart laws"* aimed at preventing or mitigating the potential misuses of data, according to plastic and responsive behaviours of laws to the evolution of technologies [Decker 2016].

The manipulation and malevolent use of data in cities are sensitive urban governance issues reflecting the unbalanced power between organisations controlling city data and other social groups and organisations excluded from decisions and operations on city data. Usually, the organisations controlling the production and use of city data are the technology providers and public authorities. On the opposite side, the other actors in the city data ecosystem[5] are:

- The subjects from which data are collected (usually citizens and city services customers)
- The intended users of data (other organisations, public, private or non-profit)
- Knowledge professionals and media that communicate through data

Despite issues and conflicts due to power inequalities in the production and use of city data, **the aspirations associated with these immaterial resources are stated and continuously confirmed in the public discourse**, both institutional or corporate, and at the local, national and global scale. Data, in particular in cities[6], are expected to:

- contributing to improve **transparency, accountability, efficiency and productivity** of local governments and public agencies
- leading toward **better policies and decisions**
- promoting **active citizenship and democratic participation** of local communities
- supporting businesses in developing **new services and commercial activities** [Kitchin, 2014].

Thus, data are nowadays deeply intertwined with the specific vision of local development elaborated at the city level and based on the underlying idea that data are a matter of public interest in cities.

[5] The concept of city data ecosystem, described in section 9.2.3, encloses the idea that the organisations involved in the production and use of data in a city cannot be reduced only to data producers and generic data users, but they include several other actors covering a variety of roles and functions in the process.

[6] It is not infrequent nowadays to consider cities as machines for the production of data.

9.2.2 CITY DATA AND OPEN DATA

Until two decades ago the production of data concerning city activities was almost completely constituted by *"small data"*[7] (e.g. dossiers and policy documents, project or technical reports, general information such as budgets or lists, and local regulations) and *"medium data"*[8] (e.g. census data) [Kitchin 2015]. These data are **generated by public administrations and agencies as part of their ordinary and extraordinary activities**, and therefore they can be considered as the "traces" of these activities. Small and medium data are intentionally generated by humans with the purpose of documenting or communicating specific activities and decisions.

Smart City technologies and web-based technologies triggered a paradigmatic shift in the capability of dynamically tracking changes in the physical environment of cities and people's behaviours through the collection and analysis of *"big data"*[9]. Differently from small data, big data are data automatically generated from sensors and devices monitoring the urban fabric and its infrastructures, through geo-localisation systems recording people's movements, and by aggregating metadata and contents from social media platforms [Kitchin 2015].

The first type of these data, **data from sensors**, are defined by Kitchin as *"urban operational data"* [Kitchin 2014b]. They are usually assumed as objective traces of facts (e.g. the status or performances of urban infrastructures) and considered as functional products aimed at supporting public or private agencies in the efficient real-time management of planning operations, local services, and infrastructures [Shelton et al. 2015]. However, it starts to be recognised that even the supposed rational data-driven decision trees implemented in these management processes are never isolated from political, social and organisational constraints bounding decisions and actions of public or private agencies [Barns 2016, Barns et al. 2017, McNeil 2015].

The second group of these data comes from routing applications and the third group are **data from social media platforms**. The latter provide an account of points of views, perspectives, positions that traditional public surveys do not capture. The massive adoption of social media platforms (by almost every age group and socio-economic population segment) provides unprecedented coverage to understand public opinion formation, personal and collective preferences, and social phenomena in real-time. However, it is difficult or risky to consider these sources as reliable representations of what society wants and expression of real local needs. Indeed, as demonstrated by recent studies, social media platforms have engagement mechanisms that tend to support certain users' behaviours oriented to self-gratification and social acceptance [Kietzmann et al. 2011, Lee & Long 2012] and types of communications reflecting only very partially individual and collective positions [Hampton et al. 2014][10] .

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[7] Small data are information already elaborated and directly understandable for humans. They can be texts or visual representations with a specific meaning that is mostly explicit.

[8] Medium data are aggregation of information requiring a form of technology support for their navigation and understanding, but still containing information to which users can attribute an explicit meaning. For instance, census data can have millions of records and requires technology support to be used, but the numbers, parameters and answer collected in the dataset are still directly readable by humans. There are also other technical definitions of medium data as a segment or sub-class of big data.

[9] Big data are large datasets, usually characterised by high volumes of data, changing or produced at high velocity, from heterogeneous sources having different structures and systems to organise data. These types of data require specific analytic methods to extract meaningful information from data and are not directly readable or including an explicit meaning.

[10] Despite this fact, data from social media platforms are usually exploited by public and private actors to develop *"geodemographic profiles"* [Harris et al. 2005] for a variety of operations that can benefit from targeting customers and end users (like in advertisement or sensibilisation campaigns). These operations can also include illegitimate actions oriented to manipulate the public opinion by leveraging on social weaknesses and fears emerging from data, providing support evidence to the concerns outlined in the critical smart city literature (e.g. see recent scandals due to microtargeting for Brexit voters in the UK).

While big data are getting extreme attention by media, businesses and governments, the importance of small data and medium data continue to be extremely high beyond their commercial value, specifically because they constitute an immediately accessible form of knowledge into and about the public domain. These data still keep regulating the relationships between different stakeholders, the understanding of local problems and needs, thus potentially supporting actions and operational measures to address them.

This is particularly relevant because, independently from their volume and type, the most important aspect of **city data is that they are relational entities**. Indeed, **despite their assumed objectivity, data are always the result of specific systems of thought, organisational or political settings, available resources, and choices about what is required to be traced through data and what decisions need data**[11]. The social, political, economic components of these ***"data assemblage"*** [definition in Kitchin 2015] impact on what types of data are collected, where, from whom, and for what purpose. All this corpus of factors makes data strictly dependent on the relational context in which data are intended to be used, beyond their content[12].

Looking at city data as resources for local development processes, it is essential also to clarify the different types of data licenses, as the license of data constitutes the primary element regulating the access and use of data by different types of stakeholders. To this regard, the ODI Institute distinguishes five types of data[13]:

- **Closed data**, reserved for internal access only
- **Data selectively shared**, accessed and used by authorised persons only under specific contracts and conditions
- **Data shared among groups**, accessed by specific groups or categories of people covering a specific role in organisations (e.g. staff of public administrations, doctors in a hospital, etc.)
- **Public data**, openly available data on public-access platforms, but with limited options for their reuse by third parties (e.g. data on governmental websites, but also from social media platforms or commercial applications)
- **Open Data**, that can be accessed and reused by anyone.

A more specific definition of Open Data developed by the Open Knowledge Foundation indicates Open Data as data publicly released that can be "*freely used, shared and built-on by anyone, anywhere, for any purpose*"[14].

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[11] Sensors for monitoring air quality in cities provide a meaningful example of this point. Data about the pollution levels or the density of a specific pollutant are usually assumed as objective information recorded by sensors. Nevertheless, the collected data are determined by the choice of installing those sensors in a certain area instead than another, and this choice is linked to the goal that the collected data are intended to serve. For instance, placing pollution detectors close to the industry district can help in proving that the air quality in a city is very low and facilitate the adoption of extraordinary measures to fight apparently critical levels of pollution. On the opposite side, the same sensors can be placed close to green areas to show that recently approved policies to improve air quality in the city are already effective. These two extreme cases of instrumental and manipulative use of data from pollution detectors illustrate the tension between the objectivity of data and their partiality, as well as the difficult legibility of the hidden factors determining the content of data in themselves.

[12] Sensors to monitor air quality in cities provides a meaningful example of this point. Data about the pollution levels or the density of a specific pollutant provide objective information, as recorded by sensors. Nevertheless, the collected data are determined by the choice of installing those sensors in a certain area instead than another, and this choice is linked to the goal that the collected data are intended to serve. For instance, placing pollution detectors close to the industry district can help in proving that the air quality in a city is very low and facilitate the adoption of extraordinary measures to fight apparently critical levels of pollution. On the opposite side, the same sensors can be placed close to green areas to show that recently approved policies to improve air quality in the city are already effective. These two extreme cases of instrumental and manipulative use of data from pollution detectors illustrate the tension between the objectivity of data and their partiality, as well as the difficult legibility of the hidden factors determining the content of data in themselves [example from Lupi 2019].

[13] The Open Data Institute. The Data Spectrum. Available online at: https://theodi.org/about-the-odi/the-data-spectrum/ (last access: 10 September 2019).

[14] Open Knowledge Foundation. Laura James (2013). Defining Open Data. Available online at: https://blog.okfn.org/2013/10/03/defining-open-data/ (last access: 10 September 2019).

This definition points out how, in a data landscape dominated by private data, **Open Data represent the segment of data resources supposed to create the broader benefits into the public sphere**, at individual and collective level. While Open Data are not necessarily produced at the city level[15], it is at that scale that there are the major expectations. As mentioned before in section 9.2.1., these expectations include enabling public authorities, communities, and business sector to make effective use of data for local projects and services.

Despite these high expectations, **the use of Open Data remains very limited**, at every scale and in different contexts, still struggling to have the desired impact. Open Data are a yet-to-be fulfilled promise for generating significant changes in the activities of city groups at the local level [Dyson 2013; Taylor et al. 2014; Sieber & Johnson 2015].

The underuse of Open Data is progressively becoming an urgent problem, considering the institutional efforts and investments in producing and publishing Open Data. In addition, there are growing requests of civil society organisations and the businesses sector to access to more public and free data on topics of public interest or relevant for their activities.

Indeed, the label "Open Data" identified originally Open Governmental Data (OGD). It was linked to Open Government policies stating the principles that knowledge produced by using public funds should be made publicly accessible, and that citizens are entitled to access to their data owned by public authorities. On this basis, conventional Open Data were completely assimilated to small and medium data tracing the activities of public administrations and the supply of public services. However, since 2008-2009, the two large smart cities programmes launched by IBM and CISCO (and then by other ICT providers) push forward these boundaries. Local governments started to have access to a large amount of data covering many new domains beside their own administrative activities. Their release as Open Data remained marginal though because conflicting with new data-related services provided by Public Administration to third parties and to the revenue models of ICT providers associated with these new smart city technologies [Lupi & Antonini 2018[16]]. Thus, this situation strongly limited and keeps limiting the availability of Open Data at the city level (including small, medium, and big data) covering domains that can be of interest for the business sector, but also for local communities, non-profit organisations, or academia.

The effects of this situation have immediate impact on the quality (and usefulness and direct exploitability) of Open Data available at the local level. It is useful to provide some examples of Open Data helping to demythologise their nature for readers without direct experience of them and to understand the "quality issues" of Open Data in practical terms. For instance, common Open Data are the datasets of the car accidents in a city district in 2014 (published perhaps one or two years later), or the rates of school inspections, or the results of past elections by constituency. Extreme examples with evident limitations for their reuse are the datasets of the amputated legs by area[17] or the internal usage in some administrations of the communication platform Yammer in the second trimester of 2016[18]. These examples illustrate the detachment of the goals apparently pursued through the release of Open Data (i.e. local development, democracy, better policies, economic growth) and the corresponding actions related to data. These actions

[15] In countries such as the UK and USA, most of Open Data are produced at the national level, while in other countries such as Italy or France are produced mainly at the local and regional level.

[16] The technical report analyses in detail the reframing of open data in the last three decades in relation to Open Government policies, Open Source Movement, and Smart City programmes.

[17] https://datausa.io/ (last access September 2019)

[18] https://data.gov.uk/dataset/cb7e292a-8da7-4492-9322-53438d7be3f5/fsa-internal-yammer-usage (last access September 2019)

indeed are often limited to the release of types of datasets that can difficulty support businesses and local communities in their activities, or not substantially at least (see also Chapter 4).

Interestingly, the underuse of Open Data has been deeply investigated, but rarely moving from the abstract concept of the "quality of data" to the critical assessment of the available types of data (its rationale and why certain datasets are published, their concrete opportunity of reuse, intended target if any, and so on). Nevertheless, several studies on this topic [Janssen et al. 2012, Barry & Bannister 2014, Martin 2014, Zuiderwijk & Janssen 2014, Beno et al. 2017, Wang et al. 2019] identified that the key barriers preventing the broader use of Open Data include:

- **the lack of self-evident uses and value of the available data**
- **inaccuracy and obsolescence of information**
- **lack of standardised metadata or significant information complementing the datasets**
- **files formats often requiring specific software to be explored**.

These studies also expose that the overall and most challenging barrier in the use of Open Data (beyond the public bodies producing and directly using them) is that ***"there is no insight into the user's perspective and the users' needs are not known"*** [Janssen et al. 2012].

So far to my knowledge, there are no specific studies providing orientation to understand the link between users' needs and Open Data in urban contexts (indicated following as City Open Data). In other words, we don't know what could make the use of **City Open Data** appropriate and suitable in the everyday activities implemented by the diverse city stakeholders, such as providing educational services, monitoring social issues, organising citizens initiatives, running commercial businesses, and so on. In particular, it is still **unclear how to generate such data by taking into account the limitations of Open Governmental Data (as acts of transparency over administrative activities) and current revenues models associated with City Data (not openly available for city stakeholders beyond the parties under contracts in smart city initiatives).**

The importance of exploring these points is primarily due to the fact that City Open Data are the segment of shared data resources in urban environments, and they could be crucial to trigger local development processes. A **common pool of shared information resources** [defined as "Knowledge Commons" in Hers & Ostrom 2005] **constitutes a common knowledge space and reference framework for local decisions**, made in the public interest by local authorities or pursued by single organisations. Even working toward different goals, actions and decisions of different actors could benefit from having a coherent and consistent shared understanding of the city context.

9.2.3 LIMITATIONS OF CURRENT OPEN DATA PORTALS

Data portals are nowadays the established class of web-based technologies aimed at supporting data producers and data users in interacting with data, especially Open Data. The design of Open Data portals is focused on enabling *transactional interactions* based on demand-offer mechanisms around data [Hansen et al. 2014]. Data portals simply work as intermediaries in a material exchange of goods (the datasets grouped in catalogues available for download) and as "digital substitutes" of the organisations providing access to specific datasets.

The **relational dimension of data is usually obscured or neglected in data portals**, failing to transform these technologies into shared platforms and dialogue space among the various actors involved in data-related processes at the local scale. This problem is particularly critical in Open Data portals, and specifically in City Data portals. Indeed, as mentioned before, these platforms are charged with high expectations about the potentiality of Open Data of reinforcing trust in institutions, supporting cross-organisational cooperation, strengthening civil society and community awareness, and contributing to economic development at the local level by facilitating new business initiatives.

The literature states that **there is not a predominant model of open data portals**[19] [Umbrich et al. 2015, Saez Martin et al. 2016]. The lack of standardised guidelines for their design (meaning effective design) often results in a limitation of the user's ability to access data, even though this is the primary goal of these type of technologies [Beno et al. 2017].

I already analysed the logic and patterns of Open Data Portals in Chapter 4, and the implications of some specific design choices as regarding the representation of users, city and the role of technology in itself. It is useful to remind here that the metaphor guiding the development of Open Data portals is the catalogue of resources and that this catalogue is implemented through three schemas:

- **data marketplace portals** that provide category-based filters to select the item to "buy-for-free" (e.g. data.gov.uk).
- **visualisation-oriented portals**, in which data sources are organised by location and partially made accessible through interactive thematic maps and graphics (e.g. maps.cdrc.ac.uk; opendata.bristol.gov.uk/maps/)
- **story-telling portals** that provide a predefined narrative walking the user through the available data sources (e.g. data.usa.io)

The common trait among these different solutions is to provide **support for the communication of one specific perspective on data**, expressed through the choice of one specific body about what to publish, how, at what level of detail, and most importantly what not to make evident [Harding et al. 2015]. These solutions crystalise the problem of the limited use of Open Data due to the lack of insights on the different perspectives of users and of their needs, as well as common concerns about the manipulation of misuse of data.

Most of the studies of Open Data initiatives take into account primarily the perspective of governmental authorities and the use of open data across different public organisations [e.g. Ubaldi 2013; Chan 2013; Veljković et al. 2014, Attard et al. 2015]. Recent works analysing and evaluating Open Data Portals highlighted how the primary scope of these technology is still facilitating the publishing of documents and data related to the administrative activities by the competent public officers [Lnenicka 2015; Umbrich et al. 2015, Sáez Martín et al. 2016; Máchová et al. 2018]. Only secondarily they are supposed to enabling users (often intended generically as "citizens") to dig in data for controlling and monitoring the work of public institutions.

Another key barrier preventing Open Data Portals to benefit the society at large is the lack of support (online and offline) to potential users for understanding the content of the available datasets and the types of restrictions to their use [Lnenicka 2015]. An envisaged combination of offline and online support stress the importance of City Open Data Portals, compared to the transnational, national and regional ones. In the latter, public authorities are distant from the potential users, distributed across vast territories, and data cover general topics often at a high scale of detail. In the former case, local authorities providing city data through a portal have also the opportunity to interact directly with potential users, usually limited to organisations and groups operating at the city level, and actively support their data-driven actions and practices.

[19] On the other hand, it is essential to mention that there are only two predominant commercial solutions for Open Data Portals, one closed and one open source, identical in their appearance and in their key features oriented to facilitate the publishing of data (for data producers) and enable their download (for data users).

The result of the current design solutions for Open Data portals is that their actual users are in general the very same institutions publishing or exchanging data with other public bodies, or a small niche of occasional users such as journalists, activists, researchers, or professionals working in ICT companies [Attard et al. 2015; Lee et al. 2015]. The ordinary users of Open Data Portals are not the public, private and non-profit organisations operating at the local level and supposed to be supported through the availability of data, at least in the public discourse. While the efforts of the small niche of Open Data users provided a few showcases and examples about the potential applications of Open Government Data for the benefit of local communities, they had a limited impact [Worthy 2015; Lee et al. 2015]. In some ways, these examples also involuntary sustained the myth of the intrinsic value of Open Data, waiting just to be unveiled for realising their empowering aims.

9.2.3 CITY DATA OPEN PORTALS AND CITY MIRRORS

The dominant vision of Open Data as an expression of Open Government processes started to be challenged in the last years by the new vision of Open Data as commons [Hess & Ostrom 2005] intended to enable citizens, communities and local stakeholders in building their own insights from publicly available data to use, reuse and integrate these data.

This new vision calls for reframing the intended users of Open Data from being recipients of public information to become active subjects having the right to use these shared resources to generate value for their own activities. In this sense, the vision of Open Data as *digital commons* [Bollier 2011] has two main outcomes. It brings back the attention on people and their actions as regarding the use of Open Data, instead than focusing on data in themselves (as the number of datasets, type of metadata, formats, licenses). Then, it enlightens the importance of the interrelations between data and actions at the local level that are defined by the communities accessing shared informational resources.

Building on this vision for investigating how to realign expectations associated with Open Data and design solutions for data portals at the city level, I explored the concept of Data Open Portal (and specifically **City Data Open Portal**) as an alternative to Open Data Portal. In other words, I decided to move the focus from the licensing of data to the **relationships build around city data**, and therefore **from the openness of data to the openness of data portals.** The exploration of this shift toward open forms of management of data at the city level was also intended to understand potential norms, rules, protocols addressing the main concerns around the manipulation and misuse of data at the local level due to the dynamic balancing of powers in the production and use of data among city stakeholders.

The literature outlining the idea of **Open Data Ecosystem** and its structures and internal flows provided essential building blocks for developing the concept of Open Portal as integrated with the research directions on Open Data moving beyond governmental perspectives. However, the specificity of focusing on city technologies required to bridge the inputs of the Open Data Ecosystem frameworks with the operational models of the Users, City and role of Technology defining the proposal of the City Mirror.

The consolidated frameworks of the Open Data Ecosystem are centred on the dynamic relationships between **actors, context and technology**. The actors are usually represented in the roles of data producers, infomediaries, data prosumers, data publishers, and data consumers. The context is defined by cultural, institutional, financial, technological resources. Technology is seen as the operative medium between the actors in the ecosystem [Davies 2011, Harrison et al. 2012, Heimstädt et al. 2014, Zuiderwijk et al. 2014). This schema is compatible with the leading core models of city mirrors, tripartite in representation of users, model of the city as context of users' actions, and role of technology in users' actions.

As regarding the **actors,** the Open Data Ecosystem frameworks identify the unit of action not at the level of the individual users of data, but at the level of structured organisations [Davies 2011, Harrison et al. 2012] having resources, capacity, motivations to set up collective actions on/with/through data. Within the Open Data Ecosystem is also explicit that each actor "play" a role in the flow connecting data to actions, and that role can change. Their role is not necessarily attached to the identity of a specific organisation as a public institution, or business or others. According to these inputs, I focused on the layers of organisations, but also on groups and networks, as the most significant users' layers of the Users core model (see Chapter 5) to be investigated in association with data as relational entities among city stakeholders.

As regarding the **context**, the Open Data Ecosystem frameworks are focused on the broad organisational and technological context in which the production, exchange, publishing and use of data is performed. Moving from this institutional and business environment (characterised by protocols and norms that are knowable) to the urban contexts in which these dynamics happen at the local scale implies to be opened to the unpredictability of relations, needs, activities associated with the data production and use. In this case, instead than focusing on the city as a functional or physical system, I focused on the city as a social system of relationships and values associated with the active transformation of the physical and functional systems mediated by the access to data and technologies, according to the City core model (see Chapter 5).

About this point, it is required to mention that there is a general consensus on the fact that the information needs of local communities still unclear, and how data could be used to address local issues as well [Goldstein & Dyson 2013; Sieber & Johnson 2015; Taylor et al. 2014; Taylor et al. 2015; Harding et al. 2015]. In particular, Tailor et al. [2015] explored the implications of "*data-in-place*" and indicates the crucial importance of discovering the actual needs and the potential use of data by taking into account the interconnection between data, people, and things. These interconnections constitute the social geography of local practices, and hints for considering primarily the social system of the City.

As regarding the role of **technology**, the Open Data Ecosystem frameworks focus on the instrumental use of technology in different phases of data-related processes, and in particular on the use of technology for the acquisition and extraction of information, their management and preparation, processing and analysis, visualisation and use, and publication, sharing and reuse [Lnenicka & Komarkova 2019]. Along with the different steps of the investigation, I considered specifically the role of data portals as web-based technologies supporting the flow of data generation and use. But I also have considered the core model of the role of Technology in local actions (see Chapter 5) as a lens for interpreting the type of dynamics enabled by technology in the different phases of data-related processes.

Building on the vision of City Data as digital and knowledge commons, I outlined the direction for exploring the concept of City Data Open Portal by readapting or extending the inputs of the Open Data Ecosystem frameworks. The exploration of alternative design solutions to the current ones shaping open data portals has been carried out as a further study on the implementation of a City Mirror.

A City Data Open Portal has essential characteristics in common with the design proposal of the City Mirror, as well as the civic social network and the cooperative governance platform presented in Chapters 7 and 8.

- Firstly, an Open Portal should provide an environment enabling the **multiple stakeholders** involved in the City Data Ecosystem to coexist and potentially collaborating in connecting data to local actions. In this sense, an Open Portal is not conceived as the data portal of one specific authority, but as a collective platform.

- Secondly, an Open Portal necessarily should support **multiple purposes** associated with diverse organisational flows, type of activities, operational domains in which data are expected to be generated, shared and used.

- Thirdly, an Open Portal is intended to support **multiscalar** actions on data, such as the integration with national or regional data sources, but also the segmentation and refinement of data at fine-grained granularities such as at the neighbourdhood or building scale.

The **case study of the city data portal of MK:Insight.X** as an example of City-Mirror-in-the-making had been developed by exploring the possibility and the practical constraints for **implementing an Open Portal for city data as natural evolution of the current Open Data portal of MK:Insight**. As I am going to explain in detail in the next section, the Open Data portal of Milton Keynes has a long history characterised by the continuous readaptation of the social practices around data and the role of data technologies over time.

Therefore, the **case study of MK:Insight.X** resulted to be particularly interesting for studying the **relational aspects of data-related processes among city stakeholders** and acquiring supporting information to generate alternative design proposals for city data enhancing these specific aspects. In addition, the research and design activities associated with this case study also enlightened patterns and applications connecting city data to local actions, users' needs and data technologies.

Thus, the general vision of **city data as knowledge commons for city stakeholders** led to consider the **data portal of the city as urban infrastructure**. The working concept of data ecosystem helped to study this urban infrastructure in its structure and dynamics. At the same time, the exceptional context of Milton Keynes and its pioneer data services and technologies pushed to **study the close relationship between local organisations, city activities and technologies by adopting historically wise perspectives** (see section 9.3.1).

9.3 DESIGN AND RESEARCH PROCESS

I carried out the design and research activities associated with the case study of MK:Insight.X from March 2018 to June 2019, collaborating with the two research groups "Intelligent Systems and Data Science" and "Collective Intelligence 4 Common Good" at the Knowledge Media Institute of The Open University[20]. The research group "Intelligent Systems and Data Science" had been involved in the last years to support

[20] I have collaborated with these three research groups to organise the empirical activities reported in section 9.3.4. I have collaborated with the "Smart City in the making" project group for the activities reported in section 9.3.3. Then, I worked with the colleagues Dr. Alessio Antonini and web developer Riccardo Pala (the design team), both affiliated to the research group "Intelligent Systems and Data Science" in elaborating the design proposal reported in section 9.5.2. I worked with Dr. Anna De Liddo, leading the research group "Collective Intelligence for Common Good" and with Dr. Alessio Antonini, on the design proposal reported in section 9.5.1. In parallel, I carried out independent research and design activities related to the topics of this dissertation and Chapter 9. In all these activities I never worked as subordinate, but as independent designer and researcher, guest at the Open University as visiting PhD researcher.
Analogously to the previous two case studies, my research for MK:Insight.X is a practice-based and not work-based research. It is grounded on my experience within the research initiative used as a case study, but not directly related to professional positions or duties (see Chapter 6, section 6.7). In this specific setting, it is also useful to clarify that the research initiative of MK:Insight.X to define the future of the data portal of Milton Keynes was not framed in any funded project. Unfortunately, this specific framing prevented the possibility of moving forward in the applied research through the actual implementation of a working prototype and a structured engagement process, differently from what hypothesized at the beginning.

the management of the existing data portal of Milton Keynes, MK:Insight. On this basis, one of the units of the group promoted an independent explorative research initiative aimed at outlining the future of the data portal.

Some preliminary activities also involved the research group working on the project "Smart City in the making" at the School of Engineering and Innovation of the Open University, engaged in studying past smart city policies in Milton Keynes.

In this setting, I carried out the analysis of past and present conditions, technologies and data practices implemented by different stakeholders at the city level related to the data portal of Milton Keynes. Then, I build on the findings of these research activities by developing preliminary design solutions associated with the concept of Open Portal (modelled as a City Mirror).

9.3.1 COMBINING HISTORICAL PERSPECTIVES AND EVOLUTIVE APPROACHES

The approach adopted to outline the nature of an Open Portal for City Data was based on two pillars:

1) understanding the contextual constraints determining the current stutus of open data technologies and the open data portal in Milton Keynes relying on the analysis of historical sources to depict a comprehensive overview of the reasons for the status quo
2) focusing on the options of partially reusing, extending, integrating, complementing current solutions for open data technologies.

Contextualising a new proposal on the deep understanding of the historical evolution of places and institutions is a common practice in urban disciplines, especially in urban planning and urban design [Abbott & Adler 1989, Kostof 1991], both at an academic and professional level. In the broader and diversified domain of urban studies (that include the sub-communities of various social sciences interested in studying urban dynamics and development mechanisms [Paddison 2019]), historical analyses are also very common, but they are mainly oriented to generate new knowledge on specific phenomena or increasing our understanding on the history of cities as object of study. Differently, in urban planning and design, historical perspectives feed the elaboration of appropriate actions and/or solutions for the city and thus frequently have a very operational purpose. While historical studies in Urban Studies are usually framed under critical, interpretivist or post-positivist epistemologies, in Urban Planning and Design they are based on assumptions and finalities compatible with a pragmatist and constructivist epistemology, oriented to generate a socially robust knowledge that is also useful to address practical problems[21].

Differently from Urban Planning and Urban Design, the historical analysis of the context of intervention is quite rare in relation to the design of information technologies. In the domain of HCI, Bell et al. [2005] proposed the use of historical accounts as a strategy to defamiliarize design products that can end to be considered unchangeable, helping to critically reflect on the reasons for specific design choices of interactive artefacts and technologies, questioning these solutions, assessing their impact on the life and practice of their users. However, there are not consolidated approaches readapting historical analysis for the HCI community. In the field of CSCW, historical account in CSCW theory had been prevalently by used to construct rich, clear, and thick definitions of specific concepts used in the research within this domain [Schmidt 2014], but remained marginal. Recently, the possibility of using historical analysis to inform more

[21] Please see also Chapter 2, section 2.6. The philosophical assumptions orienting and framing this entire work, not just this case study or the application of historical analyses in it, are under the umbrella of pragmatist and constructivist epistemological assumptions.

broadly research on and for CSCW system is emerging [Soden et al. 2019], but still applicative examples are missing. In the domain of Information Systems, historical methods are under a process of framing and codification in the perspective of consolidating their use for self-reflection and meta-analysis of the evolution of the discipline in itself.

In this case study, I combined the use of historical analysis both as a method to investigate local phenomena associated with the use of city data (as it is common in urban disciplines) and to critically approach the issues related to the current design of Open Data portals.

The second point characterising the approach adopted to outline the nature of an Open Portal had been considering the city data portal as an urban infrastructure. As every other urban infrastructure, its planning and design process must be grounded on a solid understanding of the functional requirements, but also the set of institutional constraints, both formal and informal. At the same time, the planning and design of an urban infrastructure requires a short, medium- and long-term perspectives on the organisational and urban transformations needed or affected by its implementation. Consistently with the "cautious approach to radical transformations" [Friedmann 2014], I oriented the design process on the development of **three solutions addressing the different needs, issues and problems emerging from the context analysis. These three solutions can be seen both as a set of progressive steps toward a systemic change of data-related processes at the city level, or as alternative options to pursue this change by leveraging on contingent opportunities respectively related to specific objectives to increase the impact of city data at the local level by integrating and reworking the existing portal, funds for developing new prototypes and new practices, or political support to rethink the data policies and setting up a collaborative governance of city data.**

9.3.2 STRUCTURE OF THE PROCESS

The case study of MK:Insight.X is much simpler than the previous two case studies, FirstLife and WeGovNow, as regarding the structure of the activities undertaken during the design and research process. Indeed, the activities had been driven by a small design team, without external partnerships or project deliverables, but also without dedicated financial resources. This operational setting kept low the complexity of the process and increased the commitment toward an effective use of materials, time, internal resources, opportunities of interacting with city stakeholders.

In this case study, the design and research process are entirely compressed within the pre-design phase, in between the analysis of the context and the generation of solutions addressing issues and needs identified during the process itself. On one side, this process was called to build on the heritage of the past and current data portal of the city of Milton Keynes. This heritage was not limited to the web platform for city data, but also to a network of relationships within the city data ecosystem and a set of practices and protocols associated with the kind of data services provided by the local council of Milton Keynes. On the other side, the use of the current data portal is extremely limited and there was the intention of moving forward by defining a technological alternative to facilitate the access and use of city data for city stakeholders. The **tension between the long history of the MK data portal and the exploration of alternative solutions for the future management of city data** led to approach this design problem by adopting an **historical perspective** (see section 9.3.1).

A **second tension** in the design and research process was between the **specificity of the context of Milton Keynes and the fact that the underuse of open data portals is a more general and common problem at the local, national and international level** (see section 9.2). Thus, a significant effort had been deployed to critically analyses local dynamics in relation to trends and directions observable at upper scales. The same perspective had been adopted to define the technological solutions for the future management of city data. Indeed, the focus was on balancing specificity and generality of the issues to be addressed through solutions potentially transferable and adaptable to different contexts.

The process had been structured into three macro-phases, as illustrated in Fig. 9.3.

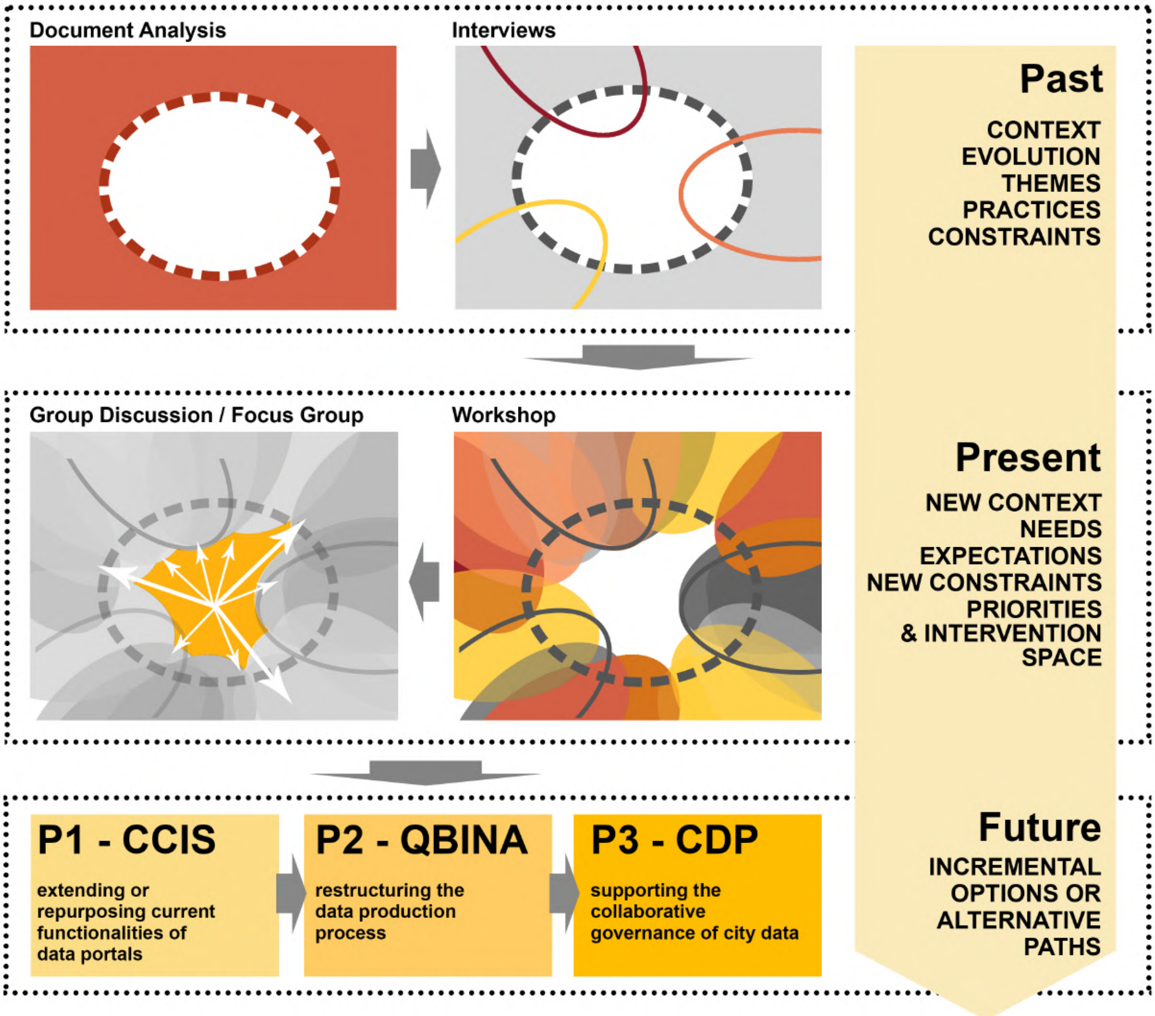


Fig. 9.3 Design and research process in the MK.Insight.X case study

The first macro-phase investigated the evolution of data-technologies and data-related services in Milton Keynes from 1998 to 2017, by taking into account the changes in the trends associated with Open Data and smart city initiatives at the national and international level. Beyond portraying the context, the goals of the document analysis and the interviews done in this phase was **outlining the boundaries of the intervention space for the next data portal**. In particular, by circumscribing themes and practices locally associated with city data in the past, but also as regarding the constraints regulating the actions of the MK Local Government within these boundaries.

The second macro-phase focused on reactualising and integrating this knowledge through the active involvement of the major stakeholders in the city data ecosystem of Milton Keynes. The workshop and group discussions organised in this phase were oriented to understand current needs, expectations, practices associated with city data from multiple perspectives. These activities helped in clarifying priorities and constraints of different classes of stakeholders, while in the first macro-phase the attention was on the local government. This phase resulted in **defining the morphology and structure of the intervention space for the next data portal.**

The third macro-phase had been developed as a flow of **three distinct sub-projects** aimed at exploring how to organically compose all the diverse instances collected and analysed before**, within the boundaries and according to the morphology of the intervention space.** The design solutions generated in this phase tried to address the central issues of open data and city data portals from different perspectives: technological, procedural and policy driven. The three design proposals included:

- A **Contested Collective Intelligence System** (CCIS) to integrate machine and human annotation of data and supporting users to understand if the available data match their purposes
- A **Question-based Information Needs Aggregator** (QBINA) to overcome the misalignment between available data and required data
- A **City Data Plan** (CPD) to infrastructure inter-organisational collaboration in data production and use at the city level.

These three proposals can be seen either as alternative paths to rethink data portals, or as steps integrated into an incremental transformation of the processes of data production and use at the local level.

Along the three macro-phases, my research activities connected the pieces of evidence gathered about the past of the Milton Keynes portals with the current needs and expectations emerging from the engagement initiatives. Then, they accompanied the design process by connecting the findings of the empirical research with the solutions progressively elaborated and iteratively validated against the constraints for intervening in the city data ecosystem. The three proposed solutions had been also informed by the proposal of the City Mirror, and designed as multi-stakeholder, multi-purpose and multi-scale web-based technologies.

The following two sections, 9.3.3 and 9.3.4, respectively report on the first and second macro-phases of the process, while the three design proposals of the third macro-phase are discussed in detail in section 9.5.

9.3.3 BUILDING ON THE LEGACY OF THE MILTON KEYNES INTELLIGENCE OBSERVATORY

Milton Keynes (MK) is the last of the new towns of the UK, founded in 1967, and driven by the aim of creating *"the city of dreams"*, innovative in its built environment, social vision and public management strategies [Bendixson & Platt 1992, Edwards 2001, Clapson 2004]. This particular status led to a substantial commitment of the local government to support and proactively promote innovation in public services, while other important stakeholders such as the University and large business companies had been historically engaged in making Milton Keynes a testbed for disruptive innovation in research and education[22], as well as in many sectors of technological and non-technologies industries[23].

This note is important to provide some context to the fact that the **local council of Milton Keynes (MK council) provided cutting-edge data-related services in the last twenty years**, also because of the "exceptionalism" of Milton Keynes and its structural commitment toward innovation. Indeed, from 2003 to 2015, the local council not only provided an open data portal to the community, but it also established a dedicated team managing the requests of data from city stakeholders and delivering online and offline

[22] The Open University, the University of Milton Keynes, had been the first high education institution providing distant learning courses since 1969, driven by the purpose of opening the access to education in the UK and in the world. Nowadays, it is the biggest university in the UK with over 170.000 students.
[23] Milton Keynes hosts headquarters and important operational units of several global companies since the '60s.

assistance in the use of data in local actions. This initiative was called **Milton Keynes Intelligence Observatory (MKiO)**. The MKiO had been dismantled in 2015 because of the shrinking of public resources, leaving behind only the technological side of the data-related services associated with the open data portal.

I started my design and research process by analysing the **documental traces of the long history of the MKiO experience that combined technological and human support in the production and use of data in local actions.** The history of the MKiO had also been analysed in relation to the national and international course of events concerning the release of public data and affecting directly and indirectly the MKiO services.

9.3.3.a The history of the MKiO and the evolution of national and international Open Data trends

The MK council included data analysts in its staff since 1998. They were required to support the different sectors of the administration through the analysis of national and internal data, but also to import state-of-the-art practices about the use of data adopted in research institutes into the local administration [Errington & Hassanali 2005]. The activities of MK council data analysts have been progressively structured to meet the new requirements of the Freedom of Information Act[24] (FOIA) signed by the UK in 2000. This new policy explicitly insufflated the principles of open government in the UK local authorities, supporting the disclosure of internal acts, reports and data associated with public services.

In 2003, the MK Council established the **MK Intelligence Observatory (MKiO): a cross-department group of data analysts and other professionals dedicated to providing analysis and data elaborations of public data**. The activities of the Intelligence Team were primarily intended to support the various department of the MK Council by overcoming the separation of competences and data in silos. Beyond that, these activities were aimed at addressing the **needs of other public agencies interacting with the MK Council and other external organisations requesting local data for their initiatives**. The MKiO was a service in between internal and external users of city data. From 2004 to 2015, the Intelligence Team had been also working to produce **reports of public relevance built on city data**, which the most important was the Social Atlas: a project of the MK Council to depicting a comprehensive profile of the city by integrating multiple data sources concerning poverty, social services, education, health[25].

In 2004, the activities of the Intelligence Team started to be supported by a technological platform, expanded and integrated over the years with additional functionalities (see section 9.3.3.c). However, the technological platform remained an accessory of the Intelligence team activities and a sort of first intermediary in the relationships with organisations not actively involved in the city data ecosystem. Indeed, from 2009 to 2014, the Intelligence Team organised trimestral meetings with partner organisations to discuss uses, case studies and applications of the available data, and to support the data sharing through networking, instead than relying on the technological platform only [Hassanali 2009]. In these years, the expression MKiO referred both to the services provided by the Intelligence Team and to the data platform.

[24] Freedom of Information Act 2000, UK legislation. http://www.legislation.gov.uk/ukpga/2000/36/contents

[25] MK Social Atlas reports and datasets. Milton Keynes Council. URL: http://mkinsight.org/?s=social+atlas visited in November 23th 2018. The Social Atlas was an initiative grounded on the national effort toward the standardisation data about factors impacting on social fragility, resulting in the definition of the Deprivation Index. The Social Atlas was an annual report and datasets, produced by MK Intelligence Team from 2004 to 2013. From 2004 to 2016, the Intelligence Team supported the dissemination of reports and new datasets by sending periodical newsletters to the registered users and to the partner organisations. More information on the Deprivation Index at: "Most Deprived Areas in the UK. Office of National Statistics". URL: https://www.ons.gov.uk/aboutus/transparencyandgovernance/freedomofinformationfoi/mostdeprivedareasintheuk. Visited on November 26th, 2018].

In parallel to the experience of the MKiO, two major changes in the international and national trends regarding the management and access to public data set the conditions for deeply restructuring activities and vision of the MKiO in the long term [see also Fig. 9.4]. These major changes concerned the framing of Open Data first, and then Smart City projects.

At the international level, Open Data started to became a topic associated with the paradigm of Open Government in 2004, with a joint declaration subscribed by the research ministries of the OECD countries that established the principle that **the knowledge produced by using public funds should be made publicly accessible**[26], highlighting the political dimensions of the open access to scientific data[27]. In the following years, this principle led to a **progressive shift from scientific data to government data as a common definition of Open Data**. Since this moment, the Open Government principles (stating that government information are of public interest since late '50s) incorporated the idea of Open Data as means for improving the transparency and accountability of governments and administrations operating in democratic settings[28] by using web-based technologies to reach and engage the public in unprecedented ways. Then, in 2007, the Open Source Movement claimed Open Data as web resources available for reuse, outlining the new role of the tech activists or data champions to intermediate the access and reuse of data for social good through new Web 2.0 technologies. In the same period, the reuse of Open Data for the "common good" is supported also by the re-emerging idea of the "knowledge as commons" [Hess and Ostrom, 2007], extending the goals of the access to public data beyond the instances of Open Government and Open Source Movement.

The international discourses build around Open Data mixed the intrinsic value of types of data such as scientific data, with the extrinsic value of data as evidence of transparent institutions. At the same time, the key assumption regarding data practices was the possibility of transferring types of cooperative practices that can be observed for the production of scientific knowledge to the production of knowledge to address community or civic challenges, with or without data champions. However, these discourses and aspirations tended to ignore the structural constraints for the wanted change. On one side, the paradigm of Open Science was based on common practices of academic collaboration among scholars and institutions working on the same topic and sharing joint data resources to generate new knowledge for understanding complex research problems such as the climate change. In these cooperative practices built around data, the involved actors would be assumed as sharing a common goal, but also the same knowledge base on the type of data or phenomena, a common vocabulary, and shared norms and expectations about research practice and research integrity[29]. Therefore, they were considered as homogeneous groups, more or less spontaneously cooperating because knowledge generation was their core activity. On the other side, the paradigm of Open Government was based on a sort of impossible antagonism between governments and general public, and on an idealistic projection of the open science practices into the public arena. In this setting, the government was supposed to provide the instruments for enabling the general public evaluating and monitoring its own activities accepting the risks related to control mechanisms offered to the public against the government. The general public was also supposed to go beyond watchdog activities for becoming empowered and empowering others through data, cooperating in knowledge creation even though this was not the core

[26] OECD Declaration on Open Access to publicly funded data Archived 20 April 2010 at the Wayback Machine.

[27] The term Open Data appeared for the first time in 1995, but the concept of Open access to scientific data (Open Science) was already institutionalized in 1957 [National Research Council US 1995, Simon 2013].

[28] Open Government. OECD, URL:http://www.oecd.org/gov/open-government.htm, visited in November 23th 2018.

[29] It is worth to highlight also that the nature of data in scientific domains refers to experimental data (often expressing quantified parameters referring to a specific phenomenon and ready to be computed), while at that time open government data were including acts, reports, census, geographical information, not intended for any specific further use than informing the general public.

activity of all segment of society, and there were objective difficulties due to the heterogeneity of interests, priorities, vocabulary of different social forces. On this side, different perspectives supported the role of tech activists or local communities, but not necessarily collaborating with others or with the public administration toward common goals.

This shift from Open Data in Science and Open Government data also divided the process of data production and communication from the actual use and reuse of data, respectively concerning public authorities on one side and an indefinite general public on the other side. As a consequence, the nature of the data practices intended to be enabled through the open access to data changed radically from being collaborative practices among peers to become control mechanisms between two parties with unbalanced powers.

The aspiration of transferring the good practices related to data from the domain of science to the improvement of public services was one of the key drivers in the vision of the MKiO. In this picture, the intelligence team was covering the role of data champion (or data intermediary) into the city data ecosystem, but working from the inside of the public sector and not in antagonism (as more frequent in the vision of the Open Source Movement). **The work of the MKiO remained for a few years in countertendency respect to national trends, focused on the production of data and data-products (such as public reports) associated to the direct needs of local organisations.** In addition, the strategic choice of a cross-departmental small unit working as a bridge among different subjects was extremely innovative and effective to make easier data exchange and realistic needs assessments (see also section 9.4).

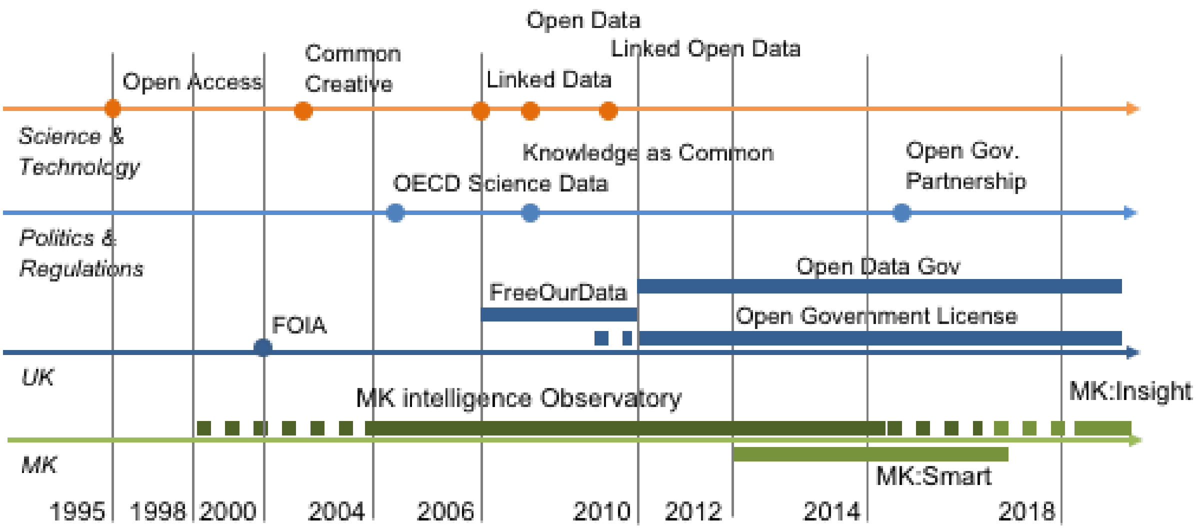


Fig. 9.4 Contextualising the experience of MKiO and MK:Insight in the national and international trends regarding Open Data (source: author, contained in the technical report Lupi&Antonini 2018)

At a national level, in the UK, the Guardian[30] started the campaign *"Free Our Data"* in 2006. This campaign brought to the public attention the importance of **accessing to government data as product of taxpayers' money**, by pointing out specifically the problematic monopoly of certain type of data by semi-public

[30] The Guardian is a British independent newspaper, not affiliated with one the two major political parties in the UK, and traditionally not necessarily aligned with the London-centric vision of the country. The Guardian supported several public campaigns since the beginning of the XX century.

agencies charging businesses for geographical and transport data[31]. In this way, the **British version of the public discourse on Open Data** became articulated in a political and an economic level, respectively supporting the **instances of citizens as taxpayers entitled to have free access to national data, and the business sector claiming their rights over the free access to medium-scale datasets essential for industry needs.** Idealistic orientations toward the potential use of data for community purposes or even setting up cooperative practices around data was not part of the public discourse on Open Data at that time in the UK. The pressure of media and lawsuits issued to the antitrust against government-funded agencies contributed the most to significant changes in the management of public data. Between 2009 and 2010, the British government defined the Open Government License (OGL) for a part of public data released as free to be used[32] and established the national open data portal (data.gov.uk), still in place[33].

In 2010, there was a critical difference in the approaches to data adopted at the national level and the ones pursued in Milton Keynes. In the first case, the emphasis was on releasing and publishing data regardless of their potential use and reuse. In Milton Keynes, the provision of data to city stakeholders remained framed within the services provided by the MKiO through the analysis and tailoring of data under the light of local needs and challenges. Publishing data in MK was just one of the outputs of multi-actor processes, participated by the local government, the MK Intelligence Team, other public agencies, non-profit organisations and local ICT and non-ICT businesses. In this context, the MK Intelligence Team's effort was focused on supporting these various actors, local administration and public agencies *in primis* though, to improve the management of their operations. As regarding the business sector more specifically, the MKiO activities were oriented instead to support the cooperation of local stakeholders with the MK council. Consistently with the orientation of the British discourse on Open Data, also the priorities of the MKiO did not include community concerns or the use of data for civic purposes as key concerns.

The second major change at the international and national level concerned the growing attention to smart city initiative since 2008-2009. This new trend had the most profound impact on the management of city data by the MKiO. Indeed, for the first time, local governments had the availability of large amount of data having the properties of scientific data (such as reliability, veracity, objectivity) and covering many new domains beside administrative activities (such as traffic and energy consumptions). These new types of government-owned data have high potential for reuse and value generation. As mentioned before, their release as Open Data is often in conflict with data-related services and revenues models associated to the partnerships between governments and tech companies managing the data collection and processing. However, these data (released or not as Open Data) configure complex data practices involving the companies to which governments outsource the data production, the governments that decide how to use internally these data and what part to release, and other stakeholders such as local businesses and organisations interested to use data as resources for their activities. Therefore, differently from the paradigm of the Open Knowledge, these practices are characterized as competitive, both internally and externally to the various organisations involved.

Cooperative models of data practices referring to the Open Knowledge paradigm persist at the city level in parallel with competitive ones within the framework of stakeholders' relationships in smart city projects, sometimes creating tensions between citizens and local governments. The widely recognized importance of city governments and stakeholders to jointly address local problems defining new ways to exploit the

[31] Free Our Data. The Guardian. URL: http://www.freeourdata.org.uk/ visited on November 26th 2018. A significant extract is: *"government-funded and approved agencies such as the Ordnance Survey and UK Hydrographic Office and Highways Agency are government-owned agencies; they collect data on our behalf. So why can't we get at that data as easily..."*

[32] Open Government License V3. The National Archives. ULR: https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ visited on November 26th 2018.

[33] Data Gov Uk - Find open data. The Government Digital Service. ULR: https://data.gov.uk/ visites on November 26th 2018.

available resources, data included, determine the importance of understanding better how to support different data practices in different domains for enabling informed decisions and actions of private and public organisations.

In 2012 Milton Keynes made its first steps into the smart city domain with a five years programme called MK:Smart[34]. This programme included important investments in a new ICT infrastructure for the production and management of urban data from sensors, but it also looked specifically to open data[35] as public resources for city stakeholders. To this regard, the MK:Smart programme was intended to realign MK with the global and national technological and operational trends on open data.

During the development of MK:Smart infrastructure, the MKiO services had been progressively reorganised, reduced and at the end closed between 2015 and 2016. In 2017, the MK Council and the Open University jointly drove the transition from the team-based services of the MKiO to a technological-centred service provided by the MK:Insight portal, officially launched in March 2018 (see section 9.3.3.c). In other words, the services of the MKiO had been replaced by an Open Data portal, pushing for the transition from a group of data experts interacting with local stakeholders to a technological platform supposed to enable local stakeholders put data in use on their own.

Relating the strategies and operation of the MKiO to the international and national trends helped to highlight both the expectational associated with this experience, and critically reasoning on the underlying vision of Open Data and the city data ecosystem shaping specific data practices. In addition, connecting the evolution of national and international trends to the progressive restructuring of the operations around city data in Milton Keynes helped to understand the political and organisational (other than financial constraints) to pursue independent local policies.

9.3.3.b Outlining the Data Practices of the MKiO Intelligence Team

The MKiO experience is particularly interesting because it could be considered as a precursor of this new vision linking data resources to a data ecosystem. Nowadays there is a generalised consensus on denying the myth that publishing data would automatically result in their use [Janssen et al. 2012, Zuiderwijk and Janssen 2014]. Nevertheless, there are no documented experiences, lasting for decades and moving beyond pilots and prototypes, of completely alternative approaches to the data production and use at the city level.

The interest in the data practices of the MKiO Intelligence Team relied precisely on the fact that the MKiO implemented for years the connection between the access to data and their actual use by city stakeholders. The experience of the MKiO had been an attempt to bridge the paradigm of Open Government and Open Knowledge at local scale, anticipating the recent vision of open data as actionable resources. Moreover, the combination of an intelligence team and a data platform developed as an experimental human-centred solution to the challenges of the use of Open Data was already beyond the vision of data as product, defining a structured service around Open Data as only recently recommended by Gurstein (2013).

At the beginning of the investigation for this case study, the only traces of the MKiO past activities were the available datasets migrated to the new portal. However, the access to these datasets did not provide elements for understanding if and how they were used before, or why they had been produced, or how local council officers and data users combined these datasets on the portal with other resources not in the portal.

[34] MK:Smart. The Open University. URL: http://www.mksmart.org/ visited on Noveber 26th 2018.
[35] MK Data Hub. The Open University. URL: https://datahub.mksmart.org/ visited on November 26th 2018.

The search for potential sources to acquire information on these aspects led to identify the social scientists working in the project *"Smart City in the Making - SCiM"* [36] as experts to be consulted in the first explorative phase of our study. Their research project was specifically aimed at studying how smart policies and technologies had been implemented in Milton Keynes in the last two decades, covering also the evolution of the MKiO service. From March 2018 to May 2018, in the framing of a voluntary academic collaboration between the SCiM researchers and the design team of MK:Insight.X, we conducted a set of 5 meetings with the referent of that project involved in on-field activities and data collection for the SCiM project. The meetings had been structured as interview sessions with the consulted expert, combined with a joint analysis of relevant documents including information on the MKiO service.

The interviews with the expert did not follow a predefined list of questions. Open questions had been driven instead by the topics mentioned in the documents analysed in each specific session, while keeping the focus on the three aspects we intended to investigate: production of data, use of data, and relationship between them. Each meeting lasted about two hours and a half, and the dialogues had been recorded to complement the notes taken by the me and a colleague during the session, and used later as complementary sources for the analysis of the MKiO data practices.

The documents discussed during the meetings had been selected by the expert as sources mentioning the activities of the MKiO or associated to the use of data provided by the MKiO. They included the transcript of an interview to a member of the MKiO staff made by the SCiM group, 3 internal reports of the MK Council about the MKiO from 2003 to 2007, 8 policies reports from 2006 to 2015, and other public documents of other stakeholders referring to the former data portal or to its content such as local plans documents or reports of local projects. The series of meetings continued until all the documents had been reviewed at least once with the expert.

The combination of interviews with document analysis allowed us to integrate factual information coming from the experience and knowledge of the expert about the evolution of the MKiO service with support evidences extracted by documental sources. In particular, the interviews performed in the frame of this collaboration provided us a comprehensive context for statements, actions, and initiatives traced in the documents, while the internal and public reports outlined the applicative scenarios of the data services provided by the Milton Keynes Local Council from 2003 to 2015. Nevertheless, this first exploratory phase did not help us to understand how the MKiO was internally organised and how data services were provided. This led me to reach the former members of the Intelligence Team for in-depth interviews about their activities in the MKiO.

Between June and July 2018, I interviewed the main data analyst and the system administrator of the MKiO that worked as part of the Intelligence Team from 2003 to 2015, and the public officer charged of the management of data services for the local council from 2015 to 2017. Other members of the intelligence team were unreachable. However, the experience of the three interviewees covered the entire life cycle of the MKiO, providing both the perspective and work details about data practices inside the Local Council and behind the city Open Data portal. I personally prepared and conducted the interviews. Each of them lasted between 90 and 100 minutes, followed the same interview guide, and it had been recorded and fully transcribed for the following analysis.

The questions to the former Intelligence Team members followed a sequence aimed at:

- defining the operational context of the team and the interviewees work in particular,

[36] http://www.scim-mk.org/

- and examining in detail the organisation and tasks of the four types of activities associated to the MKiO as emerging from the document analysis:
    - *"content management"*
    - *"information monitoring"*
    - *"information gathering"*
    - *"communication of information"*.

  For each activity, the questions concerned the tasks included at the level of individuals and team, but also the rules and procedures for their implementation and the associated outputs or outcomes.

Two of the interviewees shared with my team additional documents elaborated during their past activities for the MKiO allowing us to use them for our study. The documents provided by the former system administrator[37] are:

- the full transcript of an interview with the manager of the Intelligence team
- the partial transcripts of interviews with the senior data analyst and the data manager
- questions, data, and results of a survey on the use of data by the users registered to the MKiO platform in 2009 [38]
- screenshots and detailed description of the MKiO platform.

The documents provided by the officer managing the transition included example of the communication sent to the users to inform them about Open Data updates and initiatives at city level. These documents had been used as complementary sources to have some details about the perspective of two team members that we were unable to reach and an overview of the functionalities and use of the technological platform as part of the data service.

9.3.3.c Prevoius data portals of Milton Keynes and MK:Insight

As mentioned in section 9.3.3.a, the activities of the MKiO had been supported by a technological platform that undertook continuous updates and integrations from 2004 to 2015, to be then dismissed and replaced by the data portal MK:Insight.

The activities of the Intelligence Team started to be supported in 2004 by the first technological platform, that was a knowledge management system associated with a GIS and a data analysis module. In 2008, the MKiO knowledge management component was migrated to "Funtain", a system expanding the previous functionalities with improved search and navigation tools as well as with features for collaboration, sharing and discussion [see Fig. 9.5, 9.6]. Interestingly, these last set of features had never been used by any user from 2008 to 2015, as emerging from the internal reports prepared by the System Administrator. From 2009 to 2014, the Intelligence Team organised instead trimestral meetings with partner organisations to discuss uses, case studies and applications of the available data, and to support the data sharing through networking, considering that the platform was ineffective under this point of view [see section 9.4.1]. In these years, the expression MKiO referred both to the services provided by the Intelligence Team and to the data platform because the MKiO was using the city open data portal as a support tool in the provision of their services.

[37] The system administrator developed a master thesis on the work she was perfoming in the Intelligence team and the listed documents are attached to her thesis. Ref. tesi.
[38] The research had been carried out by the System Administrator of the Intelligence Team in collaboration with the data analysists and supported by the manager of the MKiO. The study was based on a survey sent to all the users registered on the data portal (377) and open to unregistered users, receiving 52 responses.

It is important to highlight also that the MKiO platform had been established at the beginning as a "*Local Information System*" and not as an Open Data Portal. In other words, the main purpose of the platform was aggregating, structuring, providing data on the city to local stakeholders, not simply publishing governmental data as a transparency act, as mentioned also in the previous section [Hassanali 2009].

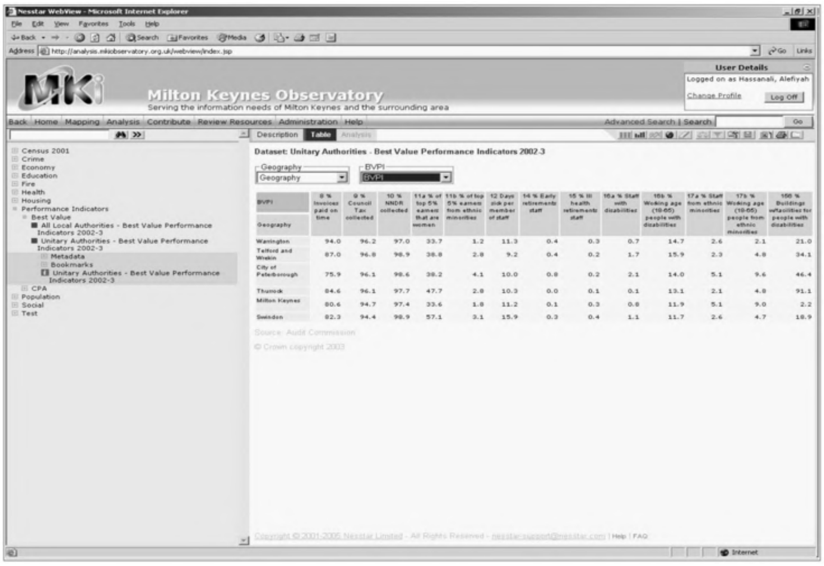


Fig. 9.5 Screenshot of the MKiO portal. Tabular Data Visualisation (source: Handbook of MKiO)

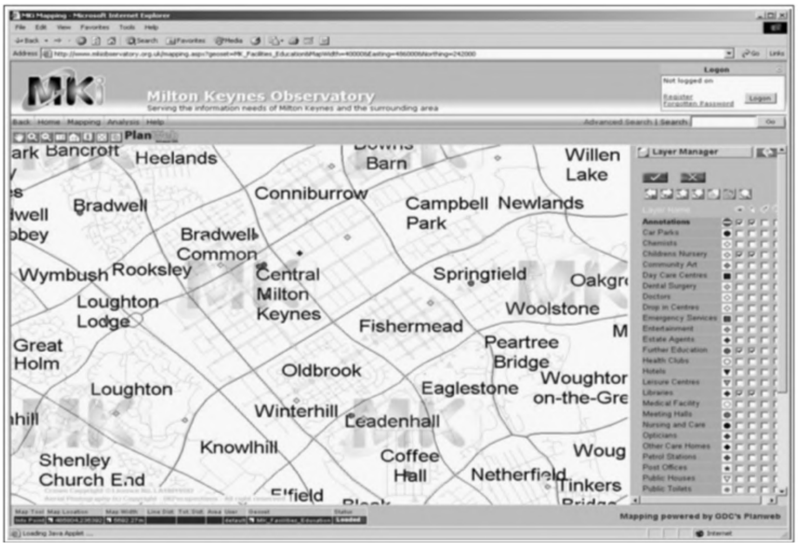


Fig. 9.6 Screenshot of the MKiO portal. Map-based Data Visualisation (source: Handbook of MKiO)

At the global level, a technological shift around 2010 and the introduction of new paradigms such as Linked Data and Semantic Web started to push toward technologies enabling end-users in being autonomous in data retrieval, exploration, visualisation and integration, that were tasks performed case by case by the Intelligence Team in the context of Milton Keynes.

From 2010 to 2018, the city of Milton Keynes progressively tried to restructure its data services, moving from an intelligence team service to have only a web-tool for data discovery (because of the technological advances mentioned above), and from a centralised unit operating for the MK Council as a hub for other city stakeholders to the idea of a distributed effort of distinct departments supported by technology only.

The old portal started its slow dismission in 2016 and, in between 2017 and 2018, the new portal MK:Insight had been launched. This new portal gathered all data and reports produced by the intelligence team over the years and new open data release at a national and city level (for a total of over 650 datasets and documents), providing support for thematic exploration of data to end-users, similarly to the national open data portal data.gov.uk, and integrating self-publishing tools available for the MK Council departments [see Fig. 9.7].

Some facts can help to understand why in 2018 arise the need to radically rethink this new portal, even though it was new. In the first eight months of activities, MK:Insight had been visited less than 5000 times, by users that just stopped at the basic statistics presented in the home page. Tragically, the top two (almost only) searched words were still *"milton keynes observatory"* and *"mki observatory"*, probably by users desperately searching to reach the previous portal or contacting the previous team. Moreover, since the launch of the portal, no new contents had been published on the portal and no new users register in the platform from the MK Council departments or other public agencies involved before by the MKiO. These disappointing results were even more critical considering that the central goal was to replacing the centralised management of city data with the distributed technology-supported approach.

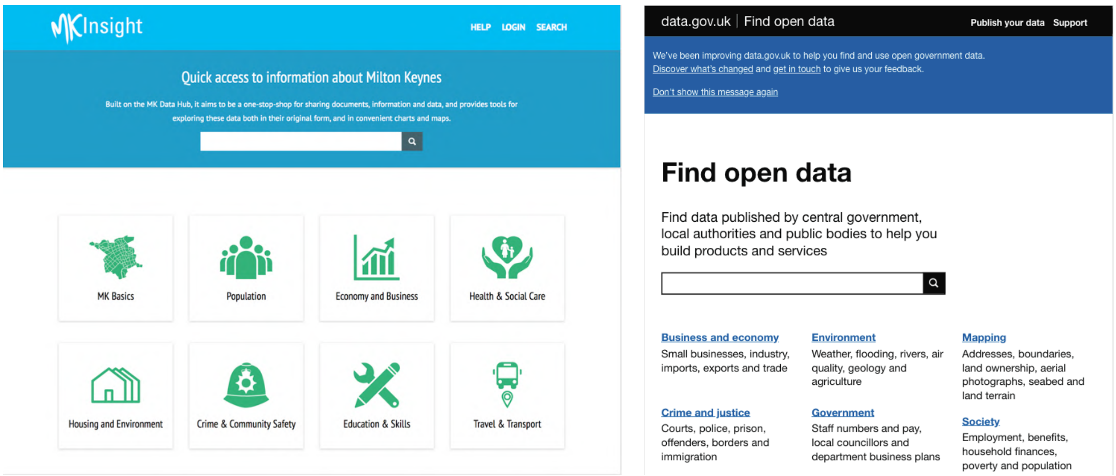


Fig. 9.7 MK:Insight home page follows the similar approach used for Data.Gov.UK.

9.3.3.d Lessons learned in the first phase

The historical analysis summarised in this section had been essential for the subsequent steps of the design and research process. This analysis:

- helped in understanding the **complex set of factors at international and national level** that impacted on the role that the data portal of Milton Keynes had at the city level
- outlined **how and why we inherited the current data portal**, and what alternatives had been implemented or experimented in the past
- provided **support information about solutions already pursued in the past** that resulted unsuccessful, avoiding to repeat them again in future design proposals
- provided a **set of applicative scenarios across various domains**, built on the availability of city data from 2003 to 2015 (see also section 9.4)
- enlightened crucial aspects and dynamics of **data practices in a collaborative environment within the city data ecosystem** (see also section 9.4).

9.3.4 CONNECTING CITY DATA TO LOCAL ACTIONS IN THE PRESENT

The current non-use of the new data portal in Milton Keynes is not actually an isolated case, for the reasons mentioned discussed in section 9.2. Indeed, the barriers preventing the use of Open Data in Milton Keynes correspond to the well-known issues including: lack of context of data sources; lack of feedback mechanisms; low level of accessibility of data sources; lack of flexible visualisation tools; lack of a shared glossary between data producers and data users; lack of applicative examples on the use of available data. Rather than addressing these issues by focusing on developing alternative technological solutions as done in the last years, we decided to investigate the root problem: understanding what could make the city open data and the data portal used in local actions nowadays.

Indeed, at the beginning of the second phase of this study, we knew already that data available on the current Milton Keynes open data portal were not used and that it was useless to pursue "cosmetic interventions" on the interfaces or improving the performances of the portal as done in the past. On the other hand, our preliminary research on what happened with the previous versions of the portal revealed that it was used until a support team was in place to help users in making an effective use of data in their activities. But the shrinking of administrative resources made now impracticable that arrangement and the current system in itself do not compensate the absence of the human support to the use of technology.

Building on that background (but also on the imponent literature remarking the same issues as widespread), we structured our work in Milton Keynes under a double perspective. On one side, we considered the specificity of Milton Keynes in terms of the set of local actors to be involved in the design process, as well as specific services and practices associated with city data that are common in this context. Thus, we considered Milton Keynes as a local data ecosystem [see section 9.2]. On the other side, we set up the analysis at a meta-operational level to gain some insights on dynamics that also recurs in other cities at the level of relationships among local stakeholders, considering that the underuse of open data portals is a widespread problem, according to the literature.

In Milton Keynes, like in every other city, there are the same classes of stakeholders interested in city data for different reasons. For instance, local government for demonstrating transparency on its activities, public agencies (e.g. National Health Services) for planning and assessing their services provided at the local level, businesses for optimizing their commercial strategies, non-profit organisations for sustaining community initiatives, and academia for research purposes. Moreover, according to common schemas characterising the public discourse on Open Data from the local to the global level, also in Milton Keynes, the local council is considered as "the" data provider. Other stakeholders are considered potential "data users" only and usually generically indicated as "citizens" or "the public". These framings remove the possibility of bringing to light the relationships and social interactions associated with data, mediated by data, or instrumental for the production, elaboration, use and communication of data.

In pursuing this second phase of the study, *"silencing"* the public discourse around Open Data and leaving aside for a moment the crystallised roles commonly attributed to the organisations representing specific classes of stakeholders within this discourse become an absolute priority. Indeed, while on one side was essential to engage local stakeholders to understanding how to support the use of city open data in local actions trough alternatives at the current portal, on the other side was meaningless to see just confirmed what we already knew to be recurrent statements (e.g. "local government must provide more data", "businesses want data just for making profits by exploiting us", "data will empower citizens and generate development", "people don't know how to use data", and so on). In other words, silencing the discourse was essential to focus on the practices and the structures of the different organisations actually working with data in the city, understanding what prevent the use of available data in these actions, and what could be the alternative solutions that could fit into this landscape.

9.3.4.a Tactics for "silencing" the public discourse on Open Data

The crystallised roles in the Open Data discourse are difficult to be challenged because they are a sort of fictitious identities such as "the" data provider, "the" data intermediaries, and so on. Over the last decades, these identities not only have generated expectations, demands and reactions to them, but they also evolved in stereotyped representations impacting on what is considered acceptable or "the norm" around city data, impacting again of the nature of data portals.

Conventional user research methods such as individual interviews, focus groups or surveys would not be effective to investigate the actual roles and relationships among city stakeholders regarding data-related processes and understanding their needs in relation to data-technologies. These methods based on asking individual positions and desiderata were unsuitable for two reasons. Creating a pluralistic dialogues space is already considered a consolidated practice to move beyond stereotypes in multi-stakeholder settings [Johansen & Nielsen 2011, Hemmati 2012]. Moreover, differently from answers that can be gathered separately, the ones collected in a collective setting tend to be balanced, pre-assessed against social and organisational constraints, and self-compensated, facilitating the formulation of a *"socially robust knowledge"* [Nowotny 2003].

Other standard methods for user research such as task analysis, contextual enquiries and ethnographic observations would be inapplicable to the variety of possible settings and applications of city data. Similarly, long-term participatory processes with multiple stakeholders would have been difficult to manage and incompatible with the time constraints for developing a simple design proposal.

The approach defined to overcome the "obstacle of the public discourse" (and related stereotypes) and move on to the exploration of the actual practices and relationships associated nowadays with the use of City Data and Open Data was based on:

- Considering the **frameworks of Open Data Ecosystem** [see Section 9.2 and Table 9.1]
- Experimenting the **use of archetypes in combination with the roles** usually defined in the Open Data Ecosystem. Archetypes are indeed social constructions concretising collective unconscious understandings of the reality [Jung 2014], but most importantly have primarily a functional nature in which the roles played by each character are strictly dependent on the narrative flow (the actions) and not on external attributions (such as social conventions and stereotypes). These roles can be ambivalent, transient, and multifaced and, at the same time, can help to build the big picture of the mutual relationships among different characters in the context.

More specifically, we decided to rework the characters of Vladimir Propp's theory on the construction of narratives [Propp 2010 – see Table 9.2] in combination with the definitions of the operational roles of different actors in the open data ecosystem [see Table 9.3] to build then the dialogue tools with local stakeholders, able to softly overcoming the barrier of the public discourse without asking direct (and possibly) uncomfortable questions.

Table 9.1 Roles of organisations involved in ecosystemic visions of open data

Roles in data-related processes	*Description*
Data subject	Subject of the data collection
Data collection promoter	Asking and supporting the data collection around a topic
Data provider	Publishing and making available data, internally produced or not
Data analyser	Analysing, processing and elaborating data for third parties
Data consumer	Using data as support for decisions and actions
Data communicator	Using data as media or evidence in communication and dissemination activities

Table 9.2 Roles of the Propp's characters in the Theory of the narrative structure

Propp's characters	*Description*
The Hero	facing a specific challenge
The Helper	helping the Hero in his mission
The Villain	contrasting or fighting the Hero
The Dispatcher	advising the hero of risks and problems due to the Villain
The Father	assigning a task to the Hero
The Donor	giving an essential object to the Hero
The Princess	the subject to be saved or the Hero's reward
The False Hero	taking credit for the Hero's activities or seeking the same reward

Table 9.3 Hybridisation of the organisational roles in the Open Data Ecosystem and the Propp's characters

Roles	*Description*	*Mapping with Propp's characters*
Promoter	identifying the problem and the approach toward the solution, sets the goal, and defines the terms or directions of activities.	The Dispatcher
Implementer	organising the resources, solves the problems, and carrying out the activities to achieve the goal.	The Hero
Influencer	helping or hindering the implementer by engaging people in favor or against the promoter's initiative or the implementer activities	The Helper, The False Hero
Decision Maker	having the authority to support or stop the promoter's initiative and/or the responsibility to evaluate the results of the implementer's activities.	The Father
Resource Holder	enabling or obstructing the implementer's activities by making available or taking away the means to perform the required tasks: materials, equipment, information, skills, powers.	The Donor, The Villain
Beneficiaries	constituting the intended target group of the initiative. Meeting their needs is one of the drivers of activities.	The Princess

These reworked definitions of the Proop's characters had been used as devices for structuring the development of stories around data in the city dialoguing with city stakeholders in Milton Keynes about their actual experiences with city data, expectations, perceptions, issues, and by focusing on the relationships supported or developed around data and the data-related operations that the future open data portal should support. These stories had been developed during a workshop with city stakeholders [see next sections].

Storytelling techniques are quite common in design research, even if not univocally codified [IDEO 2009]. They are considered as generative tools in co-design processes [Sanders 2000], as a way to inform, inspire, provide context and outline potential solutions for future designs [Beckman & Barry 2009], and most of all, as strategies to understand the perspective of others and emphasise with the needs of the prospective users in a design research process [Parrish 2006].

As regarding the generation of knowledge in research investigations, storytelling had also been proved as an effective approach to investigate any human experience [Wilkins 2004], especially when the differences between "teller" and "listener" are profound. This is certainly the case of different types of stakeholders, operating in different domains, and having a different level of familiarity with data and other settings or local organisations. In these cases, storytelling seen as a natural form of expression is recognised as effective in transferring explicit, implicit and tacit design or experiential knowledge among people [Erikson 1996, Lewis 2011].

9.3.4.b Probes toolkit

The definition of the archetypes to investigate roles and relationships in city data-related processes and the choice of using storytelling techniques to support the investigation led to design a "probes toolkit" for the empirical research activities. A probes toolkit is a set of items usually given to the participants in the research process, with or without instructions on the way to interpret its components, to perform a certain series of tasks aimed at collecting stories, opinions, perceptions, ideas [see e.g. Gaver et al. 1999, Mattelmäki 2006, or Sanders & Stappers 2014]. Toolkits can also help in abstracting and making communicable the complexity of city dynamics as the basis for a dialogue between our potential users and designers or researchers. The reciprocal trust is built on the fact that the use of toolkits enables participants to remain always in control of what they share, communicating directly or indirectly the polysemicity of elements, actions and contexts.

Fig 9.8: Probes toolkit. For each participant: 12-18 role cards, 12-18 activity cards, 1 instruction sheet, pens and colours. For each group: 1 game board and 4 copies of the same booklet describing the general theme.

The toolkit prepared for the workshop included:

I. A set of role cards covering the six archetypes characters corresponding to the different roles of the participants' organisations in their stories related to city data
II. A set of white action cards to be filled with the label and description of the activity associated with each character appearing in the story. Propp's Theory on the narrative structure identifies 31 actions, but we decided to let the participants free to define their actions.
III. A game board, designed to be used by groups of 3-4 people, both working on individual or team challenges, but in a shared working space, exactly how the city constitute a common environment for different actors
IV. An instruction sheet with the list of the five consecutive tasks to support the participants in the story-building process.

9.3.4.c Definition of the themes to be explored

The analysis of reports and documents related to the use of the MK data portal from 2003 to 2015 perfomed in the first phase of the study, as well as interviews to the former member of the MKiO, provided us a preliminary set of about 40 applicative scenarios intended as past documented uses of city data in local actions (e.g. plans, interventions, policies, internal management operations). A thematic analysis of these 40 past applicative scenarios resulted in the definition of **five macro-topics** that we decided to use as **thematic clusters for exploring the currents needs, practices and constraints in the use of city data by local stakeholders during the workshop.** These five topics were:

A. **Community Well-Being**: Social, Health, Education Services
B. **Urban development:** Planning, Housing and Energy Efficiency
C. **Mobility:** Infrastructures and Environment
D. **Economic Growth:** Employment, Facilities, Industry and Services
E. **Sustainability:** Smart Living and Local Resilience

These themes had been defined to be general enough for capturing the different perspectives of each stakeholders on topic of general interest for local communities, and at the same time, cover a wide range of typical activities implemented in urban contexts: running of public and private services, preparation of local plans and projects, organisation of community initiatives, monitoring of urban infrastructures and resources [see Fig. 9.9].

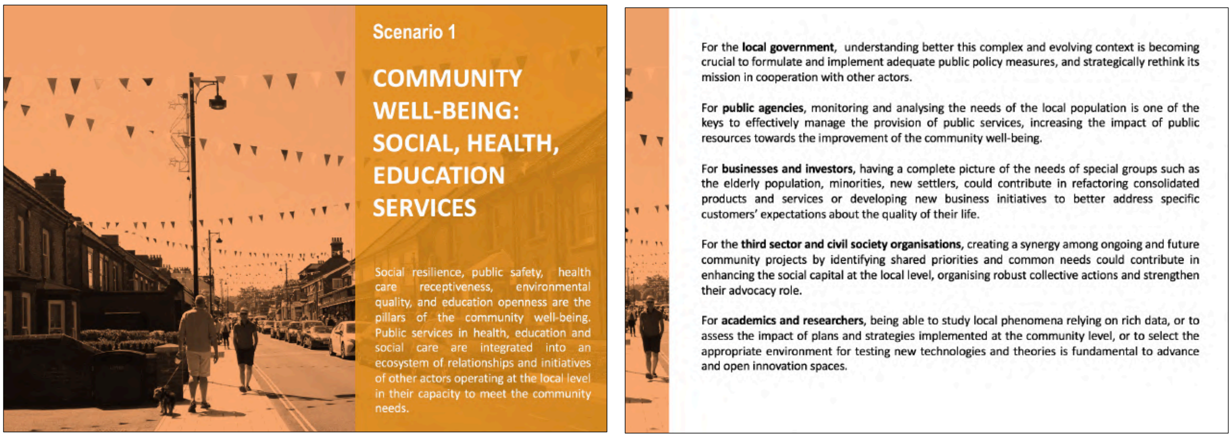


Fig. 9.9 An example of the theme description provided to one of the groups during the workshop

9.3.4.d Selection of participants and their representativeness

The participants in the workshop had been selected by considering the organisations involved in the past activities of the MK data portal before 2015, documented in internal and public reports. In addition to these organisations, we also considered new companies and organisations now actively involved in local data-related services. Invitations to participate in the study had been extended to all the identified organisations, and 18 sent their representatives to attend the workshop. Considering Milton Keynes as the environment of a local information ecosystem structured at the city scale, 14 organisations (for 18 participants) constituted a significant part of the key actors operating at local level, by providing data-related services and potentially interested to use city data for their activities. At the same time, the activities had been structured to let the participants bringing to our attention also the needs recurring in other organisations similar to the ones they belong, outlining the perspective of their organisations as representative of one of the classes of city stakeholders used in this work. Considering these classes of stakeholders, the participants were divided as follows: 5 representatives of local government, 2 of public agencies, 4 of the business sector, 4 from non-profit organisations, 3 from academia [see tab. 9.4]. In addition, three external observers and two facilitators[39] participated in the activities. During the activities, the participants had been divided into five groups, composed of a mix of representatives of different organisations and classes of stakeholders, one for each of the five themes indicated in the next section.

Table 9.4: Participants to the workshop divided by group and type of stakeholders

theme	User ID	Stakeholder
COMMUNITY WELL-BEING	P1 - JR	PUBLIC AGENCY
	P2 - LS	NON-PROFIT
	P3 - JK	LOCAL GOV
	P4 - RB	NON-PROFIT
URBAN DEVELOPMENT	P5 - VK	PUBLIC AGENCY
	P6 - PL	NON-PROFIT
	P7 - SW	BUSINESS
MOBILITY	P8 - MK	BUSINESS
	P9 - MT	ACADEMIA
	P10 - LN	LOCAL GOV
	P11 - JQ	LOCAL GOV
ECONOMIC GROWTH	P12 - IN	BUSINESS
	P13 - DD	BUSINESS
	P14 - MR	LOCAL GOV
	P15 - QL	NON-PROFIT
SUSTAINABILITY	P16 - NN	ACADEMIA
	P17 - NR	ACADEMIA
	P18 - SR	LOCAL GOV

From a research perspective, the composition of each group as a mix of classes of stakeholders worked as an additional way to triangulate the information shared during the workshop. The group composition had been determinant to generate stories already "cross-checked" for inconsistency with real-world constraints, internally by each group during the activities and externally in the follow-up discussion. Thus, this specific setting supported the generation of a socially robust knowledge, even though mediated by the subjective expressivity of each participant.

On the other side, both the participants and the external observers reported that the groups' composition facilitated the dialogue and a mutual understanding of the heterogeneous perspectives on the same theme brought by different organisations and classes of stakeholders. The participants confirmed to us that they found themselves immersed in an unexpected "confrontation" of goals, visions and practices aimed at making their different viewpoint explicit, but also understandable. The participants enjoyed the activities for this specific reason, and they resulted in being much more productive and proactive than expected, without particular conflicts with us or frictions among them. All of them built rich detailed stories mapping the operational context of their organisations, other actors involved in their activities, and the relational dimension of data in its criticalities and potentialities.

We staged a dialogue space, but the participants appropriated this space by making their differences *"sensible, acceptable and valuable"* [Wright & McCarthy 2015]. Their direct and indirect engagement in concurrent narratives helped to disrupt the ritualistic representation of conventional organisational discourses [McVeigh-Schultz 2011], that was one of the major challenges in this work. Thus, the probes toolkit resulted to be effective in silencing for a few hours the public discourse on Open Data.

[39] I was one of the two facilitators, the other was the colleague in the research unit collaborating with me in the design of the workshop activities.

Another important point is that the participants in the study had been considered as agents of their organisations and organisations sharing similar objectives, virtually representing in the study the voice of wide and diverse target groups of city data. The participants in the study had not been considered as "citizens". The perspective of citizens intended as residents in the city had been considered by taking into account that 16 out of 18 participants were also residents in Milton Keynes and adjacent villages, and so they were also "citizens". Moreover, two participants represented two non-profit organisations actively engaged in identifying citizens needs and formally charged of giving them voice in structured forms through local projects.

Lastly, each participant in the study was personally an expert on data having a solid understanding of issues and potentialities associated with the use of data, and professionally engaged in developing or providing data-related services. The participants' expertise, professional knowledge and understanding of their operational context had been conveyed during the workshop to outlining needs, criticalities and expectations associated with city data. The relevance and validity of the insights generated by the contribution of the participants to the activities relied not on a statistical relevance, but on the fact that they were domain experts and oriented (through the structure of activities) to express their perspectives as representative of local government institutions, public agencies, businesses, non-profit organisations and research institutions.

9.3.4.e Structure and development of the workshop activities

The workshop had been structured as a sequence of activities aimed at guiding the participants to map their operational context, the other actors involved in their activities, the type and role of data required or desired to implement their activities, and the criticalities associated to the use of data in local actions. These mapping activities had been performed by inviting the participant to build a story on the use of city data from their perspective by using the probes toolkit.

Each participant had been called to build a story on the theme of the group by using the toolkit and assuming the perspective of their organisation. The story-building process proceeded by completing five consecutive tasks, reported also in the instructions sheet as follows:

1. Set one of the challenges of your organisation in relation to city data and decide what role you attribute to your organisation to overcome this challenge. Use one action card to write down your challenge and one role card to describe the role played by your organisation in the story you are building.
2. Identify the other actors involved in your story and place them on the board by using the role cards.
3. Describe their actions in the story by using the action cards.
4. Indicate when and what types of data are involved in your story and in relation to each actor specify what data are needed to implement its actions
5. Highlight positive and critical steps in your story and in the interactions among the involved actors by using markers on the board to draw arrows, flows, sketches.

Differently from other experiences of storytelling groups reported in the literature [Kaakinen et al. 2012], we decided to do not force the participants in building one story for each group because we were interested in the concurrent narratives on each theme. However, the sequence of tasks to be performed had been designed to get the participants progressively familiar to each other. Indeed, starting with individual activities (e.g. set the challenge) that cooperatively concurred to build multi-narrative scenarios, the participants progressed toward a collaborative definition of issues associated with their stories (see Fig. 9.10, 9.12, 9,13). This spontaneous evolution led to connect the individual stories in three out of the five groups, precisely highlighting complementarities, shared problems or goals, joint efforts associated with data-related processes in different domains of city activities.

We have also been positively surprised by the different ways the participants interpreted the instructions and the use of the toolkit (see Fig. 9.12 -9,13). Instructions, a limited set of role cards and strict timing of the various tasks have been balanced by the freedom to set their own challenges and create their own stories. This balancing facilitated the relaxed and safe voluntary disclosure of the direct knowledge and matter of concerns of participants on a significant set of data-related processes in the city, and especially as regarding Open Data. They did not feel forced or at risk at any moment, while we were asking to make legible also critical aspects of their activities in front of other stakeholders.

The **facilitators** helped the participants only to complete their activities on time, remaining available for doubts and questions step after step. At the same time, the "off-activities" dialogues constituted the opportunity to have time for 18 "light-interviews", that would have been otherwise quite difficult to gather and still centred on the data practices of the participants and on aspects enriching the "stories" they were building. The **external observers** were authorised to observe the participants and taking notes of the evolution of their stories and the dynamics within each group, but without interacting with the participants.

Fig.9.10: Groups at work building their stories by using the probes toolkit

After the story-telling session, the participants had been involved in **two more cycles of activities**.

A structured group discussion supported by the two facilitators, ran into two parallel macro-groups including half of the participants of the previous five groups to bring in all the elements already emerged from the storytelling exercise. In 90 minutes, the discussion addressed the criticalities related to the use of data, but most importantly the **rules and actions for reconfiguring possible alternatives to the current data practices involving city data and the forms of support that a data portal could provide** [see Fig. 9.11].

A third round of **plenary discussion had been organised in the form of a 90 minutes focus group** and facilitated by an external professional to give the participants the chance of changing their interlocutor, and to me as a researcher the possibility to gather collateral information through the observation of the group dynamics and personal positions of the participants (to give more context and depth to the information shared through their stories and in the previous discussion). The discussion of the focus groups was centred on the **tensions between individual needs and expectations in the use of data within their organisation and in relation to other stakeholders.** Again, the participant had been called to **identify issues, but also planning alternatives and confronting the proposed alternative to the other positions, assessing their viability from a relational and organisational perspective.**

Fig.9.11: First round of group discussion

9.3.4.f Workshop outputs

The outputs of the workshop are five visual artefacts representing 18 stories through a composition of roles cards, activity cards, and other descriptions and signs sketched by the participants directly on the game boards (see Fig. 9.12 – 9.13). These virtual artefacts offer a synthetic multi-level representation of processes involving the use of data in city dynamics, balancing the two perspectives of the participants as individuals catching and depicting the context of their activities according to their sensibility and experiences, and as stakeholders representing the organisations they are affiliated with.

The texts and graphic signs over the boards had been disambiguated, contextualised, or integrated by three integrative sources of information:

1) the notes collected by the facilitators as "light-interviews" and asking the participants to clarify what they meant by the texts written on the boards, as well as the omitted information

2) the notes and transcripts of the group discussion carried out after the story building session and

3) the transcripts of the post-workshop interviews with the observers and facilitators who followed the activities to document their observations, remarks, impressions.

As reported in section 9.4, the analysis confirmed that in the city data ecosystem of Milton Keynes there is a distance between stereotypes and conventional expectations associated with specific classes of stakeholders, from the actual needs, capacities, competencies of local organisations. These results led the third phase of the study oriented to conceptualise alternative solutions.

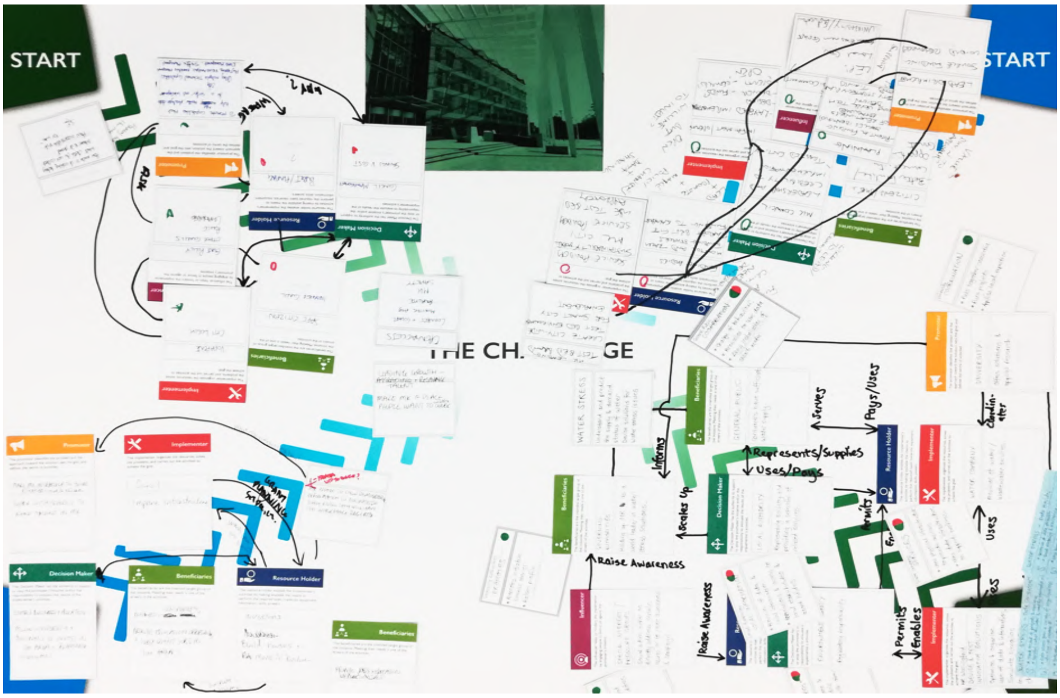


Fig. 9.12. Example of the visual artefact produced by the group "Economic Growth"

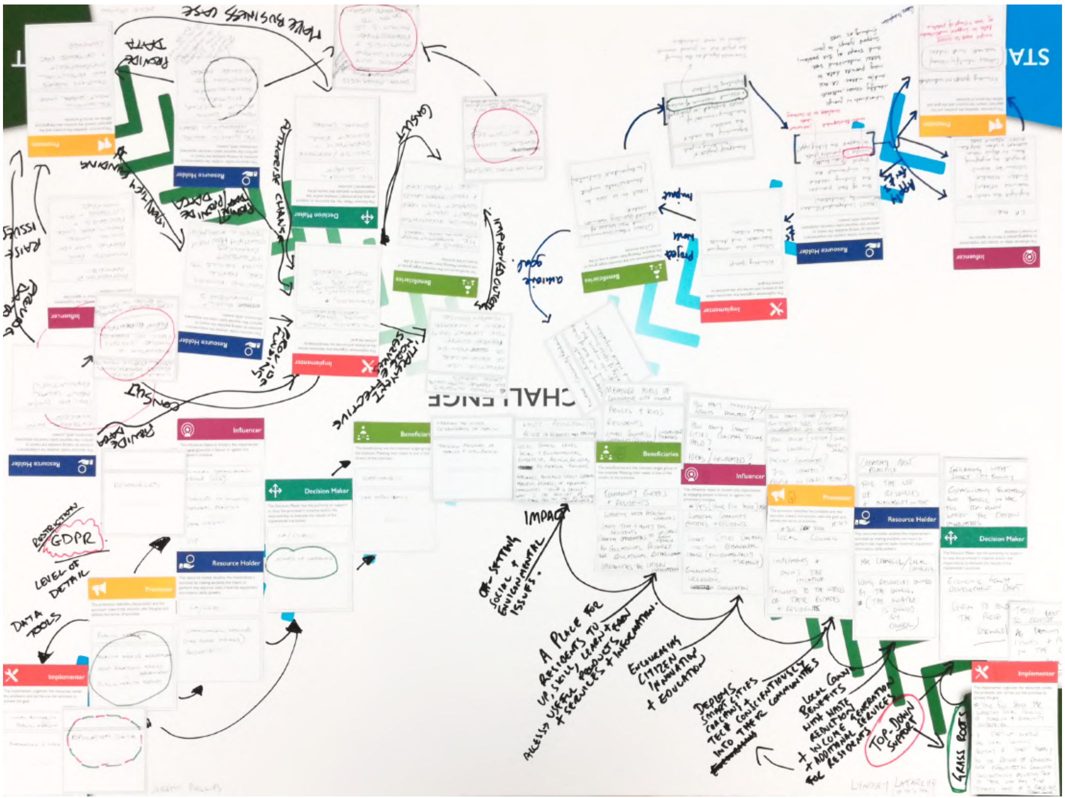


Fig. 9.13. Example of the visual artefact produced by the group "Community well-being"

9.3.5 RESEARCH ACTIVITIES INTERTWINED WITH THE DESIGN CONCEPT DEVELOPMENT

The research activities associated with the purpose of building a City Data Open Portal, consistently with the methods selected for this study (see Chapter 6, section 6.4), can be divided into:

- analytical and applied activities aimed at investigating constraints and potential design concepts to rethink the functionalities of the MK data portal (Research for Design)
- empirical research activities aimed to deeply understand logics and dynamics in the city data ecosystem through the use of ad-hoc artefacts (focused on "enacting" an Action Research process with local stakeholders through the use of strategic probes, Research through Design)
- theorethical activities aimed at modelling actions and rules into the city data ecosystem and in relation ot the porposal of the City Mirror (Grunded Theory).

In this case study, the core models presented in Chapter 5 helped especially in deepening the findings and results of the activities oriented to design the Open Portal concept and the research through design activities based on the use of probes to investigate the social dynamics in the City Data Ecosystem.

9.3.6.a DATA sources*

The research activities for this case study[40] had been supported by the following data* sources[41].

- Academic and grey literature on different phases and perspectives on Open Data operations for the historical analysis and triangulating the information collected during meetings, workshop and interviews, or integrating the background elements of the applicative scenarios.
- Notes from the 5 meetings with a representative of the project "Smart City in the Making -SCiM group", consulted as expert of how smart policies and technologies had been implemented in Milton Keynes in the last two decades, covering also the evolution of the MKiO service (Meetings carried out from March 2018 to July 2018)
- Transcript of an interview to a member of the MKiO staff made by the SCiM group
- 3 internal reports of the MK Council about the MKiO from 2003 to 2007
- 8 policy reports from 2006 to 2015
- Other public documents of other stakeholders referring to the former data portal or to its content such as local plans documents or reports of local projects.
- Notes of the 4 additional meetings with the design team on the analysis of the documents and the applicative scenarios extracted form the documents, from June 2018 to September 2018.
- Notes & transcripts of the three interviews with the former members of the MKiO intelligence team, collected between June and July 2018
- Master thesis of one of the interviewed that worked as system administrator of the MKiO platform from 2003 to 2014 and developed her work-based dissertation in 2008
- Full transcript of an interview with the manager of the Intelligence team done in 2007
- Partial transcripts of interviews with the senior data analyst and the data manager

[40] As already specified in Chapter 6 (Section 6.7.3, Research ethics), I have not used data or materials belonging to third parties. All the material used in this chapter had been produced as research materials within a spontaneous research initiative. In addition, I used public reports, grey and academic literature, and publicly accessible documents. Thus, I do not expose reserved or protected information, or data of every type owned by third parties, or data subject to authorisation for their use.

[41] Analogously to Chapters 7 and 8, I will refer to the material used in the research as data* and not data, because they do not include data, but complex elaboration of contextualised or abstract knowledge and wisdom [See Chapter 7, section 7.3.4.a].

- Questions, data, and results of a survey on the use of data by the users registered to the MKiO platform in 2009
- Screenshots and detailed description of the MKiO platform.
- Handbook and tutorials on the MKiO platform, used by the platform administrators and prepared by the ICT company that provided the platform
- User guide / tutorial of MK:Insight
- Notes of the workshop with city stakeholders, both questions and dialogues with the participants (July 2018)
- Notes and transcripts of the three group discussion sessions (July 2018)
- Notes & partial transcripts of the individual interviews made to the three facilitators of the workshop and focus group, and to the three external observers called to examine group dynamics and the activites flow, after the workshop (July 2018)
- Power point presentations and working documents prepared to facilitate the workshop activities and subsequent co-design sessions

Additional data* sources are:
- the visual artefacts produced during the public workshop with city stakeholders
- the paper prototypes made to work on the questions aggregator system
- the preliminary prototype of the questions aggregatro system
- grids and tables on the properties and features of data governance plans, city plans, and city data governance plans.
- the existing open data portal of Milton Keynes, Mk:Insight.X and its datasets
- other Open Data portals such as data.gov.uk and its datasets

9.3.6.b DATA generation activities*

Differently from the two first case studies, the research activities accompanying the process for designing the components of a City Open Portal had been developed independently from concomitant professional appointments. However, the nature of the investigation remained the one of a practice-based research grounded on the actual experience of studying the intervention space for new city technologies and defining potential design solutions able to meet the constraints, expectations and need collected in the process. Thus, on one side, the activities of data*generation and analysis were driven by specific design objectives (while not framed in a project with its material contingencies), and on the other side, my research agenda determined type, nature, and use of the data* sources in this work, and more specifically on what aspects of the process I focused my attention.

The **types of activities leading to the generation of data*** included: collective document analysis in group meetings, data analysis, technology survey, one-to-one interviews, one public workshop, three focus group sessions, co-design sessions with the design team.

The **techniques and tools applied for the generation and co-creation of data*** included: thematic analysis of documents, data analysis, technology and literature surveys, open and semi-structured interviews, preparation of working documents (excels and word files) to support the internal meetings with the design team, workshops facilitation techniques, probes toolkits and visual artefacts, paper prototypes and preliminary prototype of the questions collector system.

The **type of data*** included mainly textual documents such as reports, transcript, notes and online materials. They also included PowerPoint presentations, screenshots, graphical representations of applicative scenarios, physical or digital artefacts, spreadsheets and tables.
The **participants to the activities** from which data* had been generated included former members of the Milton Keynes Intelligence and representatives of various organisations operating in the city. To preserve the anonymity of participants and do not expose their organisations, no names are mentioned in the following analysis and I will refer generically to them by indicating the type of stakeholder or organisation they represent. In addition, other participants to the activities included the other two members of the design team of MK:Insight.X, as well as other researchers or staff of the Open University involved in the project "Smart Cities in the Making" or supporting the research initiative MK:Insight.X.

9.3.6.c DATA analysis cycles*

Analogously to the previous two case studies, data* degenerated from the activities had been analysed longitudinally, by taking into account the different inputs coming from the historical analysis, interviews, workshop, focus groups and concepts development. Then, the specific inputs for the construction of the theory of city mirror capabilities had been elaborated in a transversal analysis of all the three case studies.

The **analysis of the data practices** from the interviews with the former MKiO members followed the usual flow of a thematic analysis from the transcripts of the interviews.

The **analysis and interpretation of the workshop's outputs** for their nature of visual and textual artefacts required a more complex procedure for an in-depth systematic analysis performed by following an interpretive research process [Schwartz-Shea & Yanow 2013]. The stories traced in the virtual artefacts had been reported in textual documents, by distinguishing the texts referred to the "character" acting in the stories reported on the Role Cards, the text contained in the "Activity cards", other text annotated on the game board, and the integrative notes taken by the facilitators and the observers in relation to the specific story. All the information traced on the visual artefacts or included in the additional sources (interviews, notes, transcripts) had been classified accordingly to factors and dimensions describing the production and use of data by local actors in the city information ecosystem, and then iteratively coded in the process of identifying the relevant patterns and insights reported in the finding section of the paper.

The analysis had been organised in two parts. The first part focused on understanding the dynamics in the city information ecosystem represented through the narratives built by the participants. The second part deepened the analysis at the level of the information needs associated with the actions included in the participants' stories.

The first part of the analysis covered:

1. goals and roles set by the participants to build their stories
2. roles and activities of the other actors involved in the stories
3. relationships connecting actors, actions, and data.

The second part of the analysis interested the 87 information needs indicated by the participants on the visual artefacts or dialoguing with the facilitators or during the group discussion. The analysis had been developed in other three steps:

4. Factual analysis of the required information

5. Analysis of the expected uses of the desired or required data sources in relation to the actors indicated in the stories
6. Analysis of the expected uses of the desired or required data sources in relation to the domain or theme.

Following more details about the two parts of the analysis of the workshop outputs.

1. Goals and roles set by the participants

The goals set by the participants had been examined by taking into account the class of stakeholders the participants were representing in the workshop and the role they decided to cover in their story among the six roles defined by the role cards. The analysis then covered the relationships between the goals expressed by the participants and the class of stakeholder they were representing under the light of the key characteristics of the goal in itself:
- abstract or operational
- oriented toward organisational purposes or defined in relation to the collectivity.

The analysis of the goals continued by focusing on the relationship between goals and data, by highlighting:
- The connection between goal and data, as direct (city data necessary to reach the goal) or indirect (city data contributing to reach the goal)
- The use of data to reach the goal as expressed by the participants' stories
- The types of decisions and actions relying on the use of data from the participants' perspective: planning decisions, resource management decisions, or policy decisions.

Established the classification for each goal in the 18 stories, specific patterns had been identified in relation to the different classes of stakeholders such as the ones reported in the section 9.4 and 9.5.

2. Roles and activities of the other actors involved in the stories

The mapping of the city information ecosystem traced in the participants had been examined by considering the other actors considered in the stories and their roles.

The participants indicated a total of 126 actors in their stories. Each of them had been classified by considering:
- The selected unit (e.g. a general type of subjects such as "citizens", a specific institution or organisations, a specific group or office within an organisation, a specific person)
- The role covered in the story, accordingly to the six roles cards: Beneficiaries, Resource holder, Promoter, Decision Maker, Implementer, Influencer.
- The represented class of stakeholders: Local Government, Public Agencies, Non-profit organisation, Academia, Businesses
- The type of activity related to data perfomed by the actor in the stories: being the subject of data, promoting data collection, processing data, providing data to be used, communicating data, consuming and using data.

Once classified the roles and activities of all the actors mentioned in the story, we proceeded the analysis identifying the relevant and stable patterns within this set of information.

3. Relationships connecting actors, actions, and data.

The third step of this first part of the analysis focused on the relationships among the different actors mapped in the stories in relation to data, by considering the following aspects:
- level of stability of the relationship between who own data and who needs data, as occasional or stable
- level of formalisation of the procedures for exchanging data in these relationships, as formalised in protocols and explicit procedures, or contextually defined in relation to temporary agreements, or based on informal practices.
- nature of the data exchange, as transactional (data are just exchanged without involvement and collaboration among the parties involved in the exchange) or relational (the data exchange is part of a collaborative process among the involved parties).

As one in the previous step, the relationship among every couple of actors had been classified accordingly to the above mentioned dimensioned and then analysed to identify the stable patterns at the level of class of stakeholder. It is worth noticing that at this point our analysis did not focused on 18 subjects but on 126 distinct groups, organisations or institutions.

4. Factual analysis of the required information

87 information needs had been extracted from the stories, or in other words types of information required to support the actions described in the stories. These 87 information needs had been analysed by considering:
- the type of required data
- the status of the required data
- the current availability of the required data
- the ownership of data

The type of required data had been coded accordingly to a set of bottom-up categories emerging from the 87 information needs: data tracking or documenting local activities such as services, data about environmental phenomena or behaviours, statistics, list of items, context profiles, people or organisations profiles, surveys, projects or plans documents, evaluation reports or studies.

The status of required data has been classified in: open data, public data, data under restricted access to specific groups, data produced for internal use only, not documented information.

The current availability of the required data had been verified on the institutional portals of Milton Keynes, as well as on regional and national open data portal, organisational websites, and other online resources.

After this checking, the information needs had been classified in information currently produced, information partially produced (that means partially covering the information need) and information currently not produced or not available at all.

On the basis of the checking on the availability of data, the ownership of data had been classified as concentrated when it was possible to identify one data producer only, fragmented when the required data are produced by multiple organisations, distributed when the required information are known by a collectivity, even though not necessarily produced as data.

Then, the focus moved on the specific features of the required data:
- the nature of data as raw data or simple information or structured set of information (not differently from the well-known pyramid of Ackoff)

- the volume of data, as small or big data
- the reference time of data, intended as the time to which data refer, as past, present, future
- the production time of data, as static data or dynamic data.
- the level of detail of data, as data on individual object/subject or aggregated data
- the spatial cover referred to the geographical significance of data at building scale, city block scale, neighbourhood scale, city district scale, city scale, regional scale, national scale

The classification of the 87 information needs accordingly to these two groups of dimensions allowed to identify the features of Open Data or city data linked to local actions.

5. **Analysis of the expected uses of the desired or required data sources in relation to the actors indicated in the stories**

The intended users of the required data had been identified from the stories and then for each of the 87 information needs analysed in relation to their level of expertise on data manipulation (expert/not expert) and on the topic covered by data (expert/not expert).

Then, considering the intended users of the required data, the classification continued by considering:
- the expected types of interaction with data as direct, mediated or indirect
- the frequency of use of data as one time, possibly repeated over time, or regular
- the type of task in which the required data would be used: exploring data, analysing data, searching pieces of evidence in data, manipulating and elaborating data.

After the classification of the information needs accordingly to these dimensions, recurrent patterns had been identified connecting the features of data, the type of actors expressing the specific information need, and the intended uses of these data.

6. **Analysis of the expected uses of the desired or required data sources in relation to the domain or theme.**

The analysis concluded by focusing on the set of information needs expressed by each group corresponding to one of the five themes of the workshop to identify the specific constraints posed by the theme in the production and use of data for the potential or actual producers of the required data and their intended users.

Summarising the process in one sentence: **the analysis served the purpose of converting "wisdom"** (in the pyramid DIKW) **back into information and data, intended as conversion from structured expression of experiences, judgements, mental and social models, to minimum chunk of information and quantitative measurements.** In practical terms, the process of decomposition, annotation and connection transformed the 18 storied in a navigable dataset of over 3500 pieces of information.

This third phase, condensed in section 9.4 as regarding the three main outputs, consisted in the design and prototyping phase. In this phase, the structured information gathered through the activities had been used to **assess the internal and external consistency of the design concepts elaborated to integrate the current model of data portal for its refactoring in an Open Portal.**

9.4 APPLICATIVE SCENARIOS OF CITY DATA AND OPEN PORTALS

In this section, I am going to report the results and critical discussion of A) the retrospective investigation of the practices of the MKiO team [see also 9.3.3.b] and B) the applicative scenarios collaboratively developed during the workshop with city stakeholders in Milton Keynes [see also 9.3.4].

A. **The analysis of the practices of the MKiO team provided a clear outline of the kind of work, strategies and procedures usually hidden behind a data portal**, from the perspective of the Data producers and data publishers. The significance of the reported practices relies also on the fact that they were **data practices developed on the basis of collaborative mechanisms** inside the Intelligence team and the MK council, but most important across a series of partners and other city stakeholders operating in the city data Ecosystem. Lastly, as mentioned before, their value should be also considered in relation to the **anticipation of the new orientations toward the structuring of data services** to overcome the barriers of the underuse of city data and Open Data [see Section 9.4.1].

This **analysis of the data practices provided the boundaries for the intervention space of alternative solutions from the perspective of data actors into the public sector**. The analysis let to emerge criticalities and real evaluation criteria for the compatibility of new solutions against practices and protocols still relevant, despite the dismission of the team, because anchored to the higher-level mechanisms for the management of information into the public sector. Differently from the other two case studies reported in this work, in this case study, I had the opportunities to render in detail a single set of practices of a specific city stakeholder instead than discussing local practices at a meta level (because of the high number of analyse practices in Case study 1 and the structure of the process focused on meta-practices in Case Study 2).

B. **The analysis of the applicative scenarios developed during the workshop provided a rich, diversified and** (enough) **comprehensive picture of the data practices of a wide range of city stakeholders involved in the MK City Data ecosystem, enlightened the relational aspects related to the production and use of data in local actions.** In this part of the study, I come back to the analysis at a meta-level, highlighting in particular the vertical and longitudinal connections among the examined practices [see Section 9.4.2].

The activities and the subsequent analysis of the applicative scenarios also outlined the **profile of the information needs** that a city data portal should address to make the use of data driver of distributed benefits and development for the various city stakeholders, accordingly to the expectations associated with the availability of data ensured by new technologies and make accessible through web platforms.

9.4.1 DATA PRACTICES BEHIND A DATA PORTAL

Zooming on the activities of the MKiO, I had identified five distinct data practices (accordingly to the definition of practices and their characterisation seen in chapter 5, section 5.4). These practices are:

a) **Requests handling**
b) **Data gathering**
c) **Data elaboration**
d) **Data delivery**
e) **Users support**

These practices continued to be perfomed, while in different ways and with different outcomes, until the transition from MKiO to MK:Insight, from 2003 to 2016. They are separate one from another because they are organised accordingly to different sets of rules and principles regulating the implementation of the activities. In the following text, when specific extracts from interviews are quoted, I refer to the interviewees respectively as TM1, TM2, TM3, and to secondary sources, as interviews not directly perfomed by me or specific documents used for the triangulation of information, by making explicit my references.

9.4.1.a Request Handling

Requests for specific data to be created, processed or analysed were the starting point for the management of the MKiO activities. As emerging from the interviews, the elaboration of data for the platform was triggered by the **responsibility of addressing explicitly stated information needs** and handling data requests was one of the most important practices defining the services provided by the Intelligence Team from the beginning until the transition to the new data portal. Interestingly, this first point already frames into a completely different perspective the nature of data services provided by the MKiO compared to the paradigm of data-as-products, that is still predominant nowadays in framing Open Data as "pluri-potential" resources and in setting up open data portals as their repository. As confirmed by all the interviews and by the majority of the consulted integrative sources, the concept of ***"data on demand"*** was one of the constitutive elements of the MKiO activities.

The modalities for making data requests at the MKiO remained informal during its entire life cycle and in the transition phase in the two last years. As specified by the data analyst, *"anybody could phone us up for any information, whether it's members of the public, councillors, the police force or anybody"*, or in alternative applicants *"just e-mailed us"*, or *"knock on our door and ask for what they need"* (TM1), and this had been confirmed also by the officer involved in the transition after 2014. A limited number of requests came also through the technological platform and they were normally forwarded by the system administrator to the data analysists, that were the persons charged of handling data requests.

On the contrary, the Intelligence Team established from the beginning **an internal procedure for formally tracing each type of request by recording applicant, object of request, and type of request on a spreadsheet shared between the data analysists and with their line managers**. Over the years, this spreadsheet recording the requests worked not just as an administrative document, but as a **practical tool to plan the internal activities considering the periodicity of standard requests.** Moreover, it helped to **infer the intended uses of the required data in the cases in which the applicants do not included sufficient details in their communications by learning from previous requests** and from "*what other people have asked for it a similar manner*" (TM1).

Data requests contained usually a sufficient level of detail about the intended use of data by the applicant, such as their integration in a specific type of analysis or use as support evidences in reports and project proposal. **In the cases in which the objective of the request was not clear, the analyst proceeded to request further explanations until necessary**. As confirmed by the interviewees, the **applicants do not perceive as risky for their activities and goals to share details about the intended use of data**, probably because of the awareness on the need of the public administration to ascertain the intended use for preventing inappropriate conducts.

Two important details are that the **requests for data came prevalently from organisations** (local government offices, public agencies, non-profit organisations, businesses) and **not from individuals** (citizens), and these requests were presented by the data experts of these organisations. Most of the internal data requests coming from the Milton Keynes Council belonged to planning, housing, education, and social services departments, while the external request came from partner organisations such as police and fire bodies, and local charities. The applicants, requiring data on behalf of their organisation, were internal researchers or professionals familiar with data. Therefore, despite differences in the sector of activity, a large part of the applicants and analysists of the intelligence team shared a similar language and understanding of data elaboration and outputs, and it was not so uncommon that they personally know each other. During the transition period, data requests were instead from parish councillors or students or property agencies more interest to have basic information about the population in a specific building block or neighbourhood, and not having specific knowledge or skills about data.

As regarding the **purpose of the requests**, the Departments of the MK council and other public agencies were used to require MKiO **data for their own internal activities**, especially **planning of services and management of internal resources.** External requests coming, for instance, from local charities were driven mainly by advocacy purposes and aimed to collect support evidences on local issues for funding proposals to pursue their own activities. **It is worthy to highlight that this focus on a direct application of data for operational ends relied on the vision of the intrinsic value of data, instead than on the vision of the extrinsic value of data as means to ascertain the correctness of the government's work under the principles of the Open Government.**

The assessment of data requests was under the responsibility of the data analysts and done independently from the rest of the intelligence team. The main assessment criteria of requests were based on *"who asked for it and how important we felt the data was to people"* (TM1). The priority was granted to internal request from the Council Departments, secondly to the partner organisations of the MKiO, and thirdly to other applicants. In most of the cases, **the evaluation was based on a vision of the outcomes associated to the request, attributing more value to requests driven by public utility purposes and potentially having more impact, respect to requests that, once satisfied, would help just individual objectives, despite the consequent workload was often considerable in the first case.**

On the contrary, the evaluation of requests was strictly depended on workload concerns after the dismantling of the Intelligence Team. This radical change in handling the requests reflected the provisionally and the short term horizon of the transition period, but also the different status and role of the MKiO unit from a strategic support service to an auxiliary administrative office.

At operational level, the priority order of requests was decided according to the availability of data and the effort required for their gathering, analysis and preparation for delivery. Requests that could be rapidly met were usually processed in a short term and the outputs sent to the applicants, or lately published on the data portal (see section 9.4.1.d Data Delivery). Most of data requests were processed within two to ten days (by carrying out the practices described in the following sections) and the applicant notified about this timing. **The access to data was not perceived as an automatic operation such as downloading a dataset from a web portal, but as the output of a service based on the expert work of data analysts.** Other standard requests aligned with the internal activities of the MK council departments were met in a more extended time, such as monthly or annually.

Briefly, the **tasks included in the practice defined as "requests handling" were: collecting, recording, assessing, and planning the processing of requests.** These tasks were perfomed by the two data analysts of the Intelligence Team working together in the same room, updating each other on new requests, tracing them in a shared digital document and exchanging opinions on their assessment and the schedule for their processing.

A fundamental detail characterising this practice is the **information asymmetry between Intelligence Team and external applicants about the nature of data requests.** While data analysists knew the history of data requests, elaborated their own schema of the information needs of different type of applicants, and were aware of contemporary and/or competitive requests, on the other side, local stakeholders had *"no mechanism for them to have understood what each one was asking, unless they contacted each other"* (TM1). **The knowledge about the information needs of city organisations was thus centralised in the Intelligence Team.**

As evident from the report on this practice, the technological platform of the MKiO did not include specific features to support the collection and management of data requests and remained separate from this process.

9.4.1.b Data Gathering

The gathering of data for performing the analysis required by MK council and other city organisations constituted a practice in itself, distinct from the management of data requests and data processing. Indeed, data gathering seen as a practice involved a set of tasks covering three different situations:

- **Data are produced by national or county level public administrations** or agencies and could be requested or accessed by the analysts of the Intelligence Team
- **Data are produced by other organisations operating in Milton Keynes** or in the county and could be collected because of the formal partnership supporting the MKiO
- **Data are internally produced by the Milton Keynes Council** and could be available for the Intelligence Team while identified and collected from the competent departments.

The outputs of the Intelligence Team work often relied on the **integration of data sources related to all these three situations at the same time**. The Intelligence team was not responsible for the production of data, except for the GIS operators that were engaged in monitoring the expansion areas of the city.

Data gathering was a cyclical and iterative practice organised in collection of background sources, comparison with local data, identification of the other missing pieces, collection of integrative data sources from other department or partners organisation. Metadata were an essential component for the rapid assessment of the collected data sources concerning their **compatibility, integrability and complementarity and relied primarily on the technical training and experience of the data analyst**. TM1 stated that *"his role was basically to collect various pieces of datasets"* and specified that these data sources could be excel or word documents, with *"lots of metadata"* associated to them, as confirmed also by TM2 and TM3.

As regarding data produced at national level, the Office of National Statistics was one of the key sources for the MKiO services and their data were usually integrated with more detailed data produced by other local authorities of the NHS (National Health System). The collection of these dataset was a background activity organised accordingly to the periodicity of the release of new statistics that could be monthly, quarterly, annually, or plurennial such as Census data. The establishment of the unified portal for British governmental open data in 2011 (data.gov.uk) further facilitated the tasks of data selection and retrieval from national repositories.

From the perspective of the MKiO data analysts, the **value of government-produced data** relied on:

- **trustworthiness and certainty about the modalities for their collection and elaboration**
- **their knowledge of the meanings of parameters and indicators used to describe data**
- **their direct experience of the procedures for retrieving the desired data among the different websites and archives**

- **the opportunity to access those data as members of a public administration**
- **the compatibility between the scope of data produced by other public agencies and the outputs expected by the MKiO activities.**

Therefore, the positive judgment on the value of institutional data and the tasks for their selection and collection was related mostly to **personal considerations** (familiarity with terminology, methods, archival protocols) and **operational concerns for the effectiveness** of data services to be provided (rapid access to sources, appropriateness demonstrated in previous requests). Nevertheless, driven by the awareness on the intended use of data, the analyst of the Intelligence Team tried to **select the most adequate source** among the available ones on public repositories to **facilitate the applicants in their specific activities**.

A significant example extracted by the interview to TM1 refers to unemployment data. *"There are two different measures of unemployment, based on survey or based on administrative records. One is updated more frequently than the other. One doesn't count certain people, the other counts certain people, so it'll be a case of trying to understand what the user requesting it would need it for and then apply whichever one is needed and make them aware of what it includes and what it doesn't include"*.

Differently from data gathering activities covering the other two situations (data from partners and other council departments), in this case, the tasks of the data analysts were independently accomplished, without entailing direct interactions neither with data providers (because national data sources were already accessible online) or with other members and partners of the MKiO. Their efficacy and effectiveness relied only on the experience and autonomous decisions of the data analysist, without external contingencies or obstacles.

As regarding data produced by other partner organisations, the activities to get them in the MKiO changed between the initial setting up of the service and the practice consolidated in the subsequent years.

At the beginning, a **considerable effort had been done to get local agencies and public institutions sharing their data under the label of the MKiO by using the new data portal online**. The data analysts of the Intelligence team *"went round to all the different partner organisations to see what data they might see on the website"* and to get them *"listing all the datasets that we could potentially have on there"* (TM1). Also in this case, a spreadsheet had been used to list:

- types of data produced by each organisation
- among them, the subset of datasets that each organisation was willing to share within the MKiO or publicly
- datasets produced by other organisations, the local council or the Intelligence team that was needed by each organisation
- dataset that each organisation considered to be useful to have in the future.

The data analyst met face-to-face the referent of each organisation and get this spreadsheet filled up. This solution had been preferred to other options (such as sending the spreadsheet by e-mail) to have an overview of all the local data sources in a short time and **practically enforce the collaboration of other organisations by assuming the leadership of the operation.**

While the management of data requests remained always informal, the establishment of the MKiO and the activation of the city data portal contributed to formalize data sharing practices because the *"website was supposed to be for all these partner organisation"* (TM1). Before 2004, inter-organisational data sharing at local level was mostly based on ad hoc cases and based on a direct contact among two officers or respective organisations. Then, inter-organisational data sharing had been lightly institutionalised, framed as one of the responsibilities of local authorities and services adhering to the MKiO, and assumed to be done on a regular basis.

However, **the implementation of this new framework had been helped by pre-existing good working relationships between the referents of different organisations, that were supported by the mutual utility and perceived advantage of exchanging data produced by their respective organisations**. "*So, for example, if Thames Valley Police would make use of our population data, so we'd give them the population data. They'd give us the crime data and we'd put the two together*" (TM1).

The importance of good working relationships among people affiliated to different organisations had been highlighted as determinant for the success of the data acquisition activities, despite the formal partnership. Indeed, the main **critical factor that change this situation was the high rate of turnover in the staff** of the involved public agencies in the years after the setting up of the MKiO. This turnover stiffened spontaneous cooperative practices among data experts knowing each-other into bureaucratic fulfillment among representative of different organisations.

In the new operational context, **the Intelligence Team assumed a proactive attitude aimed to collect the required datasets for its activities, instead than relying on spontaneous data sharing practices.** After the initial collection of all the available datasets from the partner organisations, the routine for gathering local data aligned with that of national data: identifications of sources and preferential protocols, study and cataloging of sources in relation to their potential uses, periodic requests of updates and new datasets in accordance with the release cycles of each institution: monthly, quarterly, annually.

As regarding the third situation, or rather the gathering of data produced by other department of the local council, two elements supported the intelligence team tasks:

- its specialisation on population data
- the definition of a concrete output to be produced annually and integrating data from different council department.

As mentioned in section 9.3.3.b, the structure of the Intelligence team had been designed to be transversal across different silos of activities in the local Council by working as a virtual central unit in relation to all the other department and external agencies and organisations. This transversality was reflected also by the main area of expertise attributed to the Intelligence Team: dealing with population data. As commented by TM1, "*each Council Department would have their specific focus of data, so you'd have the Education Department focused on education, Social Services social services, I think there might have been someone in Environment dealing with waste stats. Our focus was on demographic data.*" Continuing, "*so we created the general data around the demographics of the population which other Council Departments would need as part of their analysis as well and we obviously need some of their data analysis as well to collect things for social analysis and local profiles*".

Data exchange between different council departments and the Intelligence Team was supported by the interdependence of their analysis and by the fact that data under the competence and figuratively "*owned*" by the Intelligence Team were required by all the rest of the local council data analysis units.

In parallel with this implicit dynamic, **the motivation for other council departments to actively collaborate with the Intelligence Team was supported by the goal of producing the "*Social Atlas*".** This document was a comprehensive profile of the city of Milton Keynes, covering almost fifteen aspects ranging from education, social services, health, to environment, planning and population projections. Its production was under the responsibility of the Intelligence Team and supposed their access to all data produced by the council.

The fact that this report was considered an important policy instrument by the Milton Keynes Council provided not only an overarching goal for data sharing to all council departments, but also **instantiate the results of this collaborative dynamic in a tangible output.** At the same time, **this concrete product incorporated political, administrative and identity values by presenting a current vision of the city, the results of the effort of the council department services and the future directions to sustain the local development.** Therefore, figuratively the single actions of individuals sharing the required data for the analysis of the intelligence team contributed to the implementation of the institutional mission of the Local Council.

The annual production of the Social Atlas drove the data gathering of internal sources. While the collection of national datasets and data from the other partner organisations followed a quite stable schedule over the year, the collection of internal data was more variable.

This situation changed after the dismantling of the Intelligence team and the stop in the production of the Social Atlas. As reported by TM3, **the collection of report and data from other council departments became quite problematic during the transition period because of the lack of recognised responsibilities of the remaining officer**. In the interview, TM3 explained how it was her initiative to *"chase"* for people among different departments to ask them to sharing regular reports and data. TM3 learned autonomously the timing release of data and reports from previous records and tried to get them from their referents.

During the entire life of the MKiO and in the transition period, **the possibility of gathering additional non-institutional data from charities or businesses was not considered**. Then, the MK:Smart project introduced the idea of valuing data produced by business and academia for institutional purposes, while not business or research data in itself, and their future integration in the city data infrastructure, including the Open Data Portal of MK:Insight.

It is important to highlight that the MKiO platform has been intended since the initial proposal to be a platform where each partner organisation could autonomously share its own data after the registration on the portal. Nevertheless, as confirmed by the user survey made in 2009 and by the interviews in our study, this option had never really being considered or used.

9.4.1.c Data Elaboration

In the previous section, I specified that the MKiO was engaged in the analysis of data produced by other organisations and departments, and less in the production of new data, for instance from surveys or primary research carried out in Milton Keynes by the Intelligence Team. The practice built around the data analysis process was structured on two groups of tasks: data segmentation and data contextualisation.

Data segmentation was organised as a sequence of activities for extracting and merging relevant data from the sources previously collected. This group of tasks included:

- **Comparison** among the available sources on same topic or close topics through a close analysis of their metadata
- **Selection** of the most appropriate data sources on the basis of previous experiences of the analyst regarding similar requests and analyses to be done
- **Cleaning** of the selected sources, or rather extraction of a subset of data required by the purpose of the analysis to be prepared by eliminating superfluous parameters and data contained in the selected data sources
- **Geographical filtering** of the selected data subsets by considering the local units under analysis, such as wards (equivalent to a city district), neighborhoods, post-code areas or urban plots (almost equivalent to a city block).
- **Integration** of the different data subsets area by area
- **Formatting** of the resulting dataset as regarding for instance style, labels, file format.

Data contextualisation was instead a nonlinear process aimed to build *"the context of data"* to get users understanding meanings and implications of data for their intended purposes. This process was adapted case by case considering the recipient of the data analysis (Local Council, Partner Organisations, external organisations, general public). In this assessment about what it could be useful for improving the understanding of data, the data analysts of the intelligence team considered:

- **Type and skill levels of the perspective users** about data manipulation, statistics, and domain knowledge
- **Type of applications of data** in the activities of the recipients.

The assessment of these two aspects relying on a mental model about users and data uses empirically constructed year after year and leading to adjust the choice of the complementary documents associated to the results of the data segmentation. As the analysts of the Intelligence Team learned by experience, there were at least **three skills levels for the users and consequently three sets of outputs** that could help them in their purposes:

- *"data people"* **needed mostly metadata** for carrying out their own analysis in their own sectors of expertise
- **"workers"**, or rather people working in public administration and related organisations, that needed **public reports and other institutional documents** to use data for policy making and management of internal activities
- *"common users"* needed **summaries and introduction to data and reports** because they would struggle in understanding both data and sector-specific public reports and they would use data to get informed about the city or for advocacy purposes (if part of volunteering groups).

Accordingly to this composite vision of data users, data resulting from the segmentation process were accompanied by:

- **Metadata**
- **Public reports**
- ***"In Brief"* documents and internal reports.**

Metadata were structured accordingly to the standards established by national regulation on public sector resources in e-government services and to the *"Integrated Public Sector Vocabulary"*, both established in 2006 [ref.]. They included the details of the publishing organisation, creator of the dataset, sources integrated in the datasets, statistical methods applied to calculate parameters and statistics, time and periodicity of the data collection or analysis. Most important, **metadata included an open field used by the analysts to briefly describe the key information that they thought could be helpful for users, and in particular limitation and reliability of data for different type of applications**. The goal of this description was to provide an expert advice to users, but also to prevent misuse and misunderstanding of data. Nevertheless, the data analysts were aware of the limited effectiveness of metadata: *"We provided quite a bit of metadata as well, which people may not have actually looked at because it was a little bit hidden I think, but that* ***hopefully would have given them some background to the pros and cons of the data and what it should be used for****. So, for example, where you've got two or three different measures of unemployment and if you read them the wrong way then it means you could be making the wrong policy decisions, but whether people actually read the metadata is a different matter" (TM1).*

The choice of public reports and documents to be associated to a specific dataset was driven by the initial exploration of the intended use of data carried out through repeated inquiries by the Intelligence Team to the applicants. This dialogic exchange *"helped us* [i.e. data analysts] *to maybe add more context to the information that the requester might not have been found and that we wouldn't provide if they didn't say what it was for" (TM1).* A significant example discussed during the two interviews to TM1 and TM2 was related to data in education. What we got after the transition to MK:Insight was a group of dataset labelled as "Education", but not containing really any information about the number of students enrolled in local schools or similar information that could be used to understand the education system in Milton Keynes. What it was missing was the context of data, that they had been created in that case to help social care services in identifying the factors affecting social fragility situations, and the education level of residents was among those. Without any additional documents would be impossible for users to understand what these data actually means and they could be used in the wrong way. By referring to the time of the MKiO, TM1 added that when "*we had a page on education* [on the data portal], *it wouldn't just be what people had asked us to put on there, we'd also have to think about what else we knew about that could potentially be in there as well, that we thought might add context to it, […] we'd use our own expertise and knowledge of other data sources that people in education may not have known about, to maybe fill in some of the blanks"*.

The third way type of documents associated to data in the last years of the MKiO were the "In brief", *"one page reports, highlighting the key points, highlighting a bit about methodology for data analysis and then linking it up to the other datasets which provided more information on the topic" (TM1).* They were internally prepared by the data analysts, prioritizing the most important or the most used datasets, and aimed to get people not expert in data to quickly understand important trends about population, unemployment, planning development, public services. In this sense, the "In Brief" accompanied monthly release of datasets on these topics.

The **output of the data elaboration thus resulted composed by four parts** covering different purposes and users' needs:

- **Datasets containing factual information and quantified parameters on a topics**
- **Metadata explaining the meaning of data in technical terms, including their reliability, limitations and suggested applications**
- **Public reports providing the background of data intended as the public initiative and goals driving their collection, involved sectors or domains of activities, and related local decisions and plans**
- **In brief documents providing an overview to data that highlighted key information of general interest.**

The importance of this combination is summarised by TM2: *"the key things that made these document resources really useful was the fact that we had the actual data, but we also provided a lot of contextual information, so as well as having the actual text backing that up with the data so for people who needed to see the figures, they could easily do that, and the actual resources would link to the full data sets on the Observatory. So, for researchers, statisticians, that was what they really wanted. For people who didn't have that level of understanding of the data, the fact that we could still summarise it and give it to them in a contextual way, they found that really useful as well"*. And TM1 added that "*If we just had the data analysis side of the Observatory, I think that would have been quite difficult for people to use it, but with the pages which introduced the datasets and also the documents that introduced the datasets, I think that probably helped a little bit, because any report does tend to maybe use too much technical language that it's maybe hard to understand for common users.*"

The most significant example of data contextualisation and interpretation was the annual preparation of the "Social Atlas" mentioned earlier. This document *"provided a description of each estate in Milton Keynes and brings together ten, fifteen different data sources pulled into one table, so the decision makers could have a quick look at their profiles and make decisions about which estates to make interventions in"* (TM1). It was a complex document, associated with a group of datasets that could be explored also on the platform, but providing already in-depth commentary of what was emerging from data, according to the perspective of the City council and the provision of public services. While expressing a specific point of view of the institution that elaborated it, it was helpful also for third sector organisations, volunteer groups and development agencies.

Even though at the beginning of the MKiO experience the activities of data analysts were predominantly oriented toward the provision of datasets to set up the Observatory services and the data portal, later they refocused on the interpretation of data and preparation of materials and documents accompanying the data analysis. Indeed, the intense and direct relationship with users through the handling of requests, helpdesk services and face-to-face meetings (described in section 9.4.1.e), **the Intelligence Team prioritised the understanding of data by users, instead than the data processing in itself.** Moreover, the interpretation of data became central for decision making in the City Council activities. Later, in the transition period, this extended practice of data elaboration had been drastically minimized, reducing the data segmentation activities to episodic special requests and eliminating the expert support of data analysts as a service for users.

It is important to highlight again that **the city data web platform was not the tool to support the tasks included in the data elaboration practice.** In particular, data segmentation activities were implemented by using other desktop software, as well as the preparation of the "reports packages" or the In Brief documents. **Every inquiry to redefine and negotiate the scope of the data analyse were done face-to-face or by phone or e-mail.** Moreover, even at the level of metadata there was a distinction among metadata associated to the datasets and those associated to their versions, successively published on the portal, because the first ones described the contents and the second one their administrative profile in term of licensing and accessibility.

Against this background, **there was a complete separation between the elaboration of data perfomed by expert data analyst and the support provided by the data portal, managed by an independent member of the Intelligence Team, the system administrator**. The core activities of data analysts were to provide commentary on data for local decision makers, while the portal was the complement for providing access to the information packages in a structured way.

9.4.1.d Data Delivery

The practice defined as "data delivery" is centred around two binaries: **restricted or public delivery of data**. In the first case, data elaborated on the basis of a specific requests are send directly to the applicant in virtue of institutional cooperation or pf the Freedom of Information Act, while in the second case, data are uploaded on the MKiO platform and made available to the public as Open Data. This **distinction relied on a judgment of utility of the produced data, but also on institutional decisions and practical concerns of the team members, and basically on an internal risk assessment of the potential misuse of data.**

Data not meant to be publicly accessible were sent privately to the applicants by e-mails, without involving for both the Intelligence team or the users any interaction on the technological platform. On the contrary, the technological platform was essential for data to be made public[42].

It is worth noticing that this small part of the data practices, definitely not central to foster collaboration among different city stakeholders in the production, exchange and use of data, was the only one supported by the city data portal of Milton Keynes, as well as in almost all the existing data portals.

9.4.1.e User support

For a few years after the establishment of the MKiO, the engagement activities carried out by the Intelligence Team were limited to public presentations of the project, demonstrations about the use of the platform for the staff of partner organisations and preparation of dissemination materials. All these activities were not integrated into the routine activities of the MKiO and resulted later in having a limited impact on both sides, intelligence team and participants. From the perspective of the organisers, demo and public presentations failed in improving the understanding of the users' needs and receiving inputs by the interested users, while from the participants' perspective, these activities did not helped them in addressing data problems in their everyday activities.

This situation changed in 2009, after a study made by the Intelligence team for understanding users' needs in relation to data from the MKiO and the use of the technological platform. The results of this survey highlighted that users needed a stronger support for understanding and using the available data, and that most of the functionalities of the platform were underused.

Relying on the results of this internal research, the management of the Intelligence Team decided to support the organisation of offline groups meetings. This decision was supported by recent research on Local Information Systems, such as the data platform of Milton Keynes. Explicitly referring to the work of Foley et al. [2007], the initial idea was to set up the *"Stats Surgeries"*, workshops aimed at improving the research skills of the users of Local information System by mixing "data people" and not experts.

Against this background, a series of user support initiatives led to consolidate a new practice of the MKiO, centred on the idea of *"find[ing] out how the Observatory could facilitate or help other teams"* (TM2).

[42] Section to be completed.

The initiatives structuring this practice were:

a) *"The Users' Group" meetings*
b) *Council Researchers meetings*
c) *Drop-in sessions.*

The "Users' Group" was intended as the group of all users registered on the MKiO platform or working in the partner organisations. However, the Users 'group meetings were open to everyone interested in the use of data provided by the Observatory. The Council Researchers Meetings were instead internal meetings reserved to the researchers and officers of City Council Departments. And lastly, the drop-in sessions were aimed to train the staff of partner organisations or other council departments in using the MKiO technological platform.

These users support initiatives involved a triple sequence of tasks organised in meeting preparation, communication, setting up, facilitation, and post-event debriefing. The organisation of these meetings was under the responsibility of a member of the team, the System Administrator (TM2), that was in charge of:

- **scheduling the activities**
- **inviting the participants** by sending e-mail notices and disseminating the MKiO digital newsletter containing the details of the meetings and a summary of the previous ones
- **managing the practical arrangements** for the meetings as regarding for instance rooms, equipment, materials
- **conducting the discussion** and the group activities
- **reporting to other members** of the intelligence team the insights coming from the participants.

The Users' Group meetings and the Council Researchers meetings had been held once every three months from 2009 to 2014, while the drop-in session were scheduled accordingly to the requests of perspective trainees, without a specific calendar.

As regarding the venue of these meetings, drop-in sessions were usually organised in the offices of the trainees, and the Users 'Group meetings were usually held in the offices of the Milton Keynes Council where the Intelligence Team was working. This choice had practical and symbolic implications. Indeed, the Intelligence Team reached directly other organisations at their place for the collection of data, and the training provided during the drop-in session was linked to that as targeted to support other data producers in sharing their data through the MKiO platform. The inertia in cooperating in the MKiO project was then pragmatically prevented or addressed by diminishing the uncertainty of not receiving the needed data because of contingencies and other constraints. On the contrary, the representatives of other organisation and departments interested in understanding how to use data for their activities was motivated enough to reach the Intelligence Team at its place, taking advantage also from the presence of other local actors for parallel purposes of networking. In the first case, other organisations and departments are the enablers of the Intelligence teamwork, and in the second case, the Intelligence Team acted as enabler and intermediary of data-mediated relationships.

The Users 'Group meetings were strongly characterised by the heterogeneity of participants, coming from different types of organisations, working in different domains and with different expertise. On the contrary, internal meetings and drop-in session were mostly carried out in small homogeneous groups, sharing a mutual understanding of information needs and applicative scenarios of data within their everyday activities. The heterogeneity of the Users Group brought significant benefits in fostering the use and impact of the MKiO data.

Commenting on this point, TM2 said: *"It could be quite mixed who we would have [at the meetings]. We had crime, police, they kind of have their own data people that we have already got an informal kind of relationship with anyway. Health, NHS used to have their researchers. Possibly fire might have had – they had their own researcher as well, so there was already this kind of informal network anyway, and they would get invited to the meetings, all researchers would get invited to the meeting anyway, and if they wanted to come, they could.* ***Who else did we have? We had quite a few charities actually, a lot of voluntary organisations, and they found a lot of the data really useful, especially for when they are doing their funding requests and things, because they need to back that up with solid data behind that.*** *So we had some representatives from there. Who else did we have? We had quite a few people internally within the council so from education, planners and social care, internally within the council as well. So, quite a mixed group, which is what made it quite interesting as well."*

In particular**, the fact that participants were encouraged to share their use cases and discusses their reciprocal applicative** scenarios with others during the meetings was one of the stronger perceived benefits of the Users 'Group. *"That was something which users found really beneficial, because sometimes, I think, when you are working in research, you can be stuck in your little siloes and it is quite useful for other users to network with other people, to find out how they are using the data. It was also quite interesting, because a lot of people hadn't thought about using data or using the system in sometimes quite innovative ways. Having that meeting where users could actually spend that time networking and discussing ideas, that was found really beneficial" (TM2).*

The Users' Group meetings followed an open format, occasionally focused around a predetermined topic, and often including:

- the explanation and discussion of new datasets produced by the MKiO or other organisations
- a Q&A session around the datasets and potential uses of data
- the presentation of applicative case studies by the participants
- the discussion of problems and issues in their working practices to be addressed through data.

The Users 'Group meetings allowed the Intelligence Team to have an overview of the different perspectives and priorities on data from organisations others than the MK Council. In the words of TM2: *"We relied on our users to tell us in the Users' group [what they needed], where we got a lot of feedback from people"*, and continuing *"I guess we wanted people to come forward and tell us what is it that is missing, and if it is useful. What we also found was that if you put something up that is useful to one person, it could be that other people also find it useful but they didn't know that that data even existed.*" Indeed, as summarised by TM1, ***"there were no real thoughts or no real controls on who used the data for what reasons"* beyond the Users 'Group.**

At the same time, **these Users 'Group meetings worked as a periodical procedure for monitoring the effectiveness of choices made around the elaboration and publishing of data as well as the data services provided by the MKiO, and decide how to reinforce, change or continue the activities**. Moreover, a few times the Users 'group meetings had been the occasion for pre-testing initiatives around data, such as the "In brief Guides", before their implementation to verify the matching between the Intelligence Team plans and the users 'expectations. "*We said <<look, this is what we are thinking of doing>> and we would ask users <<what do you think>>, and we would have to then make that judgement based on that. (TM2).*

Unfortunately, the interviewees TM1 and TM2 confirmed that there is **no documentation of the experience of the "MKiO Users' Group" because the meetings were not framed among the standard institutionalised activities and therefore did not required the preparation of specific reports by the organisers and participants.** However, at the same time, the absence of a formal framing for the Users 'Group meetings, as wells as for the Researchers Council meetings, facilitate a collaborative exchange of ideas and use cases, but on the other side failed in consolidating this practice within the MKiO and among the participants, at personal and organisational level. As evidence of this statement, TM3, the officer charged of the management of MKiO in its two closing years was not aware of the Users 'Group as a form of proactive support to the use of data by city stakeholders, despite the handover between the previous officers and the new one.

The description of this practice makes evident how all these interactions among Intelligence Team members and participants to the meetings were face-to-face encounters, in which the MKiO technological platform could be an object in the discussion but not the medium and the tool for supporting these activities. Interestingly, since 2008, the platform included functionalities such as comments and a discussion space to share ideas and use case about data, but the interviewees confirmed that these functionalities were not used, despite their intended purpose was to support users in parallel to the face-to-face meetings.

9.4.1.f From the analysis of the data practice toward to the City Data Open Portal

The deep understanding of the data practices of the MKiO in relation to the other city stakeholders and the limitations of the existing open data portal provided:

- Firstly, **support to orient the activities performed during the workshop** (in particular the second and third round of group discussion) **for understanding to what extent needs addressed before by these practices were still unmet and perceived as urgent by other ciy stakeholders** in their current practices, but also if the **solutions developed by the MKiO team were still valid and had potential for their actualisation supported by technology**

- Secondly, a **robust set of requirements for developing the concept and prototype of QBINA**, the Question-Based Information Needs aggregator (see section 9.5.3).

9.4.2 APPLICATIVE SCENARIOS OF CITY DATA IN LOCAL ACTIONS

In this section, I am going to presents the insights coming from the analysis of the workshop outputs in relation to the roles and challenges of the city stakeholders involved in the data ecosystem of Milton Keynes, their information needs and the expected uses of city data in local actions. Both during the workshop activities and the analysis of the outputs, the concept of *"Actionable Data"* had been considered to specifically indicate data serving the purposes of acting at the local level (in explicit contrast with data serving transparency obligations only). The working definition of **Actionable Data** in a city multi-stakeholder setting is:

data produced for enabling individual and collective actions that are generated, supported or mediated through the access, manipulation and use of data by local governments, public agencies, businesses, non-profit organisations and research institutions.

The understanding of the connection between data and actions at the local level and in the City ecosystem complements the understanding of the data practices in collaborative settings matured through the analysis of the experience of the MKIO. These two stands combined together provided the basis for the development of the design concepts presented in section 9.5.

To this regard, it is important to make explicit that the specific storytelling technique adopted to structure the workshop activities gave to the stories built from the perspective of the participants' organisations the four functions defined by Kendall & Kendall [2012]:

- an *"experiential function"* in the description of the experience with/within data-related processes in a specific domain
- an *"explanatory function"* in the representation of protocols and practices
- a *"validating function"* in the tension to outline processes and actions consistent with the mission, values and structure of the organisations involved in the stories
- a *"prescriptive function"*, not specifically oriented at the participants' organisations, but at the improvement of the city data ecosystem through the resolution of issues, criticalities and latent conflicts.

The readaptation of the Propp's characters used in the probes toolkit to silence the public discourse around Open Data provided a lens to study the ecological dynamics of the city open data ecosystem, partially unfolding the complex relationship between fluid contingent arrangements and persistence of archetypes in mutual perceptions in social contexts. In addition, their use as building blocks of the participants' stories substantially helped in creating *"good stories for design"* [Gruen 2000], or rather narratives incorporating a rich account of the characters, their goals, orientations, settings, and obstacles, as reported next.

In particular, the use of the toolkit allowed to access critical or overlooked information, in a form that could be used into the design process, and to do that without generating conflicts or exposing participants to any risk. In practical terms, we asked to different classes of city stakeholders what they do with data (not their opinions on the status of Open Data nowadays), what they don't do with data and why (on the basis of their protocols and constraints), for what purpose they produce or use data (in different sectors of activities and projects), with whom and under which kind of relational arrangement respect to their organisational mission and capability.

In this process, the probes had a three-fold purpose. First, the toolkit had been used as material dialogue tool with the participants and as data collection tools (two of the recurrent functions attributed to probes in the literature, especially when serving research investigations more than direct design elaborations, see Boehner et al. 2007). Secondly, the probes had been used to provoke the participants in reflecting on their everyday practices and environment [Graham et al. 2007], keeping an insider perspective on their organisation and critically assessing needs and expectations of external actors. Lastly, beyond the information or insights extracted by the workshop outputs and analysable through classical interpretive methods, the tension between the potential open interpretation of the toolkit components and the actual subjective expression of the participants outlined an ambiguous space for empathy and imagination that implicitly shaped the boundaries of the design proposal [Gaver et al. 2004].

9.4.2.a Overview of the applicative scenarios

The applicative scenarios developed with the city stakeholders covered five general themes, as indicated in section 9.3.4.c:

A. **Community Well-Being**: Social, Health, Education Services
B. **Urban development**: Planning, Housing and Energy Efficiency
C. **Mobility:** Infrastructures and Environment
D. **Economic Growth:** Employment, Facilities, Industry and Services
E. **Sustainability:** Smart Living and Local Resilience

Table 9.5. provides an overview of the specific applicative scenarios for each participant for a total of 18 stories divided into five groups. The following sections would not report in detail each story, but only the insights and patterns emerging from them, but Fig. 9.14 provides an example of the preliminary conversion of one of the stories from the visual artefacts (and toolkits materials) to a textual representation before the process of annotation, decomposition and analysis.

Table 9.5 Themes, groups and topic of the stories developed in the workshop

theme	User ID	Stakeholder	Story ID	**Local Actions based on the use of City Data**
COMMUNITY WELL-BEING	P1 - JR	PUBLIC AGENCY	N.1	Tracking the progresses of health care programmes
	P2 - LS	NON-PROFIT	N.2	Setting up a community agency to implement waste reduction projects
	P3 - JK	LOCAL GOV	N.3	Improving the management and impact of the social services delivery
	P4 - RB	NON-PROFIT	N.4	Developing individual and community resilience initiatives
URBAN DEVELOPMENT	P5 - VK	PUBLIC AGENCY	N.5	Elaborating guidelines to improve the safety of housing and public spaces
	P6 - PL	NON-PROFIT	N.6	Developing and promoting a new local plan as Housing Association
	P7 - SW	BUSINESS	N.7	Developing new data services for building groups, professional and residents
MOBILITY	P8 - MK	BUSINESS	N.8	Providing monitoring services on use and status of urban infrastructures
	P9 - MT	ACADEMIA	N.9	Studying and prototyping solutions to promote alternative mobility options
	P10 - LN	LOCAL GOV	N.10	Supporting mobility services for elders through public/private partnerships
	P11 - JQ	LOCAL GOV	N.11	Promoting and organising collective transportations for daily commuting
ECONOMIC GROWTH	P12 - IN	BUSINESS	N.12	Organising a large-scale innovation testing programme in the city
	P13 - DD	BUSINESS	N.13	Providing services to support emergency response units, police and residents
	P14 - MR	LOCAL GOV	N.14	Attracting and retaining highly skilled workforce in the city
	P15 - QL	NON-PROFIT	N.15	Improving the management of water infrastructures and water supply
SUSTAINABILITY	P16 - NN	ACADEMIA	N.16	Developing projects for social inclusion with local community and technology providers
	P17 - NR	ACADEMIA	N.17	Bringing university educational and training initiatives to local needs
	P18 - SR	LOCAL GOV	N.18	Encouraging home-working and low-impact individual behaviours

USER STORY ID	HOUSING ASSOCIATION FOR NEW DEVELOPMENT - DATA NEEDED TO INFORM DECISIONS AS TO WHETHER TO BUILD NEW HOUSES - DEMOGRAPHIC TRENDS , - COST OF LAND/BUILD , -EXPECTED RENTS , EXPECTED MAINTENANCE					
ACTORS - ROLES AND ACTIVITIES				EVALUATION		
				CRITICAL FACTORS	POSITIVE FACTORS	ADDITIONAL
ROLE CARD	ACTOR	TEXT ON THE ROLE CARD	TEXT ON ACTIVITY CARDS	ON THE BOARD	ON THE BOARD	EXPRESSED ORALLY
RESOURCE HOLDER	BUSINESS DEVELOPMENT HOUSING ASSOCIATION	GENARATE DATA [TO BUILD] A BUSINESS CASE - DEMAND (GROWING CITY, DEMOGRAPHIC TRENDS0 - AVAILABILITY OF LAND (LOCALTION, COST, PLANNING PERMISSIONS [STATUS/PROTOCOLS], LOCAL AMENITIES -SCHOOLS, SHOPS, HANG OUT) - LIKELY INCOME (RENTS) - ORGANIC COSTS (MAINTENANCE, BILLS)	GENERATE INPUT DATA FOR THE BUSINESS CASE - WORK ACROSS DIFFERETN ORGANISATIONS TO PROVIDE DATA RELATING TO THE DEMAND FRO HOUSING		GREEN POINT link between the housing association BD team and the finance officer	internal relation, clear understanding of the goal and of data required to make the business case
DECISION MAKER	FINANCE OFFICER OF THE HOUSING ASSOCIATION	EVALUATE DATA IN BUSINESS CASE - ACCURACY - PROBABILITY OF [DESIRED] OUTCOMES - TESTING AGAINST **SIMILAR MODELS AND PROPOSALS - LOOKING FOR OTHER EXAMPLES TO VERIFY DATA**			GREEN POINT the link between the finance officer and the local council , GREEN POINT between the finance officer of the housing association and the marketing department	internal relation, clear understanding of the goal and of data required to make the business case
INFLUENCER	LOCAL COUNCIL	PLANNING DEPARTMENT [THAT KNOWS] WHERE ARE HOUSES TO BE BUILT [BECAUSE OF THE LICENCES] , AND THE [DEPARTEMENT OF CITY GROWTH THAT WANTS/SHOULD] **PAINT THE CITY AS A PLACE TO LIVE + WORK.**	UPDATE LOCAL PLAN - UPDATE LOCAL PLAN BASED ON DEMOGRAPHIC AND GROWTH FORECAST - [ADDITIONAL, CONNECTING THIS STORY TO THE P7 STORY, THE ACTIVITY OF] SELL THE VIOSN, PROMOTE + ENGAGE	link from the coucil to the [perspetive] tenants - RED POINT IN THE LINK FROM THE COUNCIL TO THE BD TEAM OF THE HOUSING ASSOCIATION		unclassified and underspecified regarding the tenants, but critical respect to the availabilty of the needed information to build the business case
INFLUENCER	planning department of the local council / planners	GOOD DESIGN	UPDATE LOCAL PLAN - UPDATE LOCAL PLAN BASED ON DEMOGRAPHIC AND GROWTH FORECAST	GREEN POINT WITH RED BORDER IN THE LINK FROM THE PLANNERS/COUNCIL TO THE LOCAL COUNCIL		Confident that it is possible to update a local plan but uncertainty respect to the admistration willingness and timing in the operation, and output. The update will favorable to the business initiative?
PROMOTER	HOUSING ASSOCIATION MARKETING [OFFICE]	CREATE PR, REACH OUT POTENTIAL TENANTS, HOW TO IDENTIFY [POTENTIAL TENANTS], [MEDIA/COMMUNICATION] CHANNEL (INTERNET, VIA COUNCIL, **LOCAL PRESS**).		RED POINT WITH GREEN BORDER in the link from marketing department to the local council about the update of local plan		confident in the impact of press and their campaign and their business case to make a change in business plan (and mybe they are referring to the political part?)
[IMPLICIT INFLUENCER NOT MENTIONED AS INDIPENDENT ACTORS]	**LOCAL PRESS**					
BENEFICIARIES	TENANT	CHOICE OF AFFORDABLE HOUSING (**HOW TO FIND OUT WHAT IS AVAILABLE**) - DETAILS ABOUTN HOUSING (RENT, LOCATION, BUILDING EFFICIENCY, HOW TO VIEW , HOW TO SIGN UP		red POINT from marketing department to the perspective tenants		because of the difficulty to identy them --- (of the fact that somelse is using data to support their business decisions)
IMPLEMENTERS	BUILDERS	building **homes with APPROPRIATE FEATURES**			green point of the link from the housing association marketing , green point from the builders to the housing association	the housing association marketing is able to inlfuence the design decisions of builders about the type of productu to build, the builders are able to deliver what is required by the housing association
[IMPLICIT IMPLEMENTERS]	APP DEVELOPERS	MAKING OPEN BIM AVAILABLE			GREEN POINT IN THE LINK FROM THE APP DEVELOPMERS TO THE BUILDERS	BECAUSE OF THE UTILIY OF OPEN BIM TO BETTER SELL THE WORK

Fig. 9.14 Schematic preliminary conversion of the story N.6 from the visual artefacts (pre-analysis and annotation)

9.4.2.b Roles of the city stakeholders in the City Data Ecosystem

This analysis confirmed that in the city data ecosystem of Milton Keynes there is a distance between stereotypes and conventional expectations associated with specific classes of stakeholders, from the actual needs, capacities, competencies of local organisations.

Mapping the roles attributed by the participants to the various actors represented in their stories (*beneficiaries, decision maker, resource holder, promoter, implementer, influencer*) with the roles that these actors have in the process of producing or using data within the city data ecosystem (*data subjects, data collection promoter, data provider, data processor, data consumer, data communicator*) highlighted the difference between ideal and real roles covered by city stakeholders in connecting data to local actions. Certainly, the use of archetypes helped in let this misalignment emerging by looking at the roles covered in data-related actions. **Local government, conventionally considered as *"the" data provider*, covers primarily the role of data consumer or data collection promoter**, because of the need to make its own informed decisions and build plan and services based on evidence. Indeed, local government is mainly indicated in the stories as the resource holder and decision maker, but exclusively as a source of financial support for data-related initiatives, rather than as an actor actually producing or releasing data determinant for other stakeholders' actions. Therefore, the archetypes of the Father and the Donor appear to be closer to the reality of city data-related processes, rather than the one of the Hero, directly involved in overcoming specific challenges [see Fig. 9.15].

2	USER STORY	TYPE OF ORGANIZATION OF PARTICIPANTS	LOCAL GOVERNMENT			
			CARD ROLE	UNIT/SUBJECT	CONNOTATION/NOTES	DATA ROLES
COMMUNITY	P1 - JR	PUBLIC AGENCY	NOT MENTIONED	NOT MENTIONED	NOT MENTIONED	NOT MENTIONED
	P2 - LS	NO-PROFIT	RESOURCE HOLDER	LOCAL COUNCIL	FINANCING THE PROJECT - GENERIC	DATA CONSUMER
			DECISION MAKER	ECONOMIC GROWTH DEPARTMENT MKC	EVALUATING THE PROJECT - ADMIN	DATA CONSUMER
			PROMOTER	LOCAL COUNCIL	SUSTAINING THE PROJECT - GENERIC	DATA COLLECTION PROMOTER
	P3 - JK	LOCAL GOV	PROMOTER	MK COUNCIL ADULT SOCIAL CARE	PROVIDING SERVICES - ADMIN	DATA CONSUMER / DATA PROVIDER
			RESOURCE HOLDER	MK COUNCIL SOCIAL CARE INFORMATION TEAM	DATA ELABORATION - ADMIN	DATA PROVIDER / DATA PROCESSING
			RESOURCE HOLDER	BUDGETS MANAGERS	INTERNAL REVIEW - ADMIN	DATA CONSUMER
			DECISION MAKER	MK COUNCIL CABINET	REVIEW AND STRATEGIC DECISIONS - POLITICAL	DATA CONSUMER / DATA COLLECTION PROMOTER
			IMPLEMENTER	MK COUNCIL ADULT SOCIAL CARE COMMISSIONING	SERVICE MANAGEMENT HIGH LEVEL - ADMIN	DATA CONSUMER / DATA COMMUNICATION
	P4 - RB	NO-PROFIT	RESOURCE HOLDER	LOCAL COUNCIL	FINANCING/EVALUATING - POLITICAL	DATA CONSUMER / DATA COLLECTION PROMOTER / DATA PROVIDER
PLANNING HOUSING	P5 - VK	PUBLIC AGENCY	DECISION MAKER	LOCAL COUNCIL	DECIDE ON LOCAL POLICIES	DATA CONSUMER / DATA COLLECTION PROMOTER
	P6 - PL	NO-PROFIT	INFLUENCER	LOCAL COUNCIL, PLANNING DEPARTMENT	SUPPORT LOCAL POLICIES AND ACTIONS	DATA CONSUMER / DATA COLLECTION PROMOTER
	P7 - SW	BUSINESS	INFLUENCER	LOCAL COUNCIL, PLANNING DEPARTMENT	SUPPORT LOCAL POLICIES AND ACTIONS	DATA COLLECTION PROMOTER
MOBILITY	P8 - MK	BUSINESS	BENEFICIARY	LOCAL COUNCIL	INCREASE LOCAL TAXES BUDGET	DATA CONSUMER
			DECISION MAKER	LOCAL COUNCIL	STRATEGIC DECISIONS	DATA CONSUMER
	P9 - MT	ACADEMIA	DECISION MAKER	LOCAL COUNCIL	FINANCING AND EVALUATION	DATA COLLECTION PROMOTER
	P10 - LN	LOCAL GOV	DECISION MAKER	LOCAL COUNCIL	STRATEGIC DECISIONS	DATA COLLECTION PROMOTER / DATA PROVIDER
			BENEFICIARY	LOCAL COUNCIL	INCREASE LOCAL INDEPENDENT SERVICES	DATA CONSUMER
	P11 - JQ	LOCAL GOV	DECISION MAKER	LOCAL GOVERNMENT OFFICES	SUPPORT LOCAL POLICIES AND ACTIONS	DATA CONSUMER
			DECISION MAKER	NATIONAL GOVERNMENT	SUPPORT LOCAL POLICIES AND ACTIONS	DATA COLLECTION RPOMOTER
			RESOURCE HOLDERS	NATIONAL GOVERNMENT	FINANCING AND EVALUATION	DATA CONSUMER
			INFLUENCER	POLITICAL PARTIES	SUPPORT LOCAL POLICIES AND ACTIONS	DATA CONSUMER / DATA COMMUNICATION
BUSINESS	P12 - IN	BUSINESS	RESOURCE HOLDER	FUNDING BODIES	FINANCING AND EVALUATION	DATA CONSUMER
			DECISION MAKER	MK COUNCIL	PLANNING TEST BED INITIATIVE	DATA COLLECTION PROMOTER
	P13 - DD	BUSINESS	INFLUENCER	OTHER COUNCILS, [CITY OF] CAMBRIDGE	COMMUNICATE THEIR EXPERIENCE AS CUSTOMERS	DATA COMMUNICATION
			RESOURCE HOLDER	NOT IDENTIFIED [BUT PUBLIC FUNDING]	FINANCING AND EVALUATION	DATA CONSUMER
			DECISION MAKER	COUNCIL MANAGEMENT	STRATEGIC DECISIONS	DATA CONSUMER / DATA PROVIDER
			BENEFICIARIES	SAFE CITIZENS - INTENDED COUNCIL	USE DATA FOR LOCAL SERVICES	DATA COLLECTION PROMOTER / DATA CONSUMER
	P14 - MR	LOCAL GOV	DECISION MAKER	[MKC EDUCATION AND WORK SERVICES]	STRATEGIC DECISIONS / PLANNING INITIATIVES	DATA COLLECTION PROMOTER / DATA CONSUMER / DATA COMMUNICATION
			PROMOTER	[CITY COUNCIL]	FINANCING AND EVALUATION	DATA CONSUMER / DATA SUBJECT
			IMPLEMENTER	COUNCIL	PROVIDING THE INRASTRUCTURE TO MATCH BUSINESS, COUNCIL, STUDENTS AND POTENTIAL EMPLOYEES NEEDS	DATA COLLECTION PROMOTER / DATA CONSUMER / DATA COMMUNICATION
	P15 - QL	NO-PROFIT	DECISION MAKER	LOCAL AUTHORITY	PROMOTING NEW LOCAL ACTION TO CONTAIN WATER STRESS	DATA CONSUMER / DATA PROVIDER
			BENEFICIARIES	GOVERNING AUTHORITIES	STRATEGIC DECISIONS	DATA CONSUMER
SUSTAINABILITY	P16 - NN	ACADEMIA	DECISION MAKER	EXTERNAL FUNDING BODY [PUBLIC FUNDS]	FINANCING AND EVALUATION	DATA COLLECTION PROMOTER / DATA CONSUMER / DATA COMMUNICATION
	P17 - NR	ACADEMIA	INFLUENCER	LOCAL COUNCIL	PUBLIC ENDORSEMENT TO THE UNIVERISTY ROLE IN THE CITY	DATA COMMUNICATION
			PROMOTER	LOCAL COUNCIL	PARTNER OF UNIVERSITY	DATA CONSUMER / DATA COMMUNICATION
	P18 - SR	LOCAL GOV	PROMOTER	MKC - TRANSPORT POLICY [OFFICE]	STRATEGIC DECISIONS	DATA COLLECTION PROMOTER / DATA CONSUMER
			DECISION MAKER	MKC SENIOR MANAGEMENT OR WARD COUNCILLOR	FINANCING AND EVALUATION	DATA COLLECTION PROMOTER
			RESOURCE HOLDER	THE MKC DEPARTMENT FOR TRANSPORT	PLANNING INITIATIVES / POLICIES	DATA CONSUMER / DATA COMMUNICATION
			IMPLEMENTER	MKC TRANSPORT TEAM	IMPLEMENT THE MEAUSERS FOR LOCAL POLICIES	DATA COLLECTION PROMOTER / DATA CONSUMER
			INFLUENCER	WARD COUNCILLORS	SUPPORT LOCAL POLICIES AND ACTIONS	DATA COMMUNICATION

Fig. 9.15 Example of the mapping between the roles covered by local government in the stories and data roles in the city data ecosystem

Citizens are considered as beneficiaries in 17 out of 18 stories, consistently with the general discourse around the supposed target and focus of data-related initiatives in the dichotomy government /citizens. However, citizens result to be **framed prevalently as data subjects**, instead than seen as data consumers actively using data for their own activities, or data collection promoters. As data subjects and beneficiaries, citizens match quite well with the archetype of the Princess as a reward.

Businesses play a relevant role in all the stories, as implementer and resource holder, beyond the dichotomy local-government/citizens dominating the public discourse on Open Data. They are assumed to possess the financial and technological capacity, as well as skilled human resources to collect and process data and then enable the use of data for local actions (data provider and data analyser). Thus, IT-oriented businesses embody the archetypes of the Hero (and the Donor of instrumental resources to third parties), even though they are usually invisible in data portals.

Academia is consistently seen by its representatives and by others as implementer and influencer. In the city data ecosystem, Academia is framed as the actor able to activate local networks connecting technical, financial, administrative and community partners to implement data-related projects and data collection promoter. The archetypes better corresponding to this framing are the Helper and the Dispatcher.

Public Agencies cover marginal roles in the stories, even though most of them such as National Health services, environmental authorities, or police divisions are actively involved in data collection, analysis and communication. However, a dual-profile seems to emerge: as Dispatcher-Hero-Helper from an internal perspective on the public agencies data-related activities, and as Father-Donor from the perspective of external actors.

Non-profit organisations, similarly to public agencies, are also considered marginal and tend to have a more active profile from an internal perspective. They are mainly framed as data communicators, acting as intermediaries for the benefit of citizens, but also as data collection promoters. The stories highlighted that they could also become data providers of contextualised knowledge about local communities. They cover prevalently the role of Influencer (as Helper).

Interestingly, the archetype of the Villain, fighting and creating obstacles to the other characters, is instantiated in almost every story as a **Resource Holder that has an unclear or underspecified identity**. Its identification is stated as one of the most critical factors to address for overcoming the challenges set by the participants. Still, they were not able to identify what organisation have this kind of influence in none of the stories.

9.4.2.c Challenges and goals of city stakeholders in the City Open Data Ecosystem

The challenges reported in the stories ranged from very abstract goals, such as *"improving health and well-being of population though safe and secure housing for all"*, to operative objectives such as *"to understand and predict the supply and demand status of the water [infrastructures] to devise solutions for water-stress issues"*. It was evident that the representatives of local government and public agencies preferred an abstract definition of their goals, differently from all other stakeholders. Moreover, the stakeholders with a recognised public mission, such as local government, public agency or no-profit organisations, defined their goals under the light of their social mission and projecting the outcome of their data-related actions toward the collectivity and the common good. However, also in those cases, the implicit or operational goal referred to the specific interests of their organisations. For instance, "*retaining high qualified workers in the city*" was linked to the goal of *"sustaining local growth"*, but also more specifically to the fact that highly qualified workers residing in the city contribute to the municipal budget more than low-skilled workers because of their preferences for bigger houses taxed more. On the contrary, the representatives of the business sector preferred to define their challenges in operational terms, highlighting the importance of making explicit and publicly known that the interests of their organisations were the priority [see also Fig.9.16].

The mapping of the other city stakeholders represented in the participants' stories brought out three recurrent elements in the narratives:

a) The holders of data considered as essential to carried out local actions are not known, or their identity is unclear or underspecified (as mentioned as regarding the stakeholders' roles in section 9.4.2.b)
b) The structure, capacity and competencies of the organisations involved as external actors in the participants' stories were oversimplified, exaggerating or underplaying their real capabilities to produce, manage, process and use data
c) The relationships among different organisations build on the exchange of data were critical due to uncertainty in the roles of actors, the communication protocols, and the conditions and contents of the required datasets.

A significant example of the omission of key data holders can be found in story N.2. In this case, the entire flow of activities to start-up a community agency is based on the access to data about city waste reduction initiatives, such as *"how many staff/residents/entities are in collaboration with enterprises [implementing the waste reduction measures]. How much (weight) saved from landfill? How much money is saved? Income generated? Jobs created? People in crisis helped?"*. While knowing this information is central to the story and the participant's actions, the real or potential data providers are missing. In the story N.3, the data holders are instead underspecified and indicated generically as *"external data sources […] providing data to the MK Council"*.

As regarding the second point, story N.4 provides an example of a participant overlooking the scope and competences of other two actors in his story. Strong expectations had been oriented toward the public health authority and the technical team managing the city data portal to *"help them [the participant's organisation] access to relevant data […] to engage citizens in defining issues, interests and ideas at local level"*. Data that could be relevant for having these results are not specified, while it is assumed that it will be up to the two other actors to make such evaluation. In the same story, the participant expressed confidence in the capacity of his non-profit organisation to *"monitor the impact of community resilience measures at local level"* as one of the key skills gained from their experience working with communities. It is worth noticing that in 13 out of 18 stories the ability to assess the impact of actions at local level relying on complex information is considered a highly valuable skill, but it is never associated to the competencies available within community organisations.

In reference to the third point, story N.6 outline a process in which city data are elaborated and exchanged in synergy among different units of a housing association, building up the value of data step by step and enabling the activities for implementing a new urban development project. However, this positive constructive flow is threatened by the uncertainty about how their *"data product"* will be received and used by the local council (as an external actor) to support or stop their project. Similarly, the story N.13 presents a very positive data workflow involving different organisations to set up a service of city-safety monitoring. The critical elements in the process are due to the uncertainties about contents, conditions and protocols for access to an essential data source: *"what data do the gov[ernment] collect, where is stored, how accessible is it? For whom?"*.

Indeed, as emerging from the stories, the access to city data is regulated by established protocols and specific agreements only in rare cases in which there is a stable partnership between the actors involved in a specific action, whether they have different purposes or they need to progress a joint flow of activities. In almost the totality of other situations, the relationships between data producers and organisations interest to use data in local actions are not formalised because based on occasional contacts that imply procedures and assessments changing case by case, and therefore generating uncertainties.

TYPE OF STAKEHOLDER	USER STORY ID / ROLE IN THE STORY	GOAL/CHALLENGE	RELATION GOAL / TYPE OF STAKEHOLDER		
			TYPE OF GOAL (ABSTRACT / OPERATIVE)	COLLECTIVE / INDIVIDUAL / ORGANISATIONAL	NOTES ABOUT THE GOALS
PUBLIC AGENCY	P1 - JR	IMPROVING THE WIDER DETERMINANTS OF HEALTH - TRACKING THE PROGRESS OF HEALTH AND WELLBEING	ABSTRACT in the dimension of improving health, OPERATIVE as intended as a tracking process	ORGANISATIONAL / COLLECTIVE	The goal reflect the **mission** of the PUBLIC AGENCY the participant is affiliated with, that has a DOUBLE VALENCE. To improve the health of the population as **external objective**, and to improve the efficacy of services as **internal goal.**
NO-PROFIT	P2 - LS	WASTE REDUCTION-REUSE OF RESOURCES MORE EFFECTIVELY >>> IMPLEMENTING A PARTNERHIP BETWEEN LOCAL CONCIL, SOCIAL AND ENVIRONMENTAL ENTREPRISES FOR RECYCLING, REUSING, REPURPOSING FURNITURE, APPLIANCES , HOUSEHOLD GOODS AND CLOTHING. MEASURING RESOURCES OF INDIVIDUAL COMMUNITIES "STUFF+SKILLS" OR BETTER WAHT IS THE SKILL SET OF INDIVIDUALS AND HOW IT CAN BE UTILISED COLLECTIVELY.	OPERATIVE as based on an entrepreneurial project to build a social start up in the domain of waste reduction, in collaboration with other local actors, such as the local council.	COLLECTIVE/ ORGANISATIONAL	The goal of the participant is articulated into three levels: general, about the waste reduction, organisational, considering both the council and the social start up to create as subject that should have an advantage from the project, and the community, to be empowered through the project in exploiting its social and material capital. The social start up is situated as **connector among different subjects** , and the goal reflect this positioning.
LOCAL GOV	P3 - JK	IMPROVE OUTCOMES FOR PEOPLE WITH SOCIAL CARE NEEDS - EFFECTIVE USE OF RESOURCES TO PROVIDE PEOPLE WITH THE SUPPORT THEY NEED + INCREASE INDEPENDENCE	ABSTRACT in the dimension of improving health, OPERATIVE as based on monitoring services provision	COLLECTIVE / ORGANISATIONAL	The goal reflect the **mission** of the LOCAL GOVERNEMENT the participant is affiliated with and it has a DOUBLE VALENCE. To improve the impact of social care services (efficacy and effctiveness) as organisational goal and hoping to improve the quality of life and indipendence for assisted users. Internal / external goal.
NO-PROFIT	P4 - RB	INCREASE COMMUNITY RESILIENCE - DEVELOPING INDIVIDUAL RESILIENCE AND THAT OF VOLUNTARY GROUPS WILL IMPROVE THE QUALITY OF LIFE OF COMMUNITIES AND REDUCE INEQUALITIES	OPERATIVE as based on tracing the before/after of resilience parameters in the community in relation to a specific initiative or project	COLLECTIVE / ORGANISATIONAL	The goal reflect the **"core business"** of a no-profit organisation specialised in community engagement, able to deal with general themes such as community resilience in practical terms. Their internal goal is to sustain the achievement of the external goal.
PUBLIC AGENCY	P5 - VK	PUBLIC HEALTH - IMPROVING HEALTH AND WELLBEING OF POPULATION THROUGH SAFE AND SECURE HOUSING FOR ALL	ABSTRACT, not closer to the implementation of better housing plans	COLLECTIVE	The goal of the participant reflect an **external involvement** of the public health agency respect to the theme of city development and housing. In fact, the participant role in the scanrio is as influencer, that practically can write reports on the topic and influence indireclty closer organsiations and the general public. The action is not close to the implementation of housing development project, but at a policy level. Marginal goal compared to the organisational mission, but relevant because of the importance and the implication at collective level, that impact also on the public health themes.
NO-PROFIT	P6 - PL	HOUSING ASSOCIATION FOR NEW DEVELOPMENT - DATA NEEDED TO INFORM DECISIONS AS TO WHETHER TO BUILD NEW HOUSES - DEMOGRAPHIC TRENDS , - COST OF LAND/BUILD , -EXPECTED RENTS , EXPECTED MAINTENANCE	OPERATIVE, to buil the business case to invest in a new housing development project	ORGANISATIONAL	The goal of the participant is an **internal goal,** overlapping the scope and the mission of the type of organisation that he is representing.
BUSINESS	P7 - SW	MAKE OPEN BIM AVAILABLE >>> BIM IMPLEMENTATION	OPERATIVE , to develop a new app	ORGANISATIONAL	The goal of the participant is an **internal goal** linked to business development opportunities. - new business
BUSINESS	P8 - MK	PROVIDE INSIGHT INTO MOBILITY - ALLOW LOCAL GOVERNMENT TO UNDERSTAND WHERE AND HOW MANY PEOPLE MOVE AROUND MK	OPERATIVE, to provide data output	ORGANISATIONAL	The goal of the participant reflect the goal of the business that he is representing (a business providing data analysis and data services) and the goal of its client , that is the local governement. Therefore, the goal could be interpreted as a two part goal composed by the **complementary goals in the dynamic provider/clients.** - well established business
ACADEMIA	P9 - MT	DEVELOP AN INFRASTRUCTURE TO CHANGE THE PERCEPTION ON SAFETY OF RAILWAYS - READ WAYS ARE UNDERUTILISED AND THERE IS AN ERRONEOUS PERCEPTION THAT THEY ARE UNSAFE. DATA AND TECHS CAN BE USED TO HELP THE CHANGE IN PEOPLE'S PERCEPTION	OPERATIVE, to develop a technological infrastructure	COLLECTIVE	The goal of the participant has an operative definition (to develop a - technological - infrastructure) that reflect the **capabilities of the institution** he belong, but the goal is broader, **investing the collectivity as a whole**. This is in line with the general profile and self-representation of academia.
LOCAL GOV	P10 - LN	SAFER MOBILITY FOR OLDER PEOPLE (MORE THAT 65 YEARS OLD) - PATHWAYS FACILITIES (SAFE AND ACCESSIBLE) MORE PUBLIC/PRIVATE HIRED TRANSPORT FACILITIES FOR THEM TO MOBILE	ABSTRACT, defining a safer mobility for elders as a collective goal	COLLECTIVE	The goal of the participant is ABSTRACT, in term of being oriented to identify potential solutions for elders mobility, that is a problem perceived as of colelctive relevance. The fact that the participant indicate her role mainly as beneficiary of solution provided by other actors to reach this goal, reinforce that evalaution of the goal as abstract and not operative beancuse not directly related to the impelmentation of new services or meausures.
LOCAL GOV	P11 - JQ	TO PROVIDE TRANSPORT CHOICE WHICH IS CONVENIENT AND EASY AS THE CAR - PROVIDING TRANSPORT CHOICES WHICH IS AVAILABLE AND AS EASY TO USE SINGLE OCCUPANT VEHICLES	ABSTRACT	COLLECTIVE	The goal of the participant is abstract, in terms that it speficy the in practical terms the meaning attributed to the goal (easy as the car, easy as single occupant vehicles) but not an operative path to reach this goal. But this goal is of collective relavance, not limited to the local government mission.
BUSINESS	P12 - IN	MK LEADING TEST BED BRANDING - CREATE CITY WIDE TEST BED ENVIRONMENT FOR SMART CITY ENABLEMENT	ABSTRACT	ORGANISATIONAL	The goal of the participant is abstract, outlining a future initiative offering a test bed environment for the city business, but he does not specify the path to reach the goal. It is mostly organisational, intented as linked to the business development opportunities, while the participant do not specify a business in particular.
BUSINESS	P13 - DD	OPEN ACCESS >>> CONNECT AND COVER - MONITOR AND ANALYSE MK SAFETY	OPERATIVE	ORGANISATIONAL	The goal of the participant is operative, and related to the core activities of his business. The goal has a double valence, fro the business to provide the data analysis services and fro the customer (city council) to be able to monitor the safety level of the city.
LOCAL GOV	P14 - MR	LEADING GROWTH >>> ATTRACTING + RETAINING TALENTS - MAKE MK A PLACE WHERE PEOPLE WANT TO LIVE AND WORK	ABSTRACT	COLLECTIVE / ORGANISATIONAL	The goal of the participant is very abstract in terms of outlining a desired status (attracting and retaining talents in MK), although it has practical implication in terms of increasing the revenue from taxes fro the local council. The goal therefore is collective at an upper level (improving the attractivenss of the city) and organisational (for the implications of the outcome linked to the goal).
NO-PROFIT	P15 - QL	WATER STRESS >>> UNDERSTAND AND PREDICT THE SUPPLY AND DEMAND STATUS OF THE WATER. DEVISE SOLUTIONS FOR WATER STRESS ISSUES	OPERATIVE	ORGANISATIONAL	The goal of the participant is operative and contained into the institutional mission of the organisation is affiliated with.
ACADEMIA	P16 - NN	IDENTIFY LOCAL COMMUNITY PARTNERS TO SET UP A PROJECT ICT 4 SOCIAL INCLUSION >>> BRING TOGETHER THE RIGHT PLAYERS 4 THE PROJECT, FIND RESOURCES TO PLAN, WRITE, IMPLEMENT THE PROJECT, ENGAGE WITH THE PARTNERS	OPERATIVE	INDIVIDUAL/COLLECTIVE	The goal of the participant is stricly related to the practice of the academic work, in between research and project writing, and it has an individual connotation where the participant has an active role as implementer to reach the goal in a network of other actors. The goal is individual, but the topic is of public and collective relevance.
ACADEMIA	P17 - NR	DEVELOP THE RELATIONSHIP BETWEEN THE OU AND THE MK TERRITORY WITH THE OBJECTIVE OF GETTING STUDENTS, BRAND DEVELOPMENT, DEVELOP AND AGENDA FOR TECHNOLOGY AND KNOWLEDGE TRANSFER, HAVE IMPACT ON SOCIETY	ABSTRACT / OPERATIVE	ORGANISATIONAL	The goal of the participant is articulated at two level. One general aimed to rebuild the role of the univeristy in the territory in abstract, and the second one more operational linked to a campaing of rebranding, students attraction, business partnerships. The focus is strongly on the university as beneficiary of the process.
LOCAL GOV	P18 - SR	MODAL SHIFT TO SUSTAINABLE TRANSPORT >>> ENCOURAGE USE OF SUSTAINABLE TRANSPORT, HOME-WORKING AND ACTIVE TRAVEL INSTEAD OF SINGLE OCCUPANCY CAR USE BY IDENTIFYING JOURNEY (COMMUTE, LEISURE, SCHOOL) WHICH COULD BE MADE BY ALTERNATIVE MODES, OR REDUCED, OR ELIMINATED.	ABSTRACT	COLLECTIVE	The goal of the participant is articulated at two level, both abstract. At upper level, the modal shift is identified as a valuable outcome to achieve, and at a lower level is linked to some practical indicators that could impact on behavoiural change decisions. But aniway, the local goav also in this case is not an implementer of specific measures, if not policies.

Fig. 9.16 Extract of a part of the analysis of the goals and challenges in the stories

The stakeholders' profiles emerging from the analysis of their roles and goals in the applicative scenarios revealed the divergence between their actual goals and capabilities from the conventional roles attributed to public and private institutions in the city Open Data Ecosystem as data producers and data consumers.

However, the analysis also highlighted that each organisation, and in general each class of stakeholders, covers **multiple roles in data-related local processes**: data collection promoter, data provider, data processor, data communicator, data consumer and data subject. From the perspective of the local actors in the City Data ecosystem, it is crucial to make public the plurality of roles in the implementation of data-driven activities and in the process of data generation and use. Moreover, the results point out the importance of letting the different stakeholders in control of defining and maintaining a consistent public representation of their organisational or social mission as strong motivation for being engaged in data use and production. Indeed, the perception of local organisations by other actors in the same city ecosystem is strictly related to their roles in local activities. Therefore, publicly **communicating the reasons why a specific organisation undertakes the effort of producing and releasing data of public interest** is important to benefit of the secondary effects of that effort: **authoritativeness on a topic, corporate ethics, competitive advantage in building local partnerships and so on.**

On the other hand, the potential users of open data (and city data more in general) need **support in identifying the data providers** in the local open data ecosystem, and assessing if the organisational structure, capacities and competencies of the data providers are compatible with their needs and goals. It is worthy to highlight that the organisations holding the information required to implement local actions are often actors not considered central in the Open Data ecosystem, such as civil society organisations. In that cases, these organisations are aware of the value of their local knowledge, but the difficulty to cover all the roles in the data production process prevents them from being recognised as potential and valuable data providers.

In the complex relational context of the City Data ecosystem**, the problem of the underuse of Open Data is thus a problem related to assessing the compatibility of available data with the goals of local actions and accessing to the actors able to provide the integrative sources of information that could facilitate the use of data in the city context.**

According to this perspective, **the challenge of City Data technologies is not providing access to data, but access to people that can provide the context of data and supporting the navigation of the City Data ecosystem.**

However, it is worth to consider that these issues cannot be overcome without addressing the misrepresentation of local actors in the data-related processes and the marginality of the organisations' ability to connect data to the context. But making valuable, transferable and usable the direct knowledge of the city context by transforming local organisations in new data providers can enable them in an *empowerment-over* (Schneider, Eiband, Ullrich & Butz, 2018) and alter the current equilibrium of power among city stakeholders around the relationships mediated by data encountering resistance. Again, as seen also in the previous case studies in Chapter 7 and 8, the **design of alternative technologies intended to be multistakeholder and multipurpose necessarily requires the conscious handling of power relationships, ensuring the flexibility for dynamically negotiating power equilibrium case by case over time.** The paramount of the *"political soundness of technology"* [see Chapter 3] clearly reappears as a strict necessity for city technologies.

9.4.2.d Information needs in local actions and profile of "Actionable Data"

The analysis of the participants' stories allowed us to identify a set of 87 desired or required datasets indicated as potential sources connecting data to local actions. I used this sample to study the **characteristics of the information needs** in local actions and the profile of "Actionable Data".

The analysis of the data sources associated to the collected information needs and their classification accordingly to the licencing categories (open, public, restricted access to groups or specific persons and organisations, private closed data [Open Data Institute 2015]) show that **only a marginal part of that needs is covered by open data** (6 out of 87). Many of the information needs are linked to **public data** (23/87), accessible but not freely reusable, or to data available under restricted access (28/87). What is relevant is that around a third of information needs could be met by **data produced for internal use** by local stakeholders (35/87) and a quarter of them is not produced (21/87) due primarily to the uncertainty about the organisation that should take in charge their collection and elaboration. The remaining information needs are linked to data produced by privates for commercial purposes (15/87).

The most prominent type of data required to take actions in the stories is represented by **structured profiles of the local context**, people and organisations (30 out of 87). For instance, this type of information needs includes the "*skills of the residents and community members*", "*data about producers of recyclable wastes in the city*", and the "*land profiles including amenities and public services*". Complementary to the profiles, the participants often required lists of local actors (6/87), factual data about environment monitoring (6/87) and behavioural patterns in the use of mobility infrastructures (5/87).

The second core of information needs includes **data documenting ongoing processes, initiatives and services** (5/87) such as the *"level of civic engagement in community projects"*, *"data about trends/process/status of waste collection and treatment"*, *"data about historical/existing provision of social care services"*. We also highlighted an interest in projects and plans (6/87) envisaging the future transformation of the city, as well as data supporting the impact assessment (5/87) of past and future actions.

Lastly, the request of statistical data (16/87) is often associated to the need of tailoring broader datasets for a specific audience or extracting only subsets, such as *"population data for urban planners"*, as well as *"data about the users of city walkways break down by age"* to plan mobility services for elderly people. Surveys (11/87) depicting perceptions and opinions about specific topics were also indicated as a desirable complement to statistic data, especially in the scenarios of planning, mobility and business development. For instance, surveys about *"who is not traveling and why"*, *"experiences related to the use of infrastructures and services"*, *"the perception of well-being of residents"*.

By focusing on the nature and volume of the "actionable data", a significant majority of information needs pointed toward "**qualitative data**" (69/87), if necessary associated with "quantitative data" to make sense out of the recorded indicators (36/69). Less than a fourth are centred on quantitative data (18/87) when the needs are, for instance, costs, performances and size of user basin for a specific service. Story N.3, developed by a data expert of the city council, highlighted as a critical factor that the local government *"got a lot of data"*, but *"more resources and skills [are required] to do the analysis of the qualitative data"*.

Consistently, only a marginal part of the information needs requires *big data*, such as requests associated with monitoring traffic levels, energy consumptions and environmental parameters. Almost the totality of the information needs (79/87) could be fulfilled by *small data* providing a contextualised and comprehensive representation of the topic of the request. For instance, some requests concerns *"data about the impact of social services at local level"*, as well as *"data about the economic growth of the city"*.

Looking at the temporal features of the actionable data, the information needs highlighted strong demand for **timely information about the ongoing activities** and status of the city services and city resources (31/87), as well as indications for **future actions** based on the analysis of historical trends and current initiatives (25/87). Data about the past are relevant instead when connected to the assessment of the current state of affair to measure the impact of initiatives or as historical context for planning (31/87).

The spatial aspects linking data to their actionability highlighted that the same data could have often different uses at different scales, such as the *"list of local stakeholders and asset holders"* as well as the *"household consumption"* or the governmental data about *"safety and risky area"*. This interscalarity of a part of information needs is reflected in the level of detail of the required datasets ranging from the individual units to their aggregations, such as the *"cost of housing"* the could be measured at the city scale, neighbourhood scale or in reference to a specific building.

The last aspect to be considered in studying the information needs is that of data ownership, which can be concentrated in a single organisation, fragmented among different organisations or potentially distributed among individuals and organisations able to provide just a small portion of the overall dataset. Data sources owned by a single organisation could address less than a fourth of information needs (18/87). Most of the required datasets, in our sample, are under fragmented ownership (43/87) or could be produced by collecting distributed data within local communities (26/87).

This analysis clearly showed how Open Data currently available do not reflect the information needs of city stakeholders for their activities, not even of the local government and public agencies. The offer of city Open Data includes (in Milton Keynes and many other cities) datasets, reports and documents tracing the administrative activities and aggregating socio-demographic, environmental and geographic information. The information needs analysed in the study highlight how these types of data (licenced as Open, conceived as static finished products documenting past activities, and published by one only data producer) cover only a marginal part of the needs of potential users.

The "status" of Open Data is a desideratum for most of the city data. On the basis of the analysis, the profile of Actionable Data in the city includes most data sources that are now public data (not granting the right to reuse them), and also data produced for internal use by local stakeholders, whether public or privates, that do not constitute monetizable resources in their core business. The licencing of these data and the difficult access to part of them are problems that can be addressed by local policies, but also providing technological support to aggregate these data sources. Lastly, other actionable data sources not currently produced because of the uncertain attribution of responsibility for their production could be considered as potential "data commons" requiring a coordinated effort to their collection.

The types of data considered as actionable are a structured elaboration of information. As a participant to the workshop pointed out *"we don't have the right words to talk about data, a vocabulary for that. We all say just "data" but what we want is much more"*. Indeed, **Actionable Data are composite entities, possibly including statistical data and raw data in general, but mostly aggregating the available information in structured profiles at different spatial and temporal granularities (for instance, from the neighbourhood to the city, from weeks to decades) that have the "relational properties" of Open Data in terms of impartiality and reliability.** In this sense, actionable data sources are mainly "qualitative data" making explicit the meaning and purpose of the measured indicators or the description of processes, and are small data illustrating a clear in-depth connection between factors of local phenomena. Lastly, **Actionable Data**

sources provide information on the present and on the future to orient the decisions to be taken by local actors.

The set of all these features represent **actionable data sources as modular dynamic products**, built over time and progressively integrated with new information referred to additional spatial and temporal units respect to the original source, and presenting potential aggregation tailored on the purposes and constraints of typical applicative scenarios.

The modular evolutive nature of actionable data sources requires the collection of the needed information from multiple organisations or even individuals having pieces of local knowledge built on their direct experience of the context. In this frame, the ownership of data become a complex relation among multiple actors to **recompose fragmented or distributed information to generate an actionable data source**.

These three highlights suggest that **the problem of the underuse of Open Data should be approached as a problem of data collection for the collective and coordinated production at the local level of actionable data sources.**

Under this light, **the technological challenge for City Data technologies is not supporting users in using data, but providing support to the aggregation of the users' information needs to orient the data collection, and then facilitating the organisation of the data collection in itself**, as then considered central for developing the concept of QBINA [see section 9.5.2].

9.4.2.e Expected uses of the data sources associated to the information needs and role of City Data technologies

The last part of the analysis focused on analysing the expected uses of the desired data sources in local actions represented by the collected information needs.

The intended uses of these data sources depend strongly on the level of expertise of users in data processing and the level of knowledge on the topic covered by the information need. Their analysis outlined four stable patterns.

Information needs related to a narrow selection of themes and type of data, such as data on mobility and traffic, economic data to assess investments and performances of business initiatives, and statistic elaboration of population parameters, are associated to users with high level of expertise both on data operations and on the topic. They expect to have direct access to raw data for performing specific **data analysis** required to implement or manage routine services provided by their organisations.

Information needs related to the factors influencing or potentially impacting on the operational environment of local organisations, such as the overall economic growth of the city, the positive/negative perception of local services and the participation in community initiatives, are associated to users not necessarily expert on data processing nor the topic. They expect to **occasionally explore the requested data sources to find pieces of evidences** of phenomena, trends, specific factors affecting their own activities.

Information needs covered by lists of local resources, context profiles, projects files, report of past initiatives are associated with users that are expert on the topic of data sources, but not necessarily with strong technical expertise. In these cases, they expect to **build over time a comprehensive map of all the available**

information for one-time decisions about, for instance, future housing projects, local partnerships to set up, the feasibility of a new entrepreneurial initiative.

The fourth pattern is defined by the information needs associated to the evaluation of the performances and results of local services and projects, or to the assessment of changes over time, such as the impact of social care services, the security and safety risks in the city and trends in water consumption. In this case, users with mixed level of expertise about data manipulation and on the topic expect to use the data for **performing ad-hoc analysis, making sense of local phenomena, but also simple explorations and evidence seeking.**

By looking at the set of stories build on each of the five themes, the collected information needs outline specific constraints in the production and use of city data inherent to each theme.

In the Community Well-Being scenarios, data are required to facilitate the understanding of the context by complementing statistics with local insights based on direct lived experiences. The major challenge here is the lack of the appropriate data to set up new community initiatives, to improve local services or to address issues and problems of residents because official data do not reflect significant aspects of the community life.

In the Urban Development scenarios, data are instruments for coordinating service provision, planning and housing projects, interests and complementary business needs. The challenge, in this case, is harmonising heterogeneous data collected by different actors for different purposes to enable the coordination of these different local actions.

In the Mobility scenarios, data are mainly used for discovery by monitoring local infrastructures, optimising the use of facilities and resources, and setting new data-supported business initiatives on transportation. The challenge, in this case, is that the data collection on mobility phenomena requires a structured and systemic effort of multiple organisations to produce the required data, while their link to systemic actions remains weak.

In the Economic Growth scenarios, data are needed to support analyses of the business environment to identify new opportunities. The challenge, in this case, is the governance of the data sharing process because of the investments for data collection and the competitive advantages related to the exclusive access to data.

In the Sustainability scenarios, data are intended to foster behavioural, organisational and social change at the individual, institutional and community level. The challenge is triggering and keeping track of the on-going changes.

Interestingly, **these use patterns for the data sources (both at the level of the single information needs or at the higher level of general themes for local actions) pointed out how the information needs and the challenges in the production and use of city data actually unite different type of organisations and stakeholders, while with divergent goals.**

The analysis and interpretation of the intended uses of data considered as actionable by the workshop participants indicate the **priority of the type of task to be performed over the type of data to be used in the expected forms of support provided by technology.**

Considering the different levels of expertise on the topic or data technologies, the users' profiles appear to be very diversified. Similarly, the data-related activities to be performed at the individual level and because of the organisational goals can significantly vary for each user over time and for each local action. However, regardless the specificity of their profiles or activities, the users' priority remains **to identify a strategy (in terms of data sources, tools and techniques) to accomplish their data-related tasks** or, in other words, operationalise the fulfilment of their information needs.

Despite the wide range of data-related activities (e.g. planning, decision making, resource management), users' tasks can be divided into four macro-clusters:

a) exploration of data,
b) identification of one specific piece of evidence in data,
c) elaboration, mapping and aggregation of information,
d) data analysis relying on raw data.

Thus, forms of technology support centred on the common users' tasks could embrace the needs of a plurality of activities.

Besides tasks recurring across different data-related activities, each domain of city actions (e.g. services provision, urban development, mobility) also presents specific patterns of activities and consequently requires specific combinations of forms of support to the users' tasks. Therefore, the definition of the forms of support could be grounded on identifying the patterns of activities and tasks in common within each domain of city action.

Looking specifically at City Data portals, **the problem of the underuse of data is a problem of shifting the focus of the technology support from the acquisition of data sources to the identification of the correct operational path to manipulate data for the users' goals, accordingly to their expertise and to the domain in which they work.**

9.4.2.f From the analysis of the applicative scenarios toward the City Data Open Portal

The findings and insights coming from the in-depth analysis of the applicative scenarios developed in this second part of the study focused on the present and current information needs and data-related processes in cities. Looking at the principles (and not at the particular) in the examined dynamics, this exploratory study allowed to identify a **structural misalignment between the production of city open data and their potential use in local actions**. This misalignment involves:

- **competencies and capacities** of the various local actors within the Open Data Ecosystem
- the mismatch between **information needs** associated with local activities and data currently released as city Open Data
- the **capabilities of city data technologies** to support different profiles of users, with different levels of expertise and operating in different domains.

Building on this knowledge (as well as on the results of the analysis of the data practices presented in the previous section), the third part of the study had been projected toward the future with the definition of three design concepts and prototypes proposing alternative and progressive solutions for web-based city data technologies aimed at supporting city stakeholders in data-related local actions.

9.5 FROM NEW DESIGN METAPHORS TO NEW POLICIES FOR THE COLLABORATIVE PRODUCTION AND MANAGEMENT OF CITY DATA

The third phase of the design and research process for this case study concerned the elaboration of the inputs gathered from the historical analysis and the investigation of the current links between data and local actions into **three design concepts to rethink the logic and model of data portals for cities**. The node between the exploration of the intervention space in the previous two phases and the generative phase of design and prototyping is constituted by the formulation of **new design metaphors for data portals**. On the basis of these new metaphors, collaborating with the other permanent or temporary members of the units following this research initiative, I worked on the definition of:

- the model of the platform architecture for a **Contested Collective Intelligence System (CCSI)**
- the prototype of a **Question-Based Information Needs Aggregator (QBINA)**
- the concept and structure of the **City Data Plan** as technology-supported data governance policy **(CPD).**

Because of contingent reasons, the initial hypothesis of working on specific alternative solutions for the data portal of Milton Keynes (MK:Insight:X) had been suspended. However, this situation provided the opportunity of **focusing the effort on the definition of solutions that could be applicable and replicable also in other contexts**, without remaining too anchored to the constraints and specificity of the current MK:Insight data portal and the city of Milton Keynes. Indeed, as explained in section 9.2 and 9.4, the issues affecting the data portal of Milton Keynes are actually widespread issues regardless the specific city, country, or authority in charge of the data portal. Moreover, the analysis reported in section 9.4 was already oriented to extract general principles that are not strictly context-dependent and could serve the definition of a class of technologies instead than a single tool.

Against this background, and the choice of adopting evolutive approaches [see section 9.3.3.1], **the three proposals can be seen as a set of progressive steps or as alternative options toward a systemic change of data-related processes at the city level** implying:

- the connection of new technology modules to existing portals (limited technology effort, easy replicability, but also soft integration in current data practises)
- the development of new prototypes to start restructuring data production and use based on the information needs (balanced effort between technology and practices)
- the definition of data practices policies through the adaptation of existing technologies and existing policy tools to new purposes.

Testing these design concepts and prototypes with potential end-users representing different segments of city stakeholders had not been possible without the framing of a funded project. However, relying on the extensive amount of information and evidence clearly depicting the constraints to be considered case by case and the profiles of a wide range of applicative scenarios, the three design concepts undertook an interactive process of evaluation based on the consistency assessment between requirements and solutions that is common in the domain of Information Systems, especially for the evaluation of design concepts [ref. ref ref ref ref].

In the following sections, I present the **design metaphors** that guided this third phase and some key elements and principles of the **three design concepts aimed at building a City Data Open Portal in a modular or progressive way.**

9.5.1 RETHINKING THE DESIGN METAPHORS OF DATA AND DATA PORTALS

The implications of the insights and findings coming from the activities in the first two phases of the study led to reframing and analysing the problem of the underuse of Open Data considering the actors in the city data ecosystem, the context of the city and the role of technology. This new reframing of the problem shifts the focus of the problem itself:

- **From accessing data to identifying organisations and people that can provide knowledge for making effective use of data**

- **From fostering the use of available data sources to organising the production of data reflecting shared information needs in city activities**

- **From supporting the acquisition of data to infrastructuring data-related activities by focusing on the common patterns of users' tasks in different domains.**

Three new couple of design metaphors had been defined building on the distinction between data and data portals as two entities respectively representing contents and containers of an interactive system aimed to support users' interactions with data (considering users as part of groups, organisations and networks in the City data Ecosystem). Following the list of new metaphors contraposed to the current ones).

A. ***Data-as-a-process*** instead than data as static resource
B. ***Data portal as Data Ecosystem navigation support*** instead than being the data producer portal

The findings concerning the availability of data for enabling city stakeholders to act pointed out that information needs are often shared, data require integration and additions to be reused and fit into new activities and applicative scenarios. The concept of ***data collection infrastructure*** addresses the transversal issues of data collection by **supporting the aggregation of shared information needs and complementary capabilities for generating *common data* integrated in city practices**.

The concept of *data ecosystem navigation* emerges from the need for supporting the identification of actors and sources to foster the exchange of practices around the use of data. The findings concerning the relationship among city stakeholders mediated by data highlighted the value of representing their data-related actions under the light of the actors' motivations, profiles and roles in an environment where the generation of data is the output of a synergistic local information ecosystem.

C. ***Data-as-a service*** instead than data as product
D. ***Data Portal as a Needs Aggregator***, instead than data portal as catalogue of resources disconnected from needs

The concept of *data-as-a-service* leads to represent a service built by balancing users' requests, capabilities of data and characteristics of the overall process from data collection to the use of data. Our findings highlighted that actionable data should not be considered as predefined objects, because their nature is being dynamically interweaved with the purposes, tasks and goals of users at individual and organisational level.

E. ***Data as-a document*** instead than data as evidence
F. ***Data Portal as a Dialogue environment*** instead than data portal as a marketplace

These two last metaphors envisage the support to the operationalisation of the local knowledge of actors than not necessarily produce data, but have the knowledge to make sense of them and provide elements of the real context to which data are associated or the impact they had in specific applicative scenarios.

Building on the new metaphors, a set of general design guidelines had been defined to orient the development of future design concepts in relation to:

- the problem of overcoming the uncertainties in the communication among users, and the metaphors of Data-as-Documents and Portal as Data-Centred Dialogue Environment [Table 9.6]
- the problem of supporting the production of appropriate data for their use by city stakeholders, and the metaphors of Data-as-Process and Portal as Data Needs Aggregator [Table 9.7]
- the problem of supporting the use and reuse of existing data, and the metaphors of Data-as-Service and Portal as Data Ecosystem Navigation Support [Table 9.8]

Table 9.6 Design recommendations Data-as-Documents and Portal as Data-Centred Dialogue Environment

DESIGN OBJECT	METAPHOR	USERS	RECCOMENDATIONS
DATA	**Data-as-Documents**	Individual	*Structuring informal vs opening formal interactions.* Providing feedback mechanisms to build a traceable dialogue between data consumers and data providers, and among data users, which is orthogonal to formal and informal modalities of social interactions of city stakeholders [focus on the users of the portal]
		Organisation	
		Stakeholder	
PORTAL	**Portal as Data-Centred Dialogue Environment**	Individual	
		Organisation	
		Class of stakeholder	

Table 9.7 Design recommendations Data-as-Service and Portal as Data Needs Aggregator

DESIGN OBJECT	METAPHOR	USER LAYER	RECCOMENDATIONS
DATA	**Data-as-Service**	Individual	*Support modulated on task.* Providing modalities of interaction with data modulated on the users' tasks (elaboration, analysis, exploration, evidence seeking) instead of the type of data [Focus on content & object of action]
		Individual/Organisation	*Purpose before data.* Defining the features of data (type, nature, volume, spatial, temporal properties) on the basis of purposes and constraints of its applicative scenario [Focus on content & object of action]
		Organisation	*Data provision linked to users' decisions.* Setting the provision of data-related services according to the type of users' decisions (planning, resource management, policy) to be supported [Focus on content & object of action]
PORTAL	**Portal as Data Needs Aggregator**	Organisation	*Domain-aware data collection.* Setting the specifications for data collection according to the thematic clusters of the applicative scenarios of data [Focus on the role of technology]
		Class of stakeholder	*Aggregating data needs.* Supporting the mutual awareness among city stakeholders about shared information needs that could be scaffolded [focus on the role of technology]

Table 9.8 Design recommendations Data-as-Process and Portal as Data Ecosystem Navigation Support

DESIGN OBJECT	METAPHOR	USER LAYER	RECCOMENDATIONS
DATA	**Data-as-Process**	Individual	*Data as multi-facet entities.* Characterising data as modular entities to *infrastructure* an incremental or periodical data collection optimising the potential reuse of existing data, the generation of complementary data and the transformation of data sources trough integration and recombination [Focus on the role of technology]
		Organisation	*Data ownership as relation.* Combining the layers of data ownership (concentrated, fragmented or distributed) with the thematic silos related to data use for building significant sources composing complementary datasets within the local information ecosystem [Focus on the users of the portal]
PORTAL	**Portal as Data Ecosystem Navigation Support**	Organisation	*Representing identities and roles.* Allowing the discovery and navigation of data users and data providers in the portal under the lights of their organisational identity, mission and motivation, their profile (structure, capacities and competencies), and their roles in the process from data generation to use [Focus on the users of the portal]
		Organisation /Stakeholder	
		Class of Stakeholder	

9.5.2 DATA OPEN PORTAL AS COLLECTIVE INTELLIGENCE PLATFORMS (CCSI)

The first design concept for building a City Data Open Portal had been oriented to define a Collective Intelligence Systems. The design research focused on defining the architecture model for the system and instantiating the metaphors introduced in the previous section. In particular the ones of *"Data-as-Documents"* and "*Data Portal as Data-Centred Dialogue Environment"* looking at clusters of user groups that can be framed altogether to benefit from mutual exchange and complementarities in data operations.

The choice of exploring the possibility to readapt and reuse solutions of Collective Intelligence Systems for the design of an Open Portal had been motivated by a substantial overlapping between the aims of Collective Intelligence solutions and the goal of supporting collaborative practices through Data Portals.

The connection between Open Data, E-government technologies and collective intelligence aims is not new. Several authors and institutions mentioned that harvesting knowledge in online and offline communities and supporting collective intelligence processes through the access and use of data are desired outcomes of Open Data initiatives [e.g. Pitt et al. 2013, Larrauri & Davies 2014, Iaione 2016, Danaher et al. 2017, Saunders et al. 2017, Hengl et al. 2018]. With a more radical approach, the concept of CCSI wants to foster the use and readaptation of the principles of *collective intelligence* solutions for improving the forms of technology support to this kind of processes through Open portals. Thus, **assuming collective intelligence principles as starting point for the design of these systems and not just as potential outcome**.

The interpretation of what collective intelligence is and how it should be supported varies enormously in literature, especially in the field of design of information systems. Indeed, the widely accepted definition of collective intelligence formulated by Malone et al. [2009] is *"groups of individuals doing things collectively that seem intelligent"*. This definition refers to the idea that groups can express higher capabilities of information processing and problem solving than individuals. In the last years, web-based technologies are increasingly seen as facilitators of these tasks, thanks to the support to multiple groups, distributed groups, large and small groups interacting through several communication channels [Hintikka 2008, Luo et al. 2009]. Nevertheless, the contribution of HCI research to collective intelligence systems remained focused on individual users (their interactions with the system and other users to execute their own tasks in crowdsourcing environments) instead than investigating how to facilitate the extraction of meaning and value from collective activities [Karydis et al. 2016].

From the perspective of HCI, the applications of collective intelligence systems can be divided into three main branches: directed, passive and collaborative crowdsourcing [Bigham et al. 2015]. HCI research is mainly focused on *directed crowdsourcing systems*, in which large groups of people are called to undertake a certain task for helping in accomplishing a goal set by the system owner. In *passive crowdsourcing systems*, crowds or collectivity are not necessarily actively involved in some task, because the focus is on mining collective behavioural patterns from the collected information. Alternatively, *collaborative crowdsourcing systems* are aimed to support groups in self-determining their activities, organisation and objectives. Consistently with the framing of a City Data Open Portals as common data hubs and shared space for the collaboration among multiple stakeholders, the developed **concept focused on collaborative crowdsourcing systems, as the segment of collective intelligence technologies explicitly aimed at supporting direct interactions and knowledge exchange among users and groups of users**.

In reference to collaborative crowdsourcing and proactive collaborative processes, collective intelligence researches place an emphasis on the **commonality of goals pursued by a collectivity and the importance of building and maintaining consensus and engagement on these goals within groups and organisations** [Convertino et al. 2010, Chamberlain et al. 2012, Theiner 2014, Castillo Rosas et al. 2015]. However, there is a growing awareness on the practical issues concerning the implementation of collaborative collective intelligence processes (such as socio-cultural barriers, trust and communication problems, potential misconducts, see Filimon 2008 for a detailed overview). To this regard, the critical difference between directed crowdsourcing systems and collaborative systems is on the possibility of accommodating a plurality of perspectives, supporting users in understanding distinctions, conflicts, changes in their groups and activities [Eden & Chen 2007].

This difference is essential for building information systems that could mediate the relationships between public institutions, businesses and non-profit organisations, such as in a City Data Ecosystem. Then, especially at the city scale, it is evident how different stakeholders pursue different organisational goals in relation to city data, relying on different understandings and priorities regarding local activities associated with data and the expected technological support in these operations.

Collective intelligence paradigms do not have a specific geographical or spatial connotation [Hecht & Terven 2017], and the city environment is considered just as one of the scales for the organisation of collective intelligence processes [Atlee 2008]. However, the concepts of *Civic Intelligence* [Schuler 2009] and *Collective Intelligence for the Common Good* [Shuler et al. 2018] are emerging as a specific type of collective intelligence looking at the role of public institutions, non-profit sectors and private as organisations called to collaborate for addressing local and global challenges. Indeed, they are forms of collective intelligence *"aimed at generating societal good; improving civic engagement; enabling democratic decision making and deliberation; and producing, collectively built and owned, transformative solutions to complex societal challenges"* [Schuler et al. 2015]. Thus, they constitute an important reference also for rethinking how City Data technologies could support these types of dynamics having clear political, economic, and social characterisation [Peters & Heraud 2015].

Navigating in this technological landscape, the development of the design adopted the *Contested Collective Intelligence* framework (CCIF) as logic infrastructure for outlining the architecture model of a City Data Open Portal conceived as Dialogue environment. The CCIF keeps its focus on the proactive collaboration in groups and organisations looking at collaborative crowdsourcing systems, and at the same time, it generalises the concept of civic intelligence to settings where there is a plurality of goals and a multiplicity of coalitions united by common goals, coexisting with others at the same time and in the same virtual and real space [De Liddo et al. 2012].

The distinctive aspect of the CCIF is being aimed at generating pluralistic arenas by enabling the construction of concurrent narratives and interpretations of the same phenomena, objects, facts, documents. In this setting, technology cover the role of mediating and structuring these different instances, making them legible at a collective level. The core of this framework is grounded on recognising the intrinsic value of a *"contested knowledge"*, intended as a knowledge that can result ambiguous or open to multiple interpretation by different organisations characterised by distinct socio-cultural profiles and driven by different goals. Indeed, complex problems can be collective addressed only by taking into account these different perspectives to build a holistic understanding of problems and potential solutions for the involved actors.

The CCIF had been originally developed to inform the design of web applications supporting collaborative learning [De Liddo & Buckingham Shum 2010], community-based decision-making processes [De Liddo & Buckingham Shum 2013], public debates [Iandoli et al. 2012, Plüss & De Liddo 2015, Ullmann et al. 2019], and collective awareness on socially relevant topics [Piccolo et al. 2014]. A few transversal elements in these applications are the centrality of sense-making processes, individual and collective learning assumed as primary goals for users, and discursive practices as a way to bring out different positions and perspectives.

The concept of City Data Open Portal as multistakeholder, multi-purpose and multi-scale web-based technology is a new potential application of the CCIF. In this case, the challenge is understanding how to create the conditions for triggering collective sense-making processes concerning data in themselves and the use of data in the city data ecosystem by specific classes of stakeholders. Indeed, as seen in section 9.4, looking at city data portal, learning goals are anyway secondary respect to operational goals related to the professional and organisational activities of users. Lastly, the system of relationships among public, private and non-profit organisations is strongly influenced by structural and practical constraints related to their roles in society and at a local level, impacting on the forms of discursive practises that could be supported through technology in a shared online public space (even though we temporary silenced them during the research activities).

The architecture of a Collective Intelligence System based on the CCIF is structured in four interdependent functional layers defining components, characteristics and scope of contested collective intelligence platforms, and in this case of the Open Portal. These four layers correspond also to a sequence of steps for operationalising collective intelligence processes by combining:

- *documents*, broadly intended as knowledge sources stratified over time
- *machine-annotation* of documents, including pre-processing and automatic annotation and organisation of information, to classifie and segment them
- *human annota*tion of documents, to validate and enrich the machine annotation, and in this case sharing detil about the experiences of use of data
- *visual artifacts connecting documents and annotations* in relation to specific goals, stakeholders, themes, and other significant aggregations for the use of documents.

[Section to be completed with the schema of the CCIS architecture for the Open Portal].

9.5.3 DATA OPEN PORTAL AS LOCAL INFORMATION NEEDS AGGREGATORS (QBINA)

The second design concept for building a City Data Open Portal had been oriented to define a technological module to be integrated or associated in parallel to existing data portal as alternative entry-point for data resources, but most important for collecting the request for the production of new data. In this strand, the design research focused on building a first mockup and functioning prototype instantiating the metaphors of "*Data-as-service*" and *"Data Portal as needs aggregator"*.

Initially, the analysis of the data practices of the MKiO Team highlighted how the datasets published through the MKIO portal were a response to needs emerging from city stakeholders [see Section 9.4.1]. The design concept QBINA incorporated this input by placing the idea the "data needs" at the core of the data portal, expressed as questions that local stakeholders try to address through the use of city data in their local actions. As a result, QBINA had an interface connecting data users and producers, by collecting, clustering and analysing the emerging questions from potential users.

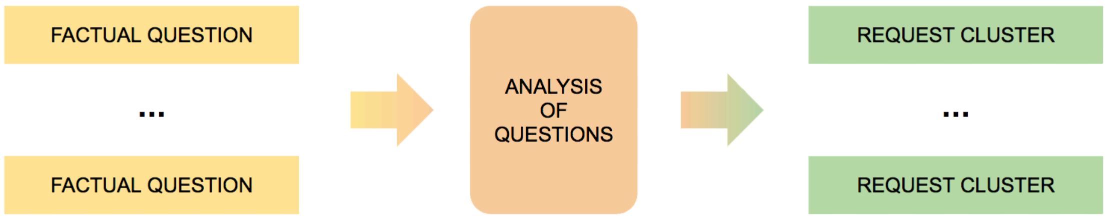


Fig. 9.17 Factual questions concerning the data needs of local actors are collected and analysed through QBINA, the analysis generates request clusters

From the perspective of data producers, the collection of requests for new data (or their elaboration) providing real applicative cases showcasing the potential value and insights needed to justify and guide the creation of new datasets. This kind of tools could also help in the optimisation of data producers and improving data-related services. The optimisation of resources and grounding on real cases is particularly critical for local authorities which are, on the one hand, compelled by law to data transparency but, on the other hand, required to justify their choices in terms of cost of production of data resources. QBINA could also benefit non-institutional organisations not directly involved in data services. Indeed, QBINA collection of questions could be used to by local organisations to develop new data-related services as complement of their core activities, in particular as regarding the evaluation of the impact of data.

QBINA main interface was a text-based input system. The user is asked to describe their scenario, and what they need to know and why. On the background, an AI is used to analyse real-time and highlight keywords on the text, such as places, temporal intervals and demographic features. The text analysis is then used to build a map-based visualisation of the requested providing visual cues about its underlying implications and therefore supporting the refinement of the request. The combination of free text-based input system and AI-based visualisation support generate informative request clustered by requiring a common view of the city.

*Fig.9.18. Mockup of a QBINA instantiation for the Milton Keynes open data portal *screenshot to be replaced*

The formulation of questions is a key factor in QBINA design. The interface provide guides the user to formulate factual questions, i.e. what, when, where, who, and to focus on what they need to know rather on what they expect to get in terms of datasets. Indeed, the analysis of the Intelligence Team practices highlighted that not why or how questions but factual questions were the boundary object connecting the work of analysts creating datasets and the activities of local organisations to be informed, enabled and supported by data.

As model of open portal potentially used by multiple stakeholders at the same time, QBINA design tried to addresses the critical limit of topic-based categorisations. Indeed, the analysis of the MKiO practices and the workshop outputs highlighted that the sector of a local activity (usually corresponding to a topic in data portal) is actually not representative of the type of data required by organisations operating in that specific sector. For instance, education services do not require education data. To this regard, QBINA text analysis enabled the clustering of requests by a common view of the city encoded in datasets, highlighting new unexpected synergies between local actors.

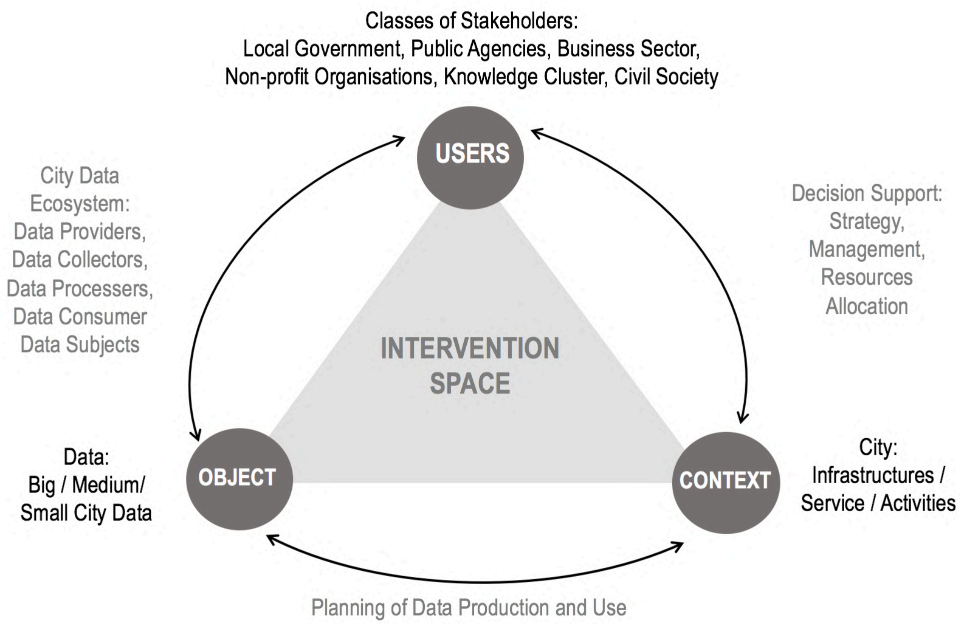
9.5.4 DATA OPEN PORTAL AS A POLICY IMPLEMENTATION TOOL (CPD)

The third design concept for building a City Data Open Portal addresses at a systemic level part of the issues identified along the research process, in particular the one related to the tension between expectations and conflicts, advantages and risks, effort and social and economic benefits coming from the wide access and use of city data by all city stakeholders. As a systemic proposal, this concept results from the combination of a policy tools outlining basic mechanisms for the governance of the processes of data production and use on one side, the City Data Plan, and a technology platform to support these processes. Consistently with a reuse-oriented and incremental approach, the "duo" policy tool-support tools admit multiple levels of implementation, even corresponding to a zero-threshold, or rather full reuse of existing tools (e.g. add-on to existing plans and readaptation of platforms already in use). In this strand, the design research had been inspired primarily by the metaphors of *"Data-as-process"* and *"Data Portal as Data Ecosystem Navigation support"*.

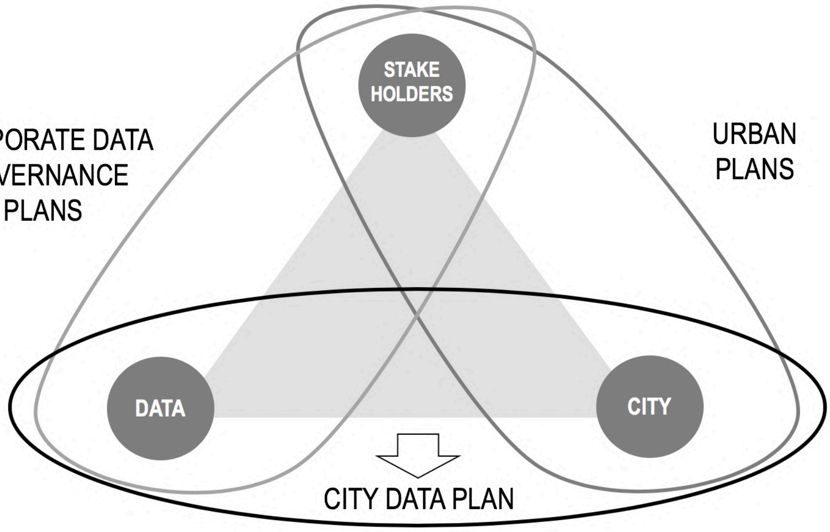
9.5.4.a From Urban Plans and Data Governance Plans to the City Data Plan

The concept of the City Data Plan had been drafted by integrating the analysis of the logics and measures of two types of solutions, specifically **policy instruments, that address problems with structure and constraints comparable with the governance of city data**. The definition of new design solutions to new problems is indeed often based on studying and repurposing solutions that proved to be effective in addressing similar problems. In this case, the identified policy instruments with these characteristics are urban plans and corporate data governance plans. **Urban plans** are traditionally meant to regulate the different interests of local stakeholders in the access and use of urban resources in order to orient an economic, environmental and socially sustainable development at the city level. Data produced in urban environments or associated with city services are nowadays essential resources for city activities, but their management is not yet incorporated in urban planning operations because city data are not yet framed as city assets, exactly as every other urban resource). On the other side, **corporate data governance plans** are well-established policy instruments for addressing all the common issues and concerns associated with the management of data in the closed setting of one organisation. However, corporate governance plans are usually limited to a small set of stakeholders on a limited set of operations. Differently, in the city context, the number of stakeholders and the operations they can perform on data are unbounded and the negotiation of the goal and vision of the city is central.

As regarding the three focal points of the design intervention space, it is possible to highlight that urban plans are the results of the interactions between Users and Context, local stakeholders and urban services or infrastructures. Corporate data governance plans are focused instead on the relationship between Object and Users, or rather data and stakeholders [see Fig. 9.19]. These two policy instruments cover therefore complementary functions in outlining a solution aimed to bridge Object and Context, city data and local actions, by taking into accounts the needs, capacities and expectations of local stakeholders [see Fig. 9.20].



9.19 Framing of the problem of the city data governance



9.20 Rationale for conceptualising the City Data

The critical **needs addressed by a City Data Plan**, similarly to enterprise data governance plans, are:

a) **containing the public and private extra-costs due to a disorganized management** of data resources in the city that lead to the replication of data collection efforts, obsolescence of data, fragmentation of information about essential services
b) **overcoming rigid organisational and technological systems** that prevent codified cooperation mechanisms to optimize human and infrastructural resources in the production and exploitation of data (on complementary domains or areas, or at different spatial and temporal granularities), without forcing difficult operational changes within each organisation
c) **enabling data producers and users to plan their data-driven activities** having a big picture of the available data and the remaining to be produced accordingly to emerging needs.

The most important aspect of urban plans to inform the conceptualisation of a City Data Plan is **outlining a specific horizon for the development of the city** and a set of desired targets to reach in a defined temporal frame. As regarding data, this scope is translated in projecting a future state for the data governance by specifying the **targets concerning transfer and balancing of competencies and responsibilities among local stakeholders for the production and use of different types of data**. Outlining vision and targets in association with a normative tool allows all the organisations operating in the city to clearly understand how they can contribute to the implementation of data-enhanced city development, knowing rights and duties linked to the participation in that operations through a shared data governance. In other words, outlining the common framework of reference.

Following, I am going to briefly schematise the key aspects characterising these two policy tools in parallel with their reinterpretation, extension, and resemanticisation in the development of the concept of City Data Plan [see Table 9.9 and Table 9.10].

Table 9.9 Overview of the key aspects of corporate data governance plans informing the conceptualisation of the City Data Plan

	Corporate Data Governance Plan	City Data Plan
Goal	Design of the relationship between people, technologies and processes related to data	
Focus	IT assets ≠ stakeholders' interests	Ownership of smart technologies ≠ ownership or rights on data
Needs	(a) increasing revenues (b) containing costs (c) reducing risks (d) improve communication	(a) increasing value of data (b) containing data mismanagement extra-costs (c) overcoming organisational barriers (d) enabling coordinated data-centred actions
Organisational bodies	Internal teams and coordination units with external stakeholders	(1) multi-stakeholder advisor board (2) cross-sectorial multi-team of domain experts and data experts (3) coordination team (4) emergency response team
Organisational goals	Formal goals: Business oriented Functional goals: Operational	Formal goals: political 3 level of Functional goals: • Within single organisations • Among interdependent organisations • Among organisation operating in the same domain or area
Decision-making power	Position of power: centralised or decentralised Relationships in decision making: hierarchical or cooperative	Decentralised and cooperative at the urban level Flexibility on organisational arrangements (centralised or decentralised, hierarchical or cooperative)
Responsibility assignment	Roles of individuals: • Accountable for decisions • Responsible for action • Consulted for inputs • Informed of decisions	Roles appointed to organisations Internally distributed to individuals
Themes of decision	Uses of data Quality of data Metadata Access requirements of data Data lifecycle	Plurality of uses of data Relevance of data Appropriateness of data Legibility of data Licensing Transformability and reuse
Focus of decision protocols	Data quality Privacy protection Security Normative compliance Interoperability Integrability	In addition: Rules of engagement at urban and inter-organisational level Conflict-resolution procedures
Technologies	Technologies monitoring the data management processes Technologies supporting spatial and temporal coordination of the involved stakeholders	

Table 9.10. Overview of the key aspects of urban plans informing the conceptualisation of the City Data Plan

	Urban Plans	**City Data Plan**
Goal	Regulating the access and exploitation of urban resources taking into account public and private interests in the transformation of the built environment	Regulating the access and exploitation of city data as a new layer of urban resources linked to the generation of value in the city
Scope	Outlining a vision for the development of the city by setting a set of desired targets to reach in a defined temporal frame	Realigning smart city visions and the output/outcome of data produced by smart city technologies
Nature	Municipal law (EU) or local policy (UK)	Policy instrument
Key resource	Land (organisations as means for the valorisation of local resources)	Organisations (data as means for enhancing the full potential of local services and social capital)
Risk assessment	Extra-load of existing infrastructures and built areas	Extra-workload of organisation involved in the city data ecosystem
Classification schema	Land use classification • Commercial (high profitability and fast transformation) • Residential (slow transformation, high value for residents) • Industrial • Services • Green areas • Etc.	Classification of engagement /effort by type of data produced: • Big data: high profitability, highly skilled workforce, investments in dedicated infrastructures • Medium data: service-oriented, skilled workforce, dedicated soft infrastructures • Small data: high utility but low profitability, no dedicated infrastructures
Decisions framework	Multi-level temporally distributed	
Competence	Public administration: • Initiator • Management • Monitoring • Evaluation	• Initiator: public or private entities having public relevance • Management, Monitoring, Evaluation: extended to other actors in the city data ecosystem
Implementation mechanisms	• Compensatory mechanisms and incentives • Monetary and non-monetary disincentives • Land Rights Transfer	• Compensatory mechanisms and incentives to produce socially relevant data • Monetary and non-monetary disincentives of data replication efforts • Rights Transfer to support cooperation in the data production and use
Preliminary operations to implement the Plan	• Primary infrastructures • Secondary infrastructures	• Information needs aggregation, training, dissemination • Restricted or reserved control of sensitive data production and use
Components	Descriptive documents and visual models (analogical or digital)	Integrated representation of policies and visual model of the real-time status of city data availability, planned operations, uncovered areas (supported by digital technologies)

The key aspects characterising the concept of the City Data Plan (CPD) as a policy instrument for the governance of city data supported by a City Data Open portal can be briefly presented in the two following clusters:

- Preparation and management of the CDP
- Contents of the CDP

9.5.4.b Preparation and management of the City Data Plan

The preparation and management of a City Data Plan require first of all the design of the institutions to get local stakeholders collaborating in the governance of city data, especially within smart city programmes. The CDP concept includes the four institutions, built on the ones proposed by Kitchin [2014] for the data governance in the cities of Ireland, but deeply revised to avoid the centralization and the monopolization of the Local Government [see Lupi 2019 for the full comparison]. Following, the institutions associated to the CDP are described here under the responsibility assignment schema taken from corporate data governance plans.

The **advisory board** is led by the local authorities and composed of representatives of all local stakeholders interested to be recognised as part of the city data ecosystem. The advisors represent local organisations involved in smart city programmes in different roles, not only as data providers or data users, to participate and monitor the choices concerning city data governance arrangements. The composition of the advisory board varies over time, according to evolving needs and opportunities given by on-going projects and initiatives. The functions of the advisory board are establishing priorities and politically orienting the definition of targets and objectives to align the management of city data to the vision and development goals of the city. While the advisory board establishes the shared rules and principles for the city data governance and it is considered accountable for their implementation, this institution does not have operational functions. However, it is intended for the board to be consulted on major decisions requiring multi-stakeholder negotiations, but not on daily operations or intra-organisations data-related activities.

The **teams of domain experts and data experts** are constituted by urban area or sector of activity, and considered as distributed units affiliated with and representing the different stakeholders in that area or sector. They are responsible for surveying local information needs, available data sources, on-going data-related initiatives, and therefore for the implementation of the City Data Plan as a strategy to achieve specific formal goals for the development of the city through a cooperative governance of city data. At an operational level, each team is independent in establishing the functional goals to orient data operations among organisations that are interdependent in the processes of data generation, processing, use, or working in the same area. The members of each team, affiliated with the local organisations involved in the implementation of the CDP, independently work within their organisation aware of the common operational framework.

The coordination team can be established within a specific organisation (e.g., local government) or as a mixed group from different organisations (e.g., local government, university, foundations). The key function of the coordination team is supporting communication and enabling cooperative practices across the distributed units of domain and data experts. In particular, the coordination team has the responsibility to get the distributed teams consulted and informed in the cases the activities of other groups could impact on the established targets and agreements for a specific area, in compliance with the protocols decided by the Advisory board. On the other side, the coordination team is consulted and informed by the Advisory board in case of updates to the plan or preparation of sectorial subplan. The distributed team can consult and inform the coordination team about procedural conflicts to be addressed.

A unit of the coordination team, or a distinct dedicated group of data experts, is responsible for coordinating the emergency response across different organisations in the most severe crisis threatening city data resources, and addressing in a centralised way specific risks and issues related to data of public interest. The emergency team works in collaboration with the coordination team, by consulting specific distributed team when necessary, and informing the advisory board on the emergency response strategy.

All these institutions are intended as **light-weight governance structures**, with a marginal impact on the workload of the organisations involved in the implementation of the City Data Plan and not requiring any restructuring of their internal workflows. The aim of these institutions is maximising the benefits coming from the availability of city data among local organisations, and minimising data duplication efforts, extra-costs related to the mismanagement and low accessibility of data resources at the urban level, risks of malevolent uses of city data by local actors.

9.5.4.c Contents of the City Data Plan

The contents of the City Data Plan consist of a set of **dynamic map-based visualisations to support independent decisions of local organisations concerning their involvement in the process of generation and use of city data and the level of cooperation with other actors active in the same area or domain**.

- The mapping of local organisations indicates their roles and levels of engagement in the city data ecosystem.
-
- The mapping of available data indicates the existing data sources covering each area of the city at various scales (e.g., metropolitan area, district, neighbourhood, building block) and on different domains (e.g., mobility, energy, community, urban development, business). These data sources include big, medium, and small data available under the conditions established by each organisation (e.g., free access, fees payment, data exchange) within the rules of the CDP. Updates on the available data sources can be independently shared on the map-based system by each organisation.

- The mapping of information needs and targets by area and domain consist of the list of data (small, medium, big) to be produced in the short, medium and long term, as part of the general CDP or sectorial sub-plans. The survey of the information needs of local organisations can be initiated in the preparatory phase of the City Data Plan (as part of the “primary infrastructuring activities”) and then dynamically updated over time. The targets actively supported by the institutions contributing to the CDP are established by the advisory board in relation to the development goals of the city, and then detailed by the operational units. The description of information needs and targets is complemented by the list of incentives, disincentives, and data transfer mechanisms oriented to facilitate and support their fulfilment.

- The mapping of on-going data generation processes and applications of city data currently in use includes the list of actors participating in the process (by domain, area and scale) and the “rules of engagement” for third parties interested in entering in the process, reusing the produced resources, extending the data sources to other domains, areas, or scale of intervention.

- The mapping of archived data sources by owner, area and domain works as the index of inactive data resources, not in use, but potentially required for future uses. They can include, for instance, reports, projects, surveys, datasets not updated anymore.

Widespread tools such as Web-GIS integrated with crowdsourcing functionalities (nowadays frequently integrated into participatory urban planning practices) can already provide the technological support to the construction, use and updates of the map-based information representing the City Data Plan, as alternative to the parallel building of a City Data Open Portal.

Besides the multi-level mapping of data resources in the city supported by technological tools, the contents of the CDP include policy documents containing:

- The list of principles and operational recommendations to separate IT governance from data governance in the agreements between data providers and data users, as well as between owners of IT resources and data services providers
- The criteria to benefit of the public or private incentives for the production of data meeting local information needs and city targets
- The criteria activating the enforcement of disincentive mechanisms and the list of limitations associated with the misuse of city data concerning the access to the CDP resources
- The conditions regulating data rights transfer of data of public interests, and the recommendations for equitable data exchange among different stakeholders in the city data ecosystem covering the roles of data subjects, data collectors, data processors, data users on one side, and the role of data providers on the other side
- The standardised communication protocols at an inter-organisational level among local organisations cooperating in the data generation and use in the same area or domain of activity
- The schema of competences and responsibilities of the institutions implementing the CDP, specifying the functioning of centralised decision-making processes at the city level, and the coordination mechanisms for decentralised operations at the level of single organisations
- The guidelines for conflicts resolution in data-related operations
- The code of conduct for the local organisations involved in the CDP institutions

9.5.4.d Applicative examples of the City Data Plan

The concept development for the CDP had been accompanied by the cyclical review and assessment against the requirements and pieces of evidence gathered during the research activities of this case study. During this process, a series of complex use cases for the integration of a City Data Plan in the context of Milton Keynes drawn upon the applicative scenarios discussed in section 9.4. Following, I report two of the most significant related to:

1. Support to Sustainable Mobility
2. Monitoring the Impact of Social Services Provision on Local Communities

Applicative example 1. Supporting Alternative Mobility Choices

- Context. The combination of intense regional and internal mobility flows determine that traffic congestion is one of the most urgent problems that Milton Keynes is facing. Road congestion due to daily commuting has a strong negative impact on the environment and the perceived well-being of citizens.
- City Vision. Milton Keynes as city supporting slow and alternative mobility choices to actively reduce traffic levels and improve environmental sustainability at the urban level.
- Existing IT infrastructure and data sources: Traffic sensors monitoring about 300 roundabouts in the city and over 2000 parking sensors in the city centre.
- Physical constraints. Milton Keynes has two distinct road networks. The high-way system is reserved for cars and penetrates in residential compound through low-speed local streets. The

> bicycle and pedestrian network constituted by the so-called "red ways" is extended throughout the entire city, but scarcely used by residents and internal commuters. The population density is very low, and the urban area is over 90 sq. km.

One of the ways to reduce traffic levels in Milton Keynes, at least at the neighbourhood scale, is by supporting cycle and pedestrian mobility on the red ways. However, the use of the red ways is particularly limited. To develop strategies and initiatives for incrementing their use among residents and internal commuters, the critical information that needs to be addressed concerns understanding the causes of the red ways underuse and what current uses could be incentivised and extended to more people.

Data coming from the existing traffic sensor network are not helpful to take decisions on these topics. On the other side, investments to extend the sensor infrastructure along the pedestrian paths are antieconomic because of the spatial extension of the red ways network, the low number of users concentrated in the weekends, privacy concerns raising specifically from the possibility to easily identify the red ways users (almost certainly residents in the same compound). More important, data coming from mobility sensors, while accurate and objective, do not address the information needs of local authorities interested in incentivising the use of red ways. Ad hoc surveys carried out on samples of the population are marginally helpful because of the variety of population profiles in each neighbourhood.

In this scenario, a City Data Plan provides an overview of existing data sources (such as one of the traffic sensor networks), information needs of the mobility department of the local council and other organisations interested to sustainable mobility, and targets to reach in terms of coverage and depth of the required information. A CDP makes public and legible the established goal (sustainable cycle and pedestrian mobility) associated with specific information needs. Moreover, it enables local stakeholders to assess the consistency of potential measures put in place to fill the information gaps with the established goal. In this case, it makes understandable the implications of choosing to extend the sensor network to red ways (unsustainable investment, privacy risks, unfulfillment of the declared information need) to the advisory board and the relevant teams.

On the other side, the mapping of local organisations by area and domain of activity provides the opportunity to identify what organisations are the most likely to have relevant information to understand the underuse of red ways or their current uses. These organisations include, for instance, several sport and leisure associations regularly organising events and initiatives for their members. Even though these associations are not conventionally considered data collectors or data producers, actually they are and could be engaged to effectively achieve the CDP goals. Their "data resources", prevalently small data, can includes reports and formal documentation of past events, but also other untraced information that can be easily aggregated from a limited number of key persons rather than from a survey on population sample to have reliable insights on the problem to be addressed. The rules of engagement of civil society organisations by public or privates are contained in the CDP in terms of incentives, benefits, rights.

This example highlights how the institutional design instantiated in the CDP can serve goals related to sustainable mobility by working in synergy with local communities in the production of meaningful information in the public interest, without relying only on the IT infrastructure. The cooperative governance of city data results from working across smart city silos and enhancing the social capital, by maintaining transparency on goals and adopted protocols.

Applicative example 2. Monitoring the Impact of Social Services Provision on Local Communities

- Context. Austerity measures and budgets cuts impose an attentive management of human resources in social and health service provision. On the other side, there is no decrease in the requests of assistance from areas characterised by high rates of socio-demographic vulnerability (due to poverty, unemployment, health issues).
- City Vision. Milton Keynes as a city where social and health services are planned and managed by monitoring and assessing the impact of area-based services.
- Existing data sources:
    - Local Council. Data on the provision of social services over the years.
    - National Health Service (NHS) facilities. Data on health services.
    - Office for National statistics. Census data 2011, segmented by area.
    - Public and private health professional associations (GP, pharmacists, nurses, homecare assistance). Data on the provided services.
    - Local charities. Data on assisted people and beneficiaries of their activities.
- Organisational constraints. While communication protocols are established and partially formalised between local governments and regional and national public agencies as concerning data exchange, there are no standard measures in place to cooperate with non-profit and private organisations.

Despite the availably of data from multiple sources, the assessment of the impact of social and health services is challenging. Indeed, data produced by local council, national health system, and health professional associations are focused on the nature and quantity of the provided services. These data do not include inputs on the quality of life of the assisted customers and describe different segments of the population at different granularities, often in a fragmented way. Furthermore, Milton Keynes is a fast-growing city with a high rate of turnover of the population due to internal or international migration. Therefore, the demographic projection of census data collected every 10 years do not necessarily represent a reliable information base on the current socio-demographic characteristics by area.

As also seen in the previous scenario, on-field complementary information can be aggregated through experimental data collection initiatives in cooperation with local charities and other organisations. These initiatives can help the local council or public agencies in assessing the impact of their services. However, the central difference in this case is that a plurality of public and private have similar information needs and interests in monitoring and iteratively assessing the impact of their own resource management choices on the provided services.

In this scenario, the CDP is intended as a common framework to cooperatively support iterative data collection initiatives addressing shared information needs among multiple organisations. These information needs concern the structured analysis of factors hindering or contributing to the impact of social and health services at the local scale. Consensus on goals and targets is built within the advisory board. Then, functional goals and procedural aspects of this multi-organisation partnership are defined at the level of the coordination team. The management of the periodical operation of data collection and analysis is on mixed teams of domain experts (on social and health services, or on the specific context to be analysed) and data experts (to support the standardisation of the collected data).

The specific schema of responsibilities and competences can be elaborated within a sub-plan of the CDP, as well as the patterns of incentives, disincentives and data rights transfer to facilitate the data integration.

9.5.4.e Value of the CPD concept

The City Data Plan, as presented in this section, is a design concept described in its operational aspects, and developed by using a design research approach. The intrinsic validity of the proposed concept relies on its compliance with the constraints posed in the problem framing [see section 9.5.1]. The value of the CDP concept is formalising a potential solution to address part of the issues related to the governance of city data discussed in the literature review [see Section 9.2]. The key questions driving the assessment of the value of concept included:

A. As regarding Users: is the CDP an instrument able to address the needs and requirements of local stakeholders participating in the city data ecosystem in different roles? Does the CDP take into account their different organisational constraints (e.g., mission, core activities, human resources)? Can the CDP be integrated into existing processes?
B. As regarding city data as Object of the plan: is the CDP a policy instrument able to prevent or limit the manipulation of data by technology providers and their clients? Are the measures included in the CDP potentially effective in contrasting malevolent or discriminatory uses of data at the local level?
C. As regarding the Context of use of data by local stakeholders: is the CDP not in contrast with other laws and regulations? Can the CDP provide support to different types of decisions and actions in the city driven by data?

A. *Users.* The concept of the City Data Plan extends the proposal developed by Kitchin [2014] to address the issues of data governance in smart cities by elaborating what types of measures can frame and support the independent activities of different institutional structures in charge of orienting and managing data-related operations in the city.

In this regard, the organisational bodies associated with the preparation and implementation of the City Data Plan take into account the different missions and structures of the various classes of stakeholders in the city data ecosystem. The local government is expected to facilitate the activities of the advisory board and take the lead of the coordination team by virtue of its institutional mission and the associated legitimate competences. Public agencies and knowledge cluster are considered as subject operating in the city but independent from local government in pursuing their missions within the advisory board and through the distributed operational team. Non-profit organisations and civil society groups are included in every governance structure because of their privileged position in understanding local information needs and the phenomena in the context. Local business, not limited to technology companies, are considered as potential sources and users of information, even in the cases where data experts are not part of their human resources and data management is not their core activity. In any case, every type of stakeholder is assumed as potentially covering all the roles in the city data ecosystem, from data provider to data consumer, from data subject to data processor.

To limit the burden of participating in the preparation and implementation of the plan, the CDP envision distributed teams coordinated by a centralised unit. Each distributed unit (that can also correspond to just one referent per organisation) work independently from the others and within the structure and rules of the organisation it belongs. In this way, adhering to the CDP governance structures can be integrated into existing management processes. Indeed, a significant improvement of the current city data governance can be achieved by constructing a clear understanding of who produce what data, for what purpose, when, where, and under what conditions those data can be accessed, and by whom. Building this knowledge base and keeping it updated does not imply internal restructuring of local organisations. Then, the rules of engagement with the CDP, and the protocols for inter-organisational cooperation on data management are aimed to minimise uncertainties due to the variety of organisational structures in terms of communication protocols, data exchange measures, and use of shared resources.

B. Object. The CDP as a policy instrument is intended to prevent or limit the manipulation of data by making explicit the rationale and the political choices supporting the deployment of specific smart city technologies in urban environment and the collection of specific data sources. In other words, a CDP helps to depict the various elements constituting the "data assemblage" [Kitchin 2011]: political, social, economic, environmental, organisational and technical factors impacting on the choices concerning data collection and analysis.

Indeed, the CDP is proposed as a common decision framework for every stakeholder in the city data ecosystem to assess the compatibility of data operations with the development goals of the city established in the advisory board. The negotiation process accompanying the CDP making is oriented to reach a consensus among city stakeholders on the contents of city data policies, and in particular on distinguishing between uses of data considered legitimate and illegitimate in a specific context.

The measures included in the CDP are expected to outline the rules of action and interactions with city data and other local stakeholders, contrasting malevolent or discriminatory uses of data at the local level through monetary and non-monetary disincentives described in previous sections.

The conceptualisation of the CDP focused on data produced by smart city technologies in a specific area and under specific agreements between technology providers and public authorities, as well as other data sources produced by local stakeholders that are fragmented, not easily reachable, not aggregated. An open issue not addressed by the City Data Plan concerns the production and use of city data managed by organisations not related to the city, such as major web-services providers like Google or Facebook. The risks associated with the manipulation and malevolent use of data by these actors need to be addressed at upper level rather than at municipal level.

C. Context. The City Data Plan is envisioned as a policy instrument that can integrate or complement existing regulations, laws and policies concerning both data and urban resources. In particular, urban laws and regulations defined at a city level can be extended to include specific section and measures concerning city data considered as urban resources of public interest, even when they are owned by privates and managed according to market-driven mechanisms. Concerning aspects already addressed by existing norms, such as privacy issues and the GDPR, a City Data Plan can provide an orientation grid to navigate the different types of concerns associated with different types of data at various spatial and temporal granularities. This form of support can facilitate a pre-assessment of the normative compliance of smart city initiatives and the related production and use of data.

A City Data Plan can also be seen as a "smart law" in itself, following the definition proposed by Decker [see Chapter 3, section 3.2.e]. Indeed, the particular form, structure and management of an urban plan give to this type of instrument the flexibility to distinguish between high-level principles and decisions on one side, and on the other side low-level operational aspects related to the management of data. The operational protocols can be dynamically revised according to the evolution of technologies and local needs and their effects on city activities, nature and characteristics of data, and definition of data-centred services. Nevertheless, contingent and dynamic variations remain bordered within the coherent decision framework constituted by the CDP.

> The high-level and low-level principles, schemas, and implementation mechanisms of the CDP are structured around the types of decisions and actions of local stakeholder. These decisions include strategic and long-term decisions, resource decisions at medium term, and resources allocation decision at short terms. To adequately support these different types of decisions, the CDP enlarges the spectrum of data considered in the plan to small and medium data, and not only big data commonly associated with smart city technologies. In addition, the CDP establishes shared rules also for private, internal, public, restricted data, and not only open data commonly considered as the only data resources of public interest. Indeed, for instance, the insights to guide strategic decisions at the local level can also come from informal sources or previous analysis contained in documents classified as small data. Moreover, the licensing of data needs to be considered as a property independent from the value or the relevance of the required information for a specific type of decision. The CDP enables each stakeholder to decide if the value of a certain dataset justifies their acquisition by payment of a fee, or if other available options (mapped in the plan) can constitute valid alternative sources of information for the type of decision they have to make.

Two more points necessitate further clarifications.

Political openness and commitment to establish a cooperative governance of data at the city level are the preconditions for preparing a City Data Plan, as well as the interest and active engagement of city stakeholders to participate in the process. However, these two points constitute the preconditions for defining and implementing every other type of urban policy, independently from the addressed topic. In the case of the governance of city data and the alignment of smart city initiatives to the vision and goals of the city, important drivers are the growing awareness of the public opinion on the consequences of an unregulated use of data and the willingness of local governments to regain independence and autonomy from technology providers, as mentioned in Section 9.2. Therefore, the ideal testbed to implement a City Data Plan is an urban context characterised by a strong political leadership and cohesive active social forces reclaiming people-centred smart city vision for the future of their city.

From a practical perspective, the preparation of a CDP requires a team of professionals with different expertise to guide the activities and concretely made the plan. The team should include planners, policy designers, data scientists, information system analysts and legal experts. Differently from the development of an urban plan—which can be managed by the internal staff of the planning department of local authorities or by external planning agencies—the preparation of a CDP implies temporarily recruiting specialists for this purpose, facilitating reciprocal multi-disciplinary understanding, and coordinating the team agenda with the activities in collaboration with city stakeholders (such as setting up the advisory board, the distributed teams in local organisations, the emergency units). However, this type of challenge is common within service design processes or social innovation design initiatives, both in the public and private sector. Experiences and inputs from these fields can support the prototyping of standardised, effective and easily manageable CDP making processes.

9.6 A CITY DATA OPEN PORTAL AS A CITY MIRROR: PRELIMINARY ANSWERS TO THE RESEARCH QUESTIONS

RQ1: *What users' characteristics should be represented on a City Mirror for offering to the city stakeholders a better understanding of the social context in which they operate?*	The constructive dialogue with a wide range of city stakeholders involved in the Milton Keynes City Data Ecosystem highlighted the importance of keeping a **multi-level representation of the missions, drivers, and values associated with specific data-related actions coexisting with contingent definition of the operational roles covered with local actions**, at the level of groups, organisations, and networks.
RQ2: *What factors should be considered for matching the specificity of the city context and the patters of local development actions with the unspecificity of the online environment defined by a City Mirror?*	The main factors for balancing specificity of the local configuration of a data ecosystem and replicable technology solutions open to the multi-stakeholder collaboration in the production and use of data include: the **identification of the patterns and scales for the data collection by themes and main topics** (e.g. mobility, social services, environmental protection); **modelling of the flows for the elaboration of data in relation to the type of decisions to be locally supported** (e.g.policy, resources allocation, resources status decisions)**; the modular construction of data resources as multi-facet entities.**
RQ3: *What type of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a city mirror in comparison with other existing tools?*	The three design concepts for building a City Data Open Portal, differently from the dominant solutions for Open Data Portal, provide support to **plan and manage data operations on the basis of collective information needs by distributing their collection, elaboration and dissemination among different stakeholders on the basis of flexible and dynamic arrangements at the local level.** The proposed tools, all multi-stakeholder, multi-purpose and multiscale, allow the **clustering of users sharing similar goals** and working on the same sources (CCSI), the **assessment of the social value and potential impact of existing and required data sources** (QBINA), the space for **optimising the use of local resources, in terms of infrastructures, expertise and institutional capital** (CDP).
RQ4: *What types of social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?*	A **misalignment between upper-level and city level strategies** related to data governance and city data resources (as contextual constraints), the rapid turnover and **instability of professional and territorial networks of key people in the city data ecosystem** (as social constraints), the unquestioned **mainstream technology solutions formally compliant** with legal requirements while not focus on multi-side needs and perspectives (as technological constraints).

RQ5: *What types of approaches could be applied in the design process for balancing the functional and non-functional requirements associated with the different perspectives and goals of city stakeholders?*	The approach designed and implemented in this case study relied on **“silencing” the public discourse** around the reciprocal stereotyped representations of different stakeholders, by focusing instead on the **identification and comparison of the structures and practices** leading to the definition of socially robust requirements across organisations.
RQ6: *What criteria should be considered for evaluating the correspondence between the platform functionalities and the expectations of the city stakeholders to be supported in their actions?*	This case study highlighted the importance for multi-stakeholder and multi-purpose technologies of enabling different segment of users to assess the **compatibility of their goals with the frame of goals, mission, and capabilities of other stakeholders**.

9.7 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 9 to the three outcome spaces outlined in Chapter 2, Section 2.7. Analogously to the previous chapters, the contributions of Chapter 9 are synthetically described in the table below.

Table 9.11 Mapping the chapter contributions with the outcome spaces of the TD framework

<table>
<tr><th>OUTCOME SPACES</th><th>TYPE OF CONTRIBUTION</th><th>CHAPTER 9</th></tr>
<tr><td rowspan="3">SYSTEM KNOWLEDGE</td><td>THEORETHICAL CONTRIBUTION</td><td></td></tr>
<tr><td>METHODOLOGICAL CONTRIBUTION</td><td>[SECTION 9.3] This chapter presents the rationale and use of historical approaches to the analysis and design of interactive systems. This kind of approaches is particularly useful in the cases of interactive systems consolidated and widely used, but not addressing the misalignment between the scope of technology and the goals of the use of technology. The historical approach allows to identify the key choices, transfer of meaning among unrelated dynamics due to contingent reasons, external constraints impacting on the definition of the underlying models of interactive systems.
This chapter also provides an example of a speed form of Action Research, called “Enacted Action Research” in which the cycle of problem definition, planning, acting, observing, reflecting can be condensed in a short time, without losing the value of collective elaborations and reflections. At the same time, this chapter clarified that the application of this kind of method requires a careful and deep preparation of the “stage of work” for the participants called to be part of the research, to set the conditions for an immediate operativity, usually reached in common forms of action research after an initial phase of trust building activities.</td></tr>
<tr><td>EMPIRICAL CONTRIBUTION</td><td>[SECTION 9.4] The empirical contribution of this chapter is two-fold:
First, it provides a detailed account of the practices for the cooperative management of data-related operations at the city level, as examined in the activities of the Milton Keynes Intelligence Team, and entailing the relationships among public agencies, local government and other territorial stakeholders
Secondly, it depicts a set of applicative scenarios linking the use of city data to local actions, focusing on the relational dimension of data as medium to negotiate and modulate the different operational and institutional roles of the stakeholders involved in the city data ecosystem.
These two sets of materials can provide input and support for further investigation and design explorations related to the nature and dynamics of data practices in cities and the role of technology in them.</td></tr>
</table>

TARGET KNOWLEDGE	FOR RESEARCHERS	
	FOR TECHNOLOGY DESIGNERS	[SECTION 9.5] The practical contribution of this chapter is the outline of alternative **design metaphors for the design of data portals** (or more specifically city data portal or open data portals). In addition, the chapter proposes and evolutive and incremental approach to the issues of technology tools under strict governmental control with the development **of technological modules seen as "add-on"** to the main solutions and opened for their use by a wide range of interested parties. In particular, the two tools **QBINA and CCSI also proposes interactional patterns with data portal based on dialogic interfaces and functionalities**, alternative to the one focused on transactional interactions only.
	FOR URBAN PRACTICTIONERS	[SECTION 9.5] The practical contribution of this chapter for urban practitioners (planners and policy makers, urban managers and innovation strategists) is the outline of the **CITY DATA PLAN as data governance tool**, built on the well-known and widely applied logics used to the development of urban plans transferred to the planning of the production and use of data seen as city resources, exactly as every other resource produced and used in the city. The concept of CITY DATA PLAN extends the potential area of intervention of urban practitioners opening new interesting opportunities and space for experimentation.
	FOR CITY STAKEHOLDERS	[SECTION 9.4] This chapter **invites city stakeholders to challenge and reflect on the assumptions about the roles and capacities of different types of organisations involved in the city data ecosystem, but also to consider the opportunities coming from alternative model of cooperation.** A significant example is related to the need of assessing the impact of the production and use of data at the local level, a recurrent problem highlighted by data producers in the public and private sectors, and the capacity of non-profit organisations to enter in the data ecosystem for addressing this kind of issues and increasing the value of data for all the actors involved, without demanding to these organisations efforts that they cannot undertake in the data productions and elaboration. The principle of subsidiarity of the different social forces in the city is fundamental in this case.
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNWOLEDGE	USERS	[SECTIONS 9.2, 9.3, 9.4] This case study, building on the theoretical assumption of this entire work, questioned the dichotomy of Open Data producers and data users attributing these two roles respectively to local government and generic citizens. On the contrary, this case study adopted an **ecological perspective on users as part of the city data ecosystem**, actively and directly operating in one of the steps and processes going form the data collection to the communication of the knowledge incorporated in data for the large public. In this case study, as in previous ones, the **political dimension of data practices and data-related operations** is considered as one of the main aspects for changes in data governance at the city level. **Transformation paths in the design of technologies for cities comes from thinking of system for democratising the governance of data and leveraging on the complementarity of capacities and needs of different city stakeholders.**

	CITY	[SECTION 9.4] This case study investigated in particular the peculiarities of data-related processes in different macro-sectors of urban activities (e.g. mobility, housing, environment, social services, business development). The study highlighted the inner logic configuring the dynamics within the city data ecosystem resulting from the interactions between the physical constraints preponderant in some cases, the level of social integration of the organisations and networks operating in that sector, and its level of interconnection with other sectors. Two significant examples are the processes related to mobility data or to community involvement. Usually, the modelling of data related processes, supported by data technologies, flatten these differences to the one of more structured processes. **Transformation paths** in the design of technologies for cities could instead originating from the **effort to provide form of support differentiated on the basis of the recurrent patterns in distinct sectors of city services.** In the end, the proposed change is moving beyond the vision of the City as *"data production machine"*, toward a more processual interpretation and support of data actions at the local level.
	TECHNOLOGY	[SECTION 9.5] The three design concepts proposed in this case study are all instruments dialoguing with other digital and normative tools to improve and regulating the access and exploitation of city data considered as urban assets. **Transformation paths** in the design of city technologies intended **to improve the current governance of city data could rely on systems able to distinguish between ownership of data and access to data, between autonomous processes and instruments for their production and elaboration, and collective tools to support their use in local development actions.**

PUBLICATIONS

The following publications include part of the contents or concepts presented in Chapter 9, in an extended version, or are related to this case study.

- *UNDER REVIEW (HCI)* – **Lupi L.**, Antonini A., *Developing an interaction design framework to rethink city data portals.* [Journal Paper]

- *UNDER REVIEW* (CSCW) – **Lupi L.**, Antonini A., *Behind an Open Data Portal: a case study on the data practices of the MKiO intelligence team.* [Journal Paper]

- *UNDER REVIEW* (IS) - **Lupi L**., Antonini A., De Liddo A., *Rethinking open data portals as collective intelligence platforms through a design research approach*. [Journal Paper]

- FORTHCOMING. **Lupi L**., Antonini A., De Liddo A., Motta E. (2019) *Actionable Open data: Connecting City Data to Local Actions. Journal of Community Informatics, Vol 15* [Journal Paper]

- **Lupi L.**, Antonini A. (2020) *Readapting Propp's Character Archetypes to Explore the Relational Dimension of City Data: a Design-Oriented Approach*, DISEÑA (16), 200-229. [Journal Paper]

- **Lupi L.,** (2019). *City Data Plan: The Conceptualisation of a Policy Instrument for Data Governance in Smart Cities*. *Urban Science*, *3*(3), 91. [Journal Paper]

- **Lupi L.,** (2019). *Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development,* IASDR 2019, Manchester, United Kingdom. [Conference Paper]

- **Lupi L.,** (2019). *Conceptualising a City Data Plan: a Preliminary Outline of a Data Governance Tool for Smart Cities*. City Futures IV – EURA – UAA Conference, Dublin, Ireland. [Conference Paper]

- **Lupi L.,** Antonini A., (2018). *From Service to Data Infrastructure – The Transition from MK Intelligence Observatory to MK:Insigh.* [Technical Report]

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CHAPTER 10.

CORE CONCEPTS AND PROPOSITIONS
FOR A THEORY OF THE CITY MIRROR CAPABILITIES

THIS CHAPTER IS NOT COMPLETE YET.

CHAPTER 10. OVERVIEW

Chapter 10 presents the systematisation of the findings coming from the case studies implemented by applying a constructive and interpretive process inspired by Grounded Theory methods. This systematisation of the findings is limited to organise the inputs coming from the empirical and applied research in **core concepts and propositions testable within further design processes of city technologies**. These elements, focused on the description of the City Mirrors capabilities, are articulated in their presentation accordingly to the main dimensions of the city systems and infrasystems (physical, functional, social, resources, relationships, values). Orthogonally, the core concepts were characterised and detailed by considering the multiple layers of the User Model and the operational schema of collective mechanisms and actions supported through technology.

The whole of core concepts and propositions constitutes the **last building block of the Design Theory of the City Mirror Capabilities** elaborated along the previous chapters, aimed at orienting the design of web-based technologies able to support city stakeholders in the orchestration of local actions.

As regarding the Transdisciplinary research framework infrastructuring this work, Chapter 10 presents the reintegration of the facets of the knowledge problem broken down after the background analysis of the real-world problem of the disconnection between technologies and city dynamics. The theoretical reintegration of the problem facets and the formulation of practical guidelines in the forms of testable propositions are the last two steps of the readapted TIPS framework, used as a guide along the research process.

Chapter 10 is composed of two macro-parts.

- A first part divided into four sections (10.1 to 10.4) explaining the general profile of the theory
- A second part divided into six sections (10.5 to 10.10) presenting the core concepts associated with the City Mirror capabilities and a set of design propositions. In particular:
  - Section 10.5 focuses on the representation of the physical system as space of action.
  - Section 10.6 is centred on the management of the temporal properties and level of ownership of local resources and their variability in urban settings
  - Section 10.7 deals with the dynamic representation of roles and identities of city stakeholders as implementers of local actions
  - Section 10.8 outlines the patterns of their relational models that inform the development of local actions
  - Section 10.9 addresses the issues related to the variety of city functions, their interdependence in reality and the web, and the dynamic clustering of compatible activities.
  - Section 10.10 provide a preliminary account of the association between values and representation of the physical and functional systems motivating local actions.

Tree more conclusive sections illustrate some practical examples for using the testable propositions (section 10.11), formulate the preliminary answers to the higher-level research questions, and summarise the chapter contributions.

CHAPTER 10. DETAILED TABLE OF CONTENTS

10.1 CONTENT OF THE LAST PART OF THE DESIGN THEORY

This entire work is built around the concept of **City technologies**, intended as information technologies focused on people and processes in the City (seen primarily as a socio-political entity), and contraposed in some way to the dominant paradigm of Urban technologies focused instead on the built environment of urban settings. The idea of the ***"political soundness"*** of technology is set as a paramount for City technologies, and intended as the appropriateness of the design solutions to fit with long-term visions, short-term goals, fluidity of roles and hierarchies, and operational frameworks of a plurality of stakeholders that coexist into the public arena of cities. As remarked in many occasions, this political soundness is even more essential in technologies aimed at supporting local development actions, as widely expected nowadays from the unprecedented potentialities offered by digital technologies. Indeed, local development processes implies the expansion of individual and collective opportunities and result from the dynamic negotiation of goals, norms and actions among all the stakeholders involved in their implementation at the local scale. Thus, technologies aimed at substantially supporting local development actions are required to provide solutions for making this dynamic negotiation of goals, norms and actions actually possible and keeping the consistency between online and offline dynamics or, in other words, mirroring the city.

Along the previous chapters, the reported experiences of the case studies clarified meaning, contents and instantiations of the design of a technology-supported political space around the:

- Negotiation of **responsibilities and competences in social innovation processes** supported by a Civic Social Network as an **amplifier and catalyst of new practices**
- Throughput legitimacy in the **management of the decisions and action**s over the city supported by a We-Governance platform **as enabler of new relational models**
- Governance of the **use of immaterial resources such data and technology itself** supported by the definition of hybrid instruments insufflating the **policy dimension into data technologies**.

Since the beginning of this work, I also tried to clarify that **all actions in the city are always collective actions** intended in the sense of enabled by multiple collective social structures that define boundaries and modalities of the actions of individuals in the City. As such, every action can be considered under the frame of its positioning into collective dynamics. These dynamics can be divided into **coordinative, cooperative and collaborative mechanisms for the implementation of actions** having a collective relevance, needing collective effort, keeping collective structures functioning and adapted to the continuous change of cities, fostering local development.

Looking at technologies that could be oriented toward the political soundness and also toward the operational support to collective dynamics, I decided to **focus on web-based technologies** as the class of information technologies that have the greatest potential in this direction. Considering though that web-based technologies are not yet oriented to build online environments and provide the kind of operational support suitable to pursue this path, I have formulated the **design proposal of a City Mirror as a platform outlining an online environment multi-stakeholder, multi-purpose and multi-scale to support coordinative, cooperative and collaborative practices in the city.** The, I have built my work on the design and research explorations associated with this proposal to understand its implication in real-world settings.

Here, at the end of the first round of these design and research explorations, and as last step of the TIDS protocol that guided this work [Fig 10.1], I am going to present the outline of a preliminary **theory of the City Mirror capabilities** to address the central question of "*How should City Mirror be designed?*"

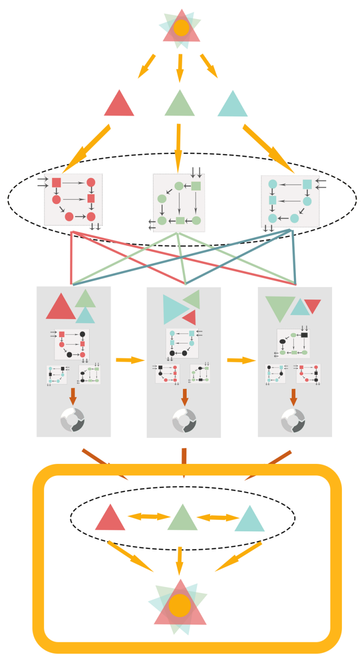

Fig. 10.1 Mapping of chapter 10 in the readapted TIPS framework

Accordingly to the framework of the **"anatomy" of a design theory** proposed by Gregor & Jones [2007] and referred specifically to the design of technologies, the theory of City Mirror capabilities is expressed through a series of ***"testable propositions"*** intended as proposition based on evidence and giving support to envisage the outcome of specific design choices. These testable propositions account also for the *"artifact mutability"*, or rather they help in anticipating the variable configurations of City Mirror, building on the knowledge stratified through the previous experience related to the case studies. Indeed, this theory is not originated within a theorethical space only, but in the mutual exchange with practice.

The other elements of a design theory in the Gregor & Jones' framework had been already covered in previous chapters. They include:

- the definition of a *"purpose and scope of the system"* to be designed, that in this work corresponds to the design proposal of the City Mirror as a set of abstract meta-requirements linked to the goals set for the technology to be designed [see Chapter 3]
- the *"principle of form and function"* of the artefact object of the theory, that in this work correspond to the definition of the research and design object as a specific class of web-based technology [see Chapter 4]
- the *"constructs"* and the *"justificatory knowledge"*, or rather the concepts and reflecting the entities or the reality relevant in the theory, and the underlying knowledge from external theories and practices, that in this work correspond to the core models and their related concepts [see Chapter 5]
- the *"principles of implementation"* intended as description of the processes for implementing the theory in specific context and the *"Expository instantiation"* intended as material implementation of the artifact for expository or testing purposes, that in this work correspond to the three case studies of prototypes of City Mirror actually used for elaborating and refinign the theory along the design and research process [see Chapter 7, 8, 9].

10.2 NATURE OF THE DESIGN THEORY AND PURPOSE OF THE PROPOSITIONS

This theory of the City Mirror capabilities is intended as a ***"designing theory"***, probable more than a design theory itself, **attributing to the term design its meaning of integral project[1] and framing of components, both internal and external, in the design of an artefact, in this case, a technology artefact**. As such, **the theory of the City Mirror capabilities is a theory for the systemic design of City technologies**.

The term *"capabilities"* is intentionally preferred to the more common term of *"affordances"* usually associated with the set of tasks allowed by the functionalities incorporated into technology system. Indeed, the term capabilities, intended as balancing between ability and opportunity to do something, better reflects reciprocal influences and interdependences between:

- How users are enabled to act over the City
- How the institutional context of the City defines the boundaries for the actions of users and the application of technology
- How technology shapes the modalities and opportunities for users to act in the City, but at the same time it is shaped by the resources, values and relationships driving the design of technology itself.

As already mentioned in previous chapters, in **urban disciplines** [Yiftachel 1989, Bahrainy & Bakhtiar 2016], theories tend to be distinguished into:

- **substantial theories**, stating the nature of objects, concepts and principles describing the city and its functioning
- **procedural theories**, covering the logic and norms regulating the processes for the City transformations, as well as recommendations on the way to approach and implement such transformations.

In **Informatics**, and more specifically in the domain of Information Systems, these two aspects are strictly intertwined. Indeed, a design theory is seen as a structured guide for analysing the problem to be addressed and elaborate, implement and evaluate potential solutions. The meta-framework followed throughout this work, or rather the Gregor & Jones' framework [Gregor & Jones 2007], provide a high-level guide to ensure the completeness of a design theory.

In **design**, theories tend to be oriented toward linguistic theories clarifying the grammar of elements, signifiers and meaning, and their composition used for the definition of specific design objects [Redström, Bahrainy & Bakhtiar 2016].

In this case, a designing theory of the capabilities of City Mirrors reconnects the components and principles of the three core models to orienting the design of a class of digital artefacts. However, this designing theory set the granularity of the propositions at the level of the logic and processes to inform the design, instead than at the level of the composition of the elements of the artefacts to be designed.

As regarding the link between theory and practice, the last part of the design theory concluded in this chapter is an ***"intermediate theory"***, aimed at **mediating the tensions between the insights coming from the**

[1] See also section 11.2, Chapter 11, about trans-linguistic issues in this work, starting precisely with the term "design

design processes of specific artefacts (such as my case studies) and the effort of abstracting and generalising these insights in concepts that could support future making, communication and learning. As introduced earlier, Redström [2017] identified three tactics to connect theory and practice in design, defined as *"Parallels", "Sequencing" and "Intermediaries"* [see Section 5.1.3.c, Chapter 5]. The first one was impracticable because the lack of an external theory from humanities or social sciences connecting the three critical dimensions of users' representation, city systems and forms of technology support in local actions. The "sequencing" tactic had been applied in the development of the core models presented in Chapter 5 and then used as conceptual devices for the construction of the case studies and the orientation of design and research activities. In this case, concepts and theories not linked to the design of artefacts or more specifically technologies had been reinterpreted to serve design purposes. In the end, **the set of core concepts and testable propositions organised in this chapter results from the experimentation of the "intermediaries" tactics, or rather they emerge from an analytic and reflective effort to distillate and conceptualise the lessons learned from the previous design experiences linked to the three case studies.**

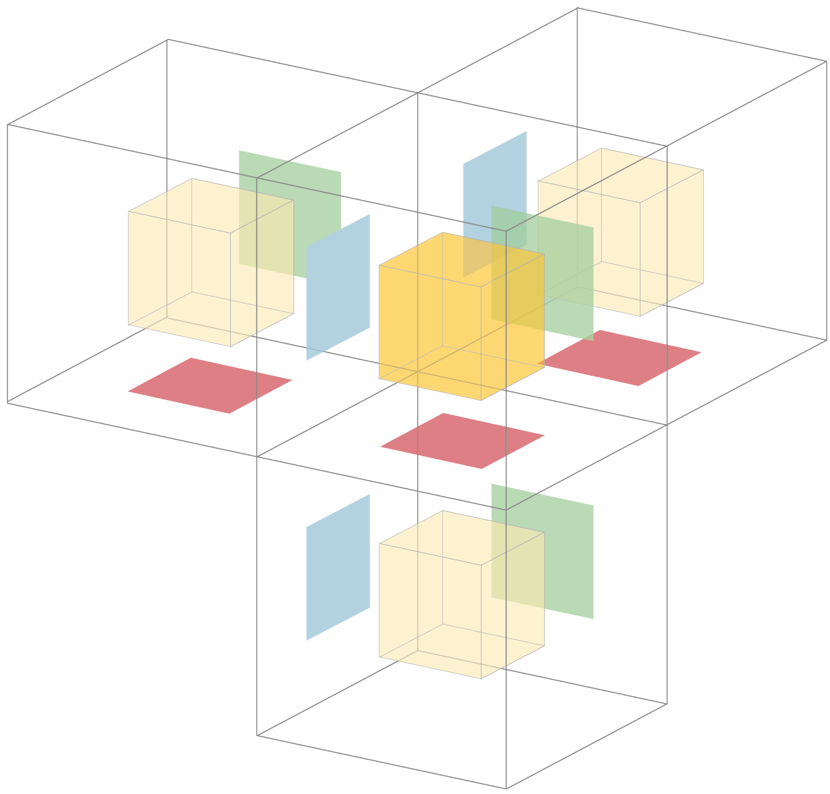

Fig. 10.4 Schema of the relation between instantiations in specific artefacts, projections from the core models, and aim of the theory.

10.2 ANALYTIC PROCESS TO FORMULATE CORE CONCEPTS AND PROPOSITIONS

The last building block of a theory of the City Mirror capabilities had been elaborated by analysing through grounded theory methods the corpus of experiences, insights, and inputs gathered along with the design and research explorations for the prototyping of three examples of city-mirror-like web-based technologies. As explained in the methodology chapter [Chapter 6], this theory relies on an abductive process integrating:

- **consolidated knowledge and practical knowledge across various disciplines reinterpreted and condensed in the three core models** of the social structures in which Users operate at the local level, the city ecosystem, and the forms of technology support to coordination, cooperation and collaboration dynamics [Chapter 5],

- **the findings coming from the empirical and applied research** associated with the three case studies [see Fig.10.2].

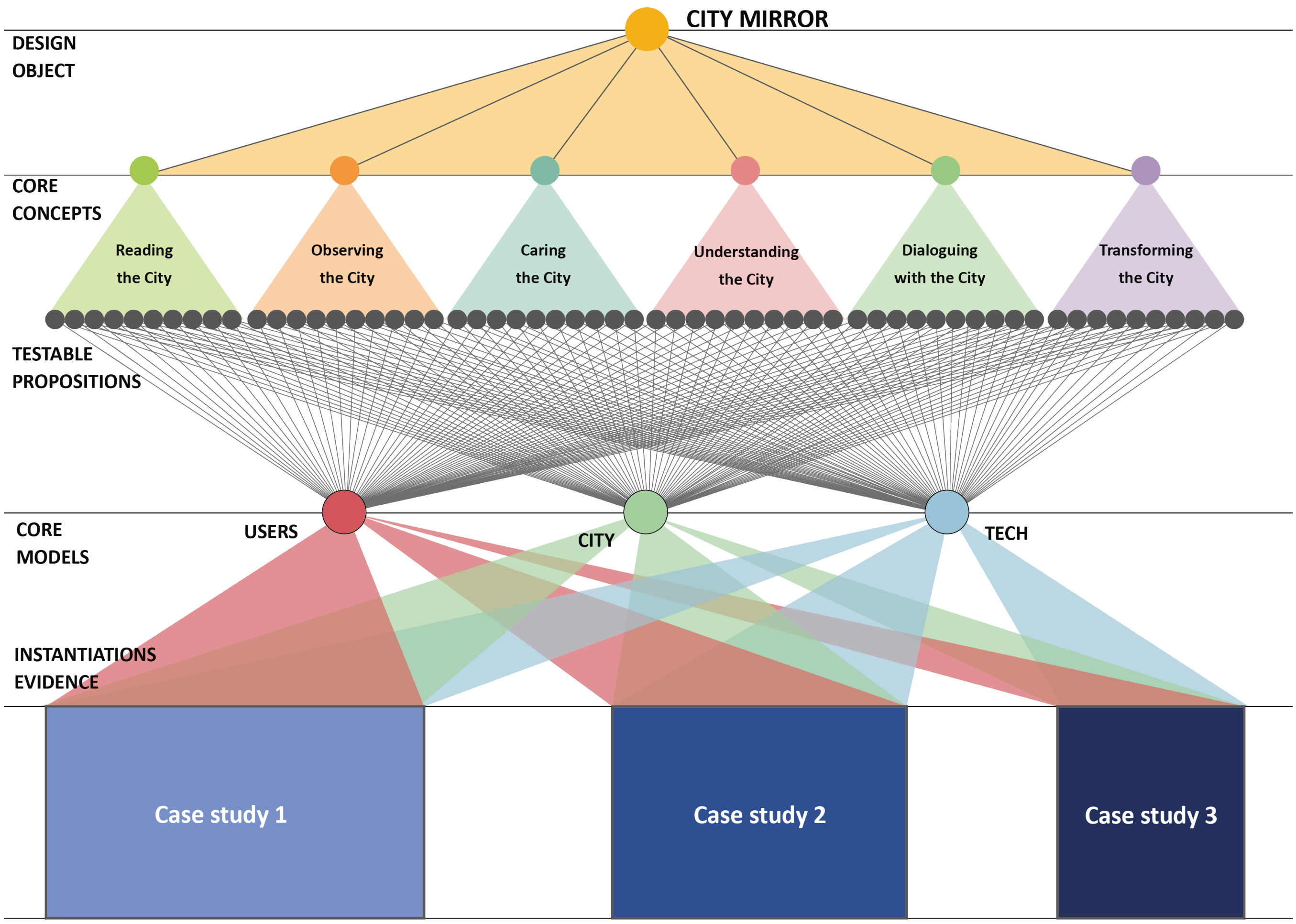

Fig. 10.2 Schema connecting the core models, case studies and definition of the core concepts in the theory

In practical terms, the three core models had been used as sounders to scan and let the case studies data resonating, by connecting the properties of the core models layers reported in Chapter 5, and Table 10.1-10.3.

Table 10.1 Characterisation of the collective users models reported in Chapter 5

KEY ASPECTS	COLLECTIVE USERS			
	GROUPS	ORGANISATIONS	COMMUNITIES	NETWORKS
Definitory concept	GOAL	RESOURCES	BOUNDARIES	OPPORTUNITIES
"biology"	sum of the **individual resources** of its members	**vertical, horizontal, mixed composition** of resource management units	sum of the **aggregation of individuals and their material or immaterial "container"**	structure of the network in terms of **density of nodes, extension and levels of the grid**
"physiology"	from **socialised decisions** within the group or **top-down indications** to explicitly connect individuals' resources and group's goals	**internal regulations, contracts, code of conducts, protocols** and chains of roles-task-responsibilities among distinct units (explicit upper-level decisions)	**selection and self-selection mechanisms** to manage community growth and keep its relative self-dependency (implicit decisions)	**exposition of the individuals' features** for attraction of additional nodes (nature and **accessibility of "social hooks", visibility of "hubs"**)
"psychology"	**internal alignment** of the group's members through **mutual awareness of the on-going actions** toward the goal	**polyarchy mechanisms** to differentiate the level of formal/actual agency over internal decisions and actions	**internal dominance schemas** to establish the "function" of each affiliated within the community, and the related social expectations and influence	**explicit conditions and implicit conventions for the activation of the network and propagation of the actions** required to the nodes
"cognition"	**changes in the topology of the group** respect to upper-level social structures (closer to the top-tier taking decisions or to the lower-tier with limited autonomy, or in between) and position-based sorting of information relevance	**intermediaries** actively **filtering** access to information, its interpretation, the limitation for the use of information	**recognisability and differentiation** from outside based on intra-community conformation practices	**social and spatial proximity** of the nodes to the action triggers
"movement"	**setting up** of a new group; **duplication, replication, emulation, partition** of other groups; **dismantling,** stop or dormient state of the group.	**acquisition of the resources** to operate; structuring; **merging/ segmentation**; forming inter-organisational temporary **coalitions**; **symmetrical/asymmetrical configurations**	**expansion, contraction; opening and closure; fusion** with other homogenous communities; dissolution by *motu proprio* or external interference.	macro-changes in the **structures of the links** between nodes (e.g. multiplication/diminishing of the links); **densification/spreading** around the hubs; establishing of **cross-network relationships**
"embodiment"	**level of dependency/ independency** respect to the upper-level social structure in which the group operates (as regarding goal settings, decisions, and operations)	**exclusive/shared ownership** of the resources; **direct/indirect management of the resources** to qualify the organisation in the context	**permeability/ impermeability** to the influence of other community at functional or representational level (eso/ecto-representation of the community)	**call/reaction mechanisms** to prove the status of the network and its nodes, confirming the access to reserved opportunities

Table 10.2 Characterisation of the City Ecosystem model reported in Chapter 5

CITY SYSTEMS	CHARACTERISATIONS – COMPONENTS – ELEMENTS TO BE CONSIDERED
PHYSICAL SYSTEM	interactions with the built environment at different scales: ▪ Upper-level environments impacting on city dynamics, formally defined, known at an abstract level and only partially experienceable (international, national, regional, territorial) ▪ City physical system, as formally defined, known for stratification and recomposition of knowledge and experiences (metropolitan scale, city scale, district) ▪ Intermediate and lower-level scales, informally defined, directly known and experienced (neighbourhood, city blocks, public spaces, buildings, indoors).
FUNCTIONAL SYSTEM	nature of actions implemented into the functional system: ▪ generating new resources, tangible and intangible ▪ transforming these resources within specific processes ▪ making these resources accessible through the definition of norms and protocols ▪ generating knowledge from/on the available and needed resources at a collective level. main issues related to the interactions with/within the functional system: ▪ interdependency of functions ▪ overlapping of functions ▪ classification of the urban activities to refer to
SOCIAL SYSTEM	classes of stakeholders in local actions: ▪ Local Governments ▪ Public Agencies ▪ Business sector ▪ Capital holders ▪ Knowledge cluster ▪ Non-Profit organisations Characterisation of the interactions within the social system ▪ Scales of action, size and resources of specific stakeholders within their cluster ▪ Internal and external definition of the roles, mission and practices of each stakeholder cluster ▪ Nature of the pursued interests (general public interest, local collective interest, private interests) ▪ Nature of reciprocal influences (over the choices, over the actions, in the implementation of actions) ▪ Distinctive social “behaviours” (regulation, adaptation, reaction)
RESOURCES INFRASYSTEM	nature of city resources respect to the ownership and determining the kind of actions and interactions they admit: ▪ Private, Semi-private or “parochial” , Semi-public or “communitary” , Public, furtherly divided in resources “under direct public management” or “urban commons”. Temporality of city resources: ▪ Permanent, Intermittent, Temporary, Ephemeral
RELATIONSHIPS INFRASYSTEM	properties characterising social relationships in the city ecosystem: ▪ formal/informal arrangements ▪ direct/indirect impact of the relationship over actions and reciprocal interactions ▪ closeness and occurrence of interactions (from rare to regular) ▪ Level of definition (accidental, planned, unplanned) ▪ directionality of influence and power dynamics ▪ framing of the relationships within laws, customs or traditions ▪ meaning attributed to actions and relationships
VALUES INFRASYSTEM	Values axes: ▪ Openness/Conservation; Self-interests/Collective Interest; self-transcendence/self-enhancement Values-driven interactions based on: ▪ Extrinsic/Intrinsic values; priority attribution, relevance in decisions and actions

Table 10.3 Characterisation of the technology support to orchestration reported in Chapter 5

levels of the core model	characterisations and aspects to be considered
coordination, cooperation, collaboration	▪ ***Goals and objectives:*** defined internally or externally to the social structures involved in the action; joint definition or compatibility assessment; compliant with the mission or beyond it; defined within existing structures and policies or autonomously; mutuality; participation to the goal because of internal limitations or by choice ▪ ***Interdependencies:*** decisional and operational autonomy; centralised or decentralised decision-making and control; high-level or low-level planning, or comprehensive or sectorial; fragmented or organic leadership of the action; involvement and mutual arrangements at high or low hierarchical levels; avoidance and resolution of conflicts ▪ ***Commitment:*** formal-informal agreements, presence-absence of meta-structures to manage the collective arrangements ▪ ***Resources:*** assets and available for 3Cs dynamics; shared or not shared resources; physical or human resources shared; level of information and systems sharing; implementation dependent or independent from leaderships; need or marginality of trust-based relationships ▪ ***Benefits and Risks:*** Individual risks and benefits for single units and higher-level structures; shared risks and benefits among the stakeholders involved; high or low risks and on what aspects; structural variable of risks and benefits (number of participants in the action, their heterogeneity, level of communication, freedom to be involved and exit), core relationships related to risks and benefits (reputation control mechanisms, trust and reciprocity among the involved parties); contingent strategies for risk reduction and benefit increase ▪ ***Conflicts:*** conflicts of interests requiring mutual adjustments; conflicts of interpretations requiring shared interpretations of the context of action
practices and meta-practices associated with programmes, processes, projects	▪ ***Oridnary vs Extraordinary actions*** ▪ ***Short, Medium, Long Term*** ▪ ***Articulation of Programmes, Processes, Projects*** ▪ ***Practices:*** what actions are implemented and how there are represented in the common discourse; sequence of activities, but also how priorities and interests are established, and asymmetries reproduced; temporal sequence of activities, and the temporalities and rhythms of practices; material and symbolic aspects associated with specific human actions and bodily interactions; use of specific artefact in the context, with its specific meaning and connection with other visible and invisible practices; practical concerns determining efforts, achievements and goals in the implementation of practices; set of measures to adapt practices to conflicts and tensions between formality and informality; how practices are consolidated through the definition of insiders or outsiders, and other learning mechanisms ▪ ***Mediation work in practices (and mata-practices):*** artifactually imprinted protocols; maps communicating in implicit or explicit forms what can be done or not in a certain context); script (interdependencies among different activities, the conditions and pre-condition for actions, the available options and choice criteria) ▪ ***Rules in meta-practices:*** "rules-in-force" (established by regulations, laws, contracts, agreements, and thus explicit) and "rules-in-use" (working rules as interpreted and applied, and usually tacit); levels of rules and coexistence of multiple set of rules; informal rules enabling the action; rules changing over time; Types of rules: position rules about positions and roles of the involved actors; boundary rules defining who is included or excluded and how positions and roles are assigned; choice rules, prescribing the actions that can be undertaken in various circumstances; aggregation rules, limiting the number of involved actors acceptable for collective actions and decision; information rules, regulating communication exchanges; payoff rules, assigning rewards or sanctions to particular actions; scope rules, envisaging what should be the expected/desired/acceptable outcomes.
forms of technology support to analysis, planning, implementation, management, assessment of actions/context of actions	▪ enabling users to work together by **arranging roles, tasks and human resources through malleable (versatile and flexible) protocols** that can be changes on fly, while **remaining accessible and legible to users** and, at the same time, consistent with all the other elements defining the context in which users work ▪ adapting the context in which users work by - locating, blocking or obtaining the access, showing, hiding, publicising, concealing ***informational resources*** - locating, procuring, allocating, reserving, deploying, consuming, transforming ***material resources*** - locating, procuring, allocating, reserving, deploying, using ***technical resources*** - reserving, using ***infrastructural resources.***
study of interactions within/on web-based technologies	▪ ***design metaphors*** ▪ ***types of interactions*** with a digital system: instructing, inputs/outputs exchange, manipulating digital objects (texts, visual contents, and multimedia contents), exploring contents and objects, responding to inputs and requests coming from the system itself ▪ ***underlying model(s) of the reality and its representation on the system***

Looking at the entire research process reported in this work a continuous flow of research and design activities, the Grounded Theory methods' practical application proceeded in the following way.

- *First case study.* **Open coding** of all the materials collected in the initial phase of the participatory design process of FirstLife, including about 150 applicative scenarios on over one hundred distinct city practices. Open coding of the issues and constraints associated by different social structures to the use of map-based interfaces, temporal features, specific user profile and other. Starting of the **axial coding** on these materials, progressively integrated by other collected in the subsequent phases of the participatory design process by also relying on a focused sampling of these materials along selected dimensions (such as scale of action, or rime, or involved actors, or domain of intervention) made possible through the multiplication of the experimental silos for the data collections. The extensive and long work conducted during the first case study provided a preliminary basis for defining an initial set of concepts appearing already saturated and for identifying other space for further investigations.

- *Second case study.* **Open coding** of new elements; theoretical sampling of materials covering the aspects remained unconsolidated after the first case study, triangulation and validation of the concepts selected in the first case study, **axial coding** of the new material and concepts to be reformulated under the light of new evidences. Starting of the **selective coding** based on the resulting axial codes.

- *Third case study.* Same flow of the second case study, considering the new codes and concepts from this case study in relation to the previous one for triangulation, reframing, and consolidation in **selective codes**.

- Normalisation, triangulation and final selective coding in the cross-case analysis. After multiple iterations, the hierarchy of codes ended up into six macro-categories of City Mirror capabilities.

Along this process, the elements of the core models provided a knowledge infrastructure to focusing the data collection and analysis on the understanding of the connections among the three core models at various levels [see Fig. 10.3].

Fig. 10.3 Schema of the three case studies and their contribution to the GT

10.4 ORGANISATION OF THE CORE CONCEPTS AND PROPOSITIONS

A cartesian metaphor can help to introduce the schema outlined by the set of core concepts included in the theory. I can say that that the core concepts are organised accordingly to a schema where:

- the City is considered as the horizontal plan in which we move our attention to cover the different systems and infrasystems [see Table 10.1]
- the social structures corresponding to the collective Users and layered individual User are distinct parallel horizontal plans overlapping the City [see Table 10.2]
- a City Mirror Technology is the vertical plan projecting the connections among the plans of the City and the Users.

The result of this underlying geometrical construction is a corpus of core concepts and propositions structured along six axes, one for each system and infrasystem of the City [see Fig. 10.4]. The propositions concerning the capabilities of a City Mirrors are formulated as relations between the components and properties of the City systems and infrasystems, and the key elements of the social structures profiles.

The propositions are the consolidation of specific functional and non-functional requirements and evaluation criteria consistently recurring in the participatory activities associated with the three case studies. Their identification and abstraction in meta-requirements is based on the application of GT methods as specified before. The propositions are aimed at providing practical inputs and guideline to designers. Thus, they are expressed in most of the cases through the following structure:

#Pn. [What a City Mirror does] + [in what way – interfaces, services, data] + [for what end in a multi-stakeholder, multi-purpose and multi-scale environment] + [in what type of circumstance – 3Cs dynamics].

The elaboration of the core concepts is aimed at reintegrating the three facets of the knowledge problem of recomposing the representation of the different stakeholders acting in the city at multiple level, the flows and logic of city processes, and the forms of support to collective dynamics in the online environment proposed by city technologies.

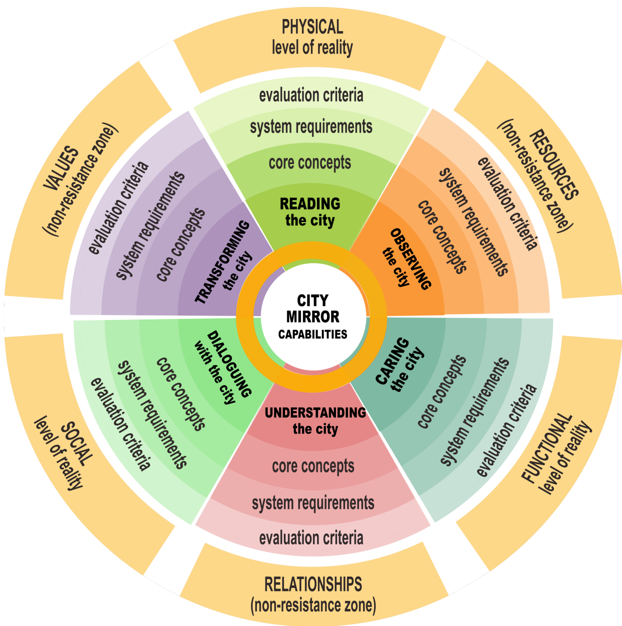

Fig. 10.3 Schema connecting the City mirror capabilities with the City model infrastructure

Following, as frequently done in previous chapters, a bidimensional arrangement of contents serves the purpose of facilitating a quick grasp with of the structure and relationships among the propositions included in the theory without forcing the cognitive effort of recomposing them logically and visually and possibly contributing to the economy of the communication mediated by this dissertation. The future extension of this draft will provide examples and references back to three case studies in relation to the various propositions.

10.5 READING THE CITY

10.5.1 CORE CONCEPTS

Designing a City Mirror (CM) implies designing **web-based technologies capable of making the City legible to users by decoding and attributing correct meaning to the space of actions**. The capability incapsulated in the concept of ***"Reading the City"* through technology refers to the legibility of the physical system of the city, under the influence of the infrasystems of values and resource that impact its perception and representation.**

The concept of Reading the City can be broken down into a set of sub-concepts related to actions essential for the orchestration of local actions enabled by specific CM capabilities. These sub-concepts articulate the concept of Reading the City taking into account the structural, discursive and practical aspects of the coexistence of multiple city stakeholders in a shared virtual space. A City Mirror should provide support to:

- *[structure]* Isolating, identifying, **extracting the components** of the urban environment as single elements, area-based clusters, or type
- *[structure]* Purposively **connecting urban components** that are structurally (e.g. normatively), functionally (e.g. public spaces) and analogically related (e.g. school – library)
- *[discourse]* Attributing **intrinsic meanings to urban components and meaning associated with the actions** hosted in the corresponding area
- *[discourse]* Comparing and weighting the **concurrent or conflictual meanings** associated to the urban components by different users' segments
- *[practice]* Understanding the **implicit and explicit offline social rules for the construction of the virtual representation of urban components** as regarding the legitimacy, competencies, and responsibilities over the shared online contents providing their description
- *[practice]* Understanding the **effects of the online manipulation of the urban components' virtual representation over the actual changes** happening in an offline dimension in terms of perceptions and actions

10.5.2 PROPOSITIONS

The main dimensions considered for defining the propositions to instantiate this capability include:

- the **scales of actions in the physical system of the city**, going from indoor spaces to the national scale, grouped into scales allowing the direct sensorial knowledge of the context of actions, requiring the bridging between direct knowledge and cognitive modelling of the context of action, based on the abstract definition only of their boundaries

- the **intertwined aspects of the definition of places**, as specific spatial arrangements of spaces, their contingent usage and the representation values, and their alternative configurations
- the **regimes of places** as public, private, semi-public, semi-private and parochial
- the values of **openness or conservation** in relation to the emotional and identity elements
- the **concentration or distribution** of activities.

10.6 OBSERVING THE CITY

10.6.1 CORE CONCEPTS

Designing a City Mirror implies designing **web-based technologies capable of tracing the changes in the configuration and reconfiguration of the city resources over time**. The capability indicated as *"Observing the City"* through technology refers to enabling assessment, decisions and actions to change the properties of the infrasystem of resources, taking into account the material constraints of the physical system and the geometries of the involved stakeholders in the social system of the city.

10.6.2 PROPOSITIONS

The dimensions considered for defining the propositions to instantiate this capability include:

- the **nature of resources** as tangible or intangible, unique or replicable, centralised or multiplied (resources infrasystem)
- the **accessibility of resources** in relation to the norms for their fruition (resources infrasystem)
- the **ownership of resources** (social system)
- the temporal aspects related to the **permanence of resources** (physical system)

10.7 DIALOGUING WITH THE CITY

10.7.1 CORE CONCEPTS

Designing a City Mirror implies designing **web-based technologies capable of identifying the relevant elements in the schema of responsibilities, competences, interests, representations, missions, and goals of the stakeholders operating in the city.** The capability indicated as *"Dialoguing with City"* through technology refers to the navigation of the social system of the City, accordingly to the norms of the infrasystem of the relationships among city stakeholders and the status and properties of the resources interested by their actions.

The concept of Dialoguing with the City can be broken down in the following sub-concepts and specific capabilities. >>

10.7.2 PROPOSITIONS

The dimensions considered for defining the propositions to instantiate this capability include:

- the internal and external definition of the actors included in each **class of city stakeholder** (social system)
- the **types and nature of relationships** among these class of stakeholders and their variability (Relationships infrasystem)
- the **direct and indirect influence** of each class of stakeholders over the decision, actions, processes over other classes of stakeholders, but also the vertical and horizontal influence among different social structure within the same class of stakeholders (Relationships infrasystem)
- the **nature of the pursued interests** and the associated values along the axis of openness/conservation, self-interest/collective interest (Values infrasystem)

10.8 UNDERSTANDING THE CITY

10.8.1 CORE CONCEPTS

Designing a City Mirror implies designing **web-based technologies capable of supporting users in understanding the underlying social norms and logics of local relational dynamics.** The capability expressed as *"Understanding the City"* through technology refers to the possibility of shaping in a flexible and adaptable way the schema of social interactions in the infrasystem of the relationships in the city, taking into account the balances of power and influence of the parties involved in the relationship within the social system of the city and the domain of action in the functional system of the city.

10.8.2 PROPOSITIONS

The dimensions considered for defining the propositions to instantiate this capability include:

- the **structure of the formal and informal relationships** within the same social structure and with external social structures
- the **impact of these arrangements** toward actions and decisions in terms of support, interference, block
- the **closeness and continuity** of interactions in relation to the type of actions and domains
- the norms and constraints determining the **reciprocal influence** among the city stakeholders in the social system of the city
- the meanings and acceptability attributed to these reciprocal influences and their visibility

10.9 CARING THE CITY

10.9.1 CORE CONCEPTS

Designing a City Mirror implies designing **web-based technologies capable of providing differentiates and adaptative forms of support to local activities in various domains to better address evolving local needs by potentially activating connections among shared or complementary practices.** The capability expressed as *"Caring the City"* through technology refers to the support at the construction of synergic dynamics in the production of resources, delivery of services and knowledge generation within the functional system of cities, by taking into account the grid of interdependences and the general orientations in the two infrasystems of relationships and resources.

10.9.2 PROPOSITIONS

The dimensions considered for defining the propositions to instantiate this capability include:

- the types of actions developed within the functional system of cities across different sectors and domain of activities,
- the interdependence or overlapping among actions within the same sectors and across different sectors, and the structure of relationships derivating from these connections
- the properties of city resources, especially under the profile of their accessibility and permanence impacting on the definition of decisions and actions

10.10 TRANSFORMING THE CITY

10.10.1 CORE CONCEPTS

Designing a City Mirror implies designing **web-based technologies capable of creating a dialogue space for the construction of shared vision of the cities and the coexistence among multiple concurrent visions of the city, its identity and future orientations.** The capability expressed as *"Transforming the City"* through technology refers to the definition of potential reconfigurations of the physical and social system of cities in relation to the infrasystem of collective values at the local scale.

10.10.2 PROPOSITIONS

The dimensions considered for defining the propositions to instantiate this capability include:

- the axes for the definition of the values driving the potential actions, as openness/conservation, self-interest/collective interests, transcendence /immanence (values infrasystem)
- the criteria for the priorities attributed to different values in relation to the perceived proximity of potential transformation and their direct or indirect impact (value infrasystem & physical system)
- the relevance given to specific sets of values in the internal and external definition of the different classes of city stakeholders (social system)

10.11 CHAPTER HIGHLIGHTS

This section summarises the contributions of Chapter 10 to the three outcome spaces outlined in Chapter 2 -Section 2.7. Similarly to the previous chapters, the contributions of Chapter 10 are synthetically described in the table below.

Table 10.10 Chapter 10 Highlights

OUTCOME SPACES	TYPE OF CONTRIBUTION	CHAPTER 1
SYSTEM KNOWLEDGE	THEORETHICAL CONTRIBUTION	Last building block of the Design Theory organising the key concept to describe the capabilities of a City Mirror integrating the core models with the lesson learned from the case studies.
	METHODOLOGICAL CONTRIBUTION	Grounded theory built on the use of applicative scenarios and digital artefacts as sources for the theory development
	EMPIRICAL CONTRIBUTION	
TARGET KNOWLEDGE	FOR RESEARCHERS	
	FOR TECHNOLOGY DESIGNERS	Rationale for some recurrent issues associated with map-based interfaces, temporalized contents, shared contents.
	FOR URBAN PRACTICTIONERS	Connection between typical aspects of city dynamics to their transfer in the design of city technologies.
	FOR CITY STAKEHOLDERS	
	FOR DECISION MAKERS	
	FOR TECHNOLOGY PROVIDERS	
TRANSFORMATIONAL KNWOLEDGE	USERS	
	CITY	
	TECHNOLOGY	

PUBLICATIONS

The following publications include part of the concepts or contents presented in Chapter 10, while in a preliminary form and integrated sometimes in other flows of investigation.

- Lupi L., (2019) Building City Mirrors: structuring design-driven explorations of future web-based technologies for local development, IASDR 2019, Manchester, United Kingdom.
- Lupi L., Antonini A., (2019). City planning and Web-Based technologies: misalignments, convergences and possible future directions.16th International Conference on Computers in Urban Planning and Urban Management CUPUM 2019, Wuhan, China.
- Lupi L., (2018). Rethinking digital maps as collaborative tools: An empirical study on how a map-based platform can be integrated in multi-scale and multistakeholder urban actions. 12th AESOP Young Academics Conference: Navigating Change, Groningen, Netherlands.
- Antonini A., Lupi L., Boella G., Schifanella C., (2017). Time and timing in the city: how to represent dynamic urban entities on a map-based platform. 15th International Conference on Computers in Urban Planning and Urban Management CUPUM 2017, Adelaide, Australia.
- Lupi L., Antonini A., Boella G., Schifanella C., Sanasi L., (2016). Back to public: rethinking the public dimension of institutional and private initiatives on an urban data platform. 2016 IEEE International Smart Cities Conference – IEEE ISC2, Trento, Italy.
- Lupi L., Antonini A., Boella G., Mason E., (2016) Real society in virtual space: a platform to share responsibilities in urban regeneration processes, in G. Colombo, P. Lombardi, G. Mondini (edited by), 9th International Conference on Innovation in Urban and Regional Planning INPUT 2016, Conference Proceedings Book "eagor./e- γορά for the transition toward resilient communities", Turin, Italy.

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CHAPTER 11.

CONCLUSIONS

CHAPTER 11. OVERVIEW

Chapter 11 reconnects the starting point of this work found in the problem of the marginality of information technologies in supporting local development actions with the outcomes of the research process. In this way, Chapter 11 strengthens the connection between the research questions centred on studying the prototypes of web technologies designed as multi-stakeholders, multi-purpose, and multi-scale, and the more general problem-driven question about what type of technology and what capabilities that technology should have to support local actions.

According to this double level of questions, the outcomes of the research are presented in relation to the contributions to the urban and informatics disciplines (**system knowledge**) and to the contributions for the society in general (**target knowledge** and **transformational knowledge**).

Chapter 11 is organised in nine sections as follows.

- Section 11.1 goes **back to the statements related to the real-world problem driving the research** and design explorations in this work.
- Section 11.2 outlines the **answers to the research questions** and the sub-level questions, also including an aspirational answer to the overall research question.
- Section 11.3 presents some notes about the **criticalities linked to the adoption of a transdisciplinary research framework** during the development of the work and the elaboration of the thesis.
- Section 11.4 summarises the **research outcomes of this work to the target knowledge and to the transformation knowledge**, in relation to the main potentially interested target groups and the three facets of the problem: users, city, technology.
- Section 11.5 summarises the **methodological, empirical, and theoretical contributions** to the system knowledge into the domains of the **urban disciplines** selected as roots for this study.
- Section 11.6 summarises the **methodological, empirical, and theoretical contributions** to the system knowledge into the domains of the **system design disciplines in informatics** selected as roots for this study.
- Section 11.7 points out some **open issues** still unaddressed but relevant for the future development of city-mirror-like technologies.
- Section 11.8 anticipates some **future lines of research** to extend and integrate this work.
- Section 11.9 concludes the work with some **final remarks** on the meaning of aiming at creating city mirrors in the future.

CHAPTER 11. DETAILED TABLE OF CONTENTS

11.1 BACK TO THE REAL-WORLD PROBLEM

The starting point of this thesis was a **real-world problem**, that is still there. Information technologies applied in cities, and web-based technologies in particular, deeply changed our way to experience the urban environment at a personal level and contributed to rethinking the management of some urban services leveraging the unprecedented availability of data. Nevertheless, **these technologies remain still marginal in supporting collective actions in cities and contributing to local development processes** [see also section 1.1, Chapter 1]. Indeed, local development actions are not limited to commercial transactions or to the relationships between citizens and public authorities. They include all those actions implemented by groups, organisations, and communities impacting directly and indirectly on the public domain of cities and oriented to extend the opportunities for individual and collectivities to improve the quality of their lives, living environment, and society functioning at large [see also section 1. 4.3. Chapter 1].

The gap between expectations and reality as regarding the potential of web-based technologies of contributing to overcome current collective challenges of cities can be linked to a multitude of factors. First of all, **this gap reflects a specific political vision of cities** and its social environment [see Chapter 1]. Amongst other factors determining this problem, there are the **difficulties of facing the variability of unpredictable urban setting configurations in the definition of scalable and replicable online services**, or the **rigidity of business models for technology provision in cities** crystallising illusionary relationships between governments and citizens [see Section 1.2.1., Chapter 1, and Sections 3.2. and 3.5, Chapter 3]. As argued since the beginning of this thesis, **these aspects are purely contingent and intertwined**. Indeed, a better understanding and modelling of city socio-political dynamics in relation to technology can open new opportunities for alternative business models and services. Research obviously can help in the first step of this process: producing theoretical knowledge, potentially translatable in actionable knowledge outside the academic milieu.

Considering
- the complexity of this problem
- the need for a forced or voluntary change in the dominant political visions instantiated in current technologies for cities to implement any concrete alternative
- and the limited role that research can realistically have in the process (especially a PhD thesis),

this work never aimed at a solution to fill the gap mentioned earlier. **This work tried instead to explore other perspectives, strategies and artefacts to conceptually overcome or bypass the stringent limitations posed by the contingencies linked to a lack of structured and operational knowledge on the link between collective formation in cities and forms of technological support to their local actions** [see Section 1.3.3, Chapter 1].

Undertaking this endeavour, **I decided to keep aside discourses and topics usually linked to smart city** research and smart city technologies [see Chapter 1, section 1.2], preferring to focus on local development. **Local development is not necessarily "smart"**, or rather fast and reactive [see Section 1.4.3, Chapter 1], but it frequently results from the alchemy of orchestrating local interests, resources, initiatives in forms expanding opportunities for growth at a collective level through continuous minimal changes in the definition of local institutions.

Communication among people is the foundation for any attempt of negotiating and composing the different instances represented by the plurality of city stakeholders. For this reason, **I concentrated my attention on web-based technologies** that are specifically meant to enable and facilitate communication among people. Secondly, this choice was also motivated by the fact that these technologies' **socio-political readiness still lags well behind their technical readiness**, preventing their deeper integration in city dynamics and defining a widely underexplored research space. Lastly, the concerns related to feasibility of this work imposed to start the investigation from Web 2.0 platforms (widely accessible and linked to a wide range of urban activities already), looking though to general principles that could be effectively translated to new tools under the paradigms of the Web 3.0, Web 4.0 and Web 5.0 [see Section 4.1.2, Chapter 4].

It could seem at least strange having addressed these topics in a doctoral programme in Urban and Regional Development. However, along my PhD journey, I have been motivated by the certainty that working **to better understand how to get information technologies better supporting collective actions in cities is absolutely relevant for urban research, especially planning research** that is supposed to be proactively engaged with urban phenomena linked or linkable to local development processes for remaining relevant in itself [see section 1.1.4, Chapter 1]. Building on this certainty, I proposed in this work to move beyond the analysis, study and criticism of existing technologies applied in urban environments. I have dared to hypothesise that **approaches, vision, frameworks consolidated in urban research could actually be useful to fill the gap between expectation and reality in the forms of technology support to local actions by taking into account negotiation dynamics among city stakeholders.** However, these approaches, visions, and frameworks necessitate to be abstracted, generalised and operationalised to be transferred to other domains, informatics in primis, and becoming exploitable in the design of future technologies. **In this work, I tried to experiment myself how to structure this transfer at a theoretical and practical level, in this thesis and most of all working in the projects reported in my case studies** [see Chapters 6 to 9]. Indeed, defining **the knowledge problem of "citifying technologies" as a deep design problem** imposed to keep research and design in parallel throughout the investigation process. In other words, this experiment and the nature of the problem made necessary to be directly engaged in iteratively testing assumptions and design choices into the world to extract useful insights for progressing in the direction of aligning expectations and realities and overcoming current contingencies.

The findings elaborated on the basis of the insights gathered across the case studies contributed to outlining the capabilities of technologies reflecting city dynamics, shortened in City Mirrors, that was stated as the objective of the research [see Section 1.3.3., Chapter 1]. The **theory of the City Mirrors capabilities is necessarily partial and provisional** [see Chapter 10], as every design theory I would say. Nevertheless, the value of this work relies on its contribution to improving the understanding of the disconnection between current technology solutions and local development processes through:

- the **reframing of the problem** from being a wicked problem to become a problem that could admit potential solutions (Chapter 3)
- the definition of the specific **design challenges** to overcome the limitations of current web-based technologies applied in cities (Chapter 4)
- the conceptualisation of the multiplicity of social structures, domains of activities, and forms of technological support in a set of **operational schemas** to approach the design of interactive systems in an integrated way (Chapter 5)
- the **strategy to deal with such complexity** in an agile way across different contexts and design processes (Chapter 6)
- the **lessons learned** crafting, assembling, building prototypes of City Mirrors and testing them against city stakeholders'settings (Chapters 7, 8, 9).

Providing new lenses and instruments to address a real-world problem that affects society at large is indeed the true aim of a transdisciplinary work [see Chapter 2], and this thesis embraced this vision. In this sense, the end of this work is actually just the beginning for planning alternative ways to approach the design and use of web-based technologies in cities. In the research protocol applied in the thesis, the phase of action in the world can now start and plan for the future by building on a deeper understanding of the problem [see Fig. 11.1].

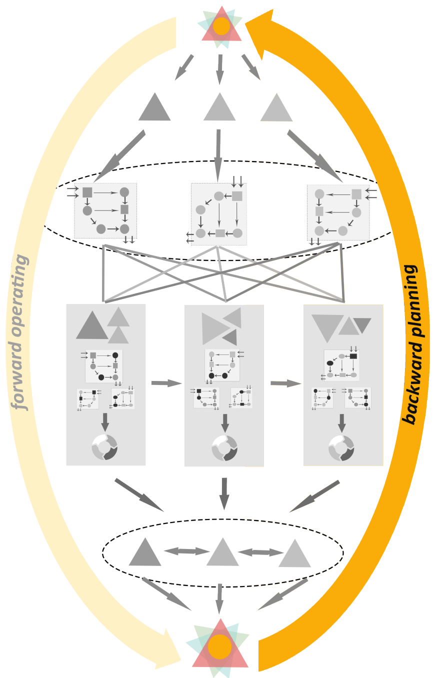

Fig. 11.1 Addressing the problem building on the research outcomes. Or "Backward planning" in the TIDS protocol

11.2 REVISITING THE RESEARCH QUESTIONS

In this section, I am going to briefly summarise the answers to the research questions that oriented this work. At the beginning of this thesis, I have formulated the problem-driven question as follows:

RQ: *how to design web-based technologies to support city stakeholders in the orchestration of local development actions?*

Then, highlighting that this problem is a deep design problem, this overall question was split into two high-level questions reflecting, from a research perspective, the complementarity between investigating city dynamics and designing web-based technologies consistent with the meta-model of the City Mirror.

*RQA*_How the interdependence between users' representations, city context and local actions can be coherently transposed in the digital environment provided by a City Mirror?*

*RQB*_How to design a platform intended to be multi-stakeholder, multi-purpose and multi-scale by taking into account the plurality of interests, goals, types of activities and settings of local development processes?*

Following, the answers to these two questions are articulated by addressing the two groups of sub-questions in which they have been destructured.

11.2.1 ANSWERS TO THE FIRST SET OF RESEARCH QUESTIONS

The first set of research questions focused on the investigation of the interdependence between users' representations, city context and local actions in City Mirrors.

RQ1_What characteristics of the users involved in local activities are significative and acceptable to be represented in a City Mirror for enabling city stakeholders to understand the social context of their actions?

RQ1 aimed to identify the obstacles and implications of rendering users' characteristics as part of different types of social structures in an urban environment and the characteristics of these social structures in an online environment shared among various city stakeholders. In particular, **the characteristics that can be negatively correlated to the acceptance and use of new technologies exposing these types of information because of the risks of sharing them in an open multi-stakeholder environment**. Indeed, even though the rhetorics of the full transparency often permeates the public discourse around city dynamics, information asymmetry among different stakeholders is one of their structural elements and deeply shapes even local practices. Thus, **hypothesising to design city technologies serving a plurality of interests and purposes becomes essential to understand the limit between what is virtually potentially represented on an online city platform and what is significative and acceptable for its potential users to support their everyday operations.**

This research question was addressed in three steps.

1. Firstly, I developed a holistic model of the users considered as part of collective structures in which they operate, complemented by the meta-model of the "collective users" representing these structures as a whole with its own agency, structure and representation. The novelty of this core model (reported in Chapter 5) was essential to overcome the shortcomings and scarce significance of common user models focusing on a personal profile and cognitive frameworks as regarding the operational and social constraints bounding the single user's actions in collective actions in cities. This model organised the core properties and characteristics defining users' roles, type of actions, and interaction rules within groups, organisations, communities and networks.

2. The second step consisted of practically using this core model as a mental model during the design activities associated with the case studies (reported in Chapters 7,8,9), especially to correctely interpret and stratify the insights gathered from the numerous stakeholders involved in the design processes. The three case studies stressed the element of potential conflict and negotiation among city stakeholders by proposing: a) a civic social network meant to support the self-organisations of local actions, independently from a top-down lead; b) a multi-tool platform aimed at supporting cooperative governance mechanisms in city transformations; c) systems and policies to open and rebalance the city data ecosystem. At this step, the core model had been iteratively refined in its granularity and its effectiveness tested to frame the issues emerging from the field.

3. In the third step, the core model was used to orient the cross-case analysis that led to the formulation of the core concepts and propositions completing the theory of the City Mirror capabilities presented in Chapter 10. In particular, the insights and following abstraction and definition of the key concepts had been based on the analysis of needs and practices of:

- formal and informal groups, within and aside organisations, operating in a centralised or distributed way in many domains and at multiple scales; place-based communities and communities of practice; territorial, professional and personal networks, in the first case study
- public, private and non-profit organisations involved in local processes across a multiplicity of settings and contexts; local communities as existing or perceived; groups and networks across organisations and communities, in the second case study
- organisations and networks within and outside the city data ecosystem in the third case study.

Regarding the layers of the user model outlined in the first core model, the key findings addressing RQ1 can be summarised as follows.

At all levels, the case studies (and in particular the first two) highlighted the importance of keeping a **strict consistency between the roles covered by users within the social structures in which they operate, and the roles played on the platform without introducing implicit subordinated relationships among users, between individual users and collective entities, among collective entities**. Indeed, roles commonly defined on web-based platforms, such as "initiator" and "follower" or "group admin" and "member", repeatedly resulted considered problematic, especially in cooperative dynamics among peers having different level of influence over the public at the local level. Related to this aspect, in particular the second and third case study helped to clarify that a priority for the coexistence of multiple stakeholders united in formal and informal partnership offline was **representing the differences in competences and responsibilities of subjects jointly participating to the same actions and processes, especially when their contributions to the actions' outcomes were not clearly separable.** The third cross-layer priority for a significative and acceptable representation of city stakeholders in a shared platform is the need of **arranging a multi-level representation of the mission socially attributed or publicly pursued by specific actors and the drivers and motives related to contingent situations and actions**. This point is meant to minimise the propagation of conflicts of interpretations over the roles and aims of each stakeholder involved in a specific action.

Looking more specifically at collective users such as **Groups**, a critical issue for the use of a City Mirror platform emerged in the case of **spontaneous groups autonomously set within other organisation, larger groups or territorial networks, but pursuing goals not completely aligned to the one of the upper-level structures.** In these cases, **the visibility of the group** as an independent unit is a problem in itself, that can be disguised in common circumstances and made acceptable by transferring the attribution of the group's action to the larger unit and flag the specific competence or responsibility of the group's members, besides the roles already covered in the larger unit. Indeed, in these cases, this operational configuration can lead to conflicts between formal and informal leadership that could hinder the achievement of the group's goals and its possibility to coordinate their activities across organisations, communities, and networks, or to scale up.

Rendering the boundaries among different **Communities of place**, especially when not self-included within administrative perimeters, resulted to be essential for distinguishing between communities interested by area-based interventions and communities impacted by specific local development actions, both promoted by public or private interests. However, a critical aspect making this **boundary delimitation acceptable is to link it to a specific action, set it as strictly temporary** (even though communities of place tend to be commonly seen as permanent), and **open the operation to trace these boundaries** to all the promoters of local actions. The **representation of the community internal dominance schema**, surprisingly, emerged as an important element to **let the community perceived as more permeable**. This point could be correlated to the exposition of the focal points and dynamics for the inclusion of new external elements, and at the same time to acknowledge the specific roles of some members of the community.

Defining **Organisations as bottom-up units** on a multi-stakeholder platform means not establishing organisations as standalone entities, existing independently from the presence of their agents on the platform, but deriving instead the organisations' representation from the presence of their agents as regarding consistence, distribution, involvement in local actions, and their aggregation in operational units and lines. While this option resulted convincing to avoid the phenomena of the "empty box" and potentially allow richer and more authentic pictures of the organisations involved in local actions, the need for filtering and control of the representation of an organisation in a multi-stakeholder environment remains. However, a solution to these divergent needs explored in the first case study is **decoupling the permanent features of an organisation from its day-to-day operations**, associating the first one to the places where the organisation operates, and the second ones linked to the agents implementing these operations. Another central issue in the bottom-up representation of partnerships among multiple organisations or the articulation of large organisations is the exposition of polyarchy mechanisms, defined as the **asymmetrical dynamics of self-determination and participation to the organisation processes and the actual decisional impact of these practices**, both internal and external to the organisation and partnership. In these cases, the acceptability of a City Mirror is subordinate to the chance of **legitimately provide and support multiple parallel representations of the actions resulting from these dynamics** (for instance, by emphasising the process over the outcomes, the importance of the partnership in the context, etc. through different uses of the same building blocks available for the representation of these actions).

An important aspect for a significant and acceptable **representation of Territorial Networks consist of the timeseries linked to the past activation of the network, the reasons for the activation and the related actions**. Indeed, differently from personal or professional networks, the case studies highlighted how territorial networks seem to be more resilient to changes in their nodes. On the other side, the identification and representation of all nodes of territorial networks can also result problematic when expose the persistence of informal coalitions, making preferable to highlight the extension of the network, its levels, and possible cross-network relationships.

As regarding, the representation of the **individual user in the plurality of the roles covered in the city** (e.g. as a resident, professional, activist, parent, public officer, etc.), the first study allowed to extensively test and discuss this possibility in a wide range of applicative scenarios, always confirming the acceptability and even desirability of this option to support the self-organisation of local actions. The possibility to highlight role-based expertise, agency, choices, level of engagement and commitment of individuals in local actions figured between critical requirements also in the other two case studies, both for the participation to urban transformation and the activation in the city data ecosystem.

While some insights from the field could apparently result controversial, they actually clearly reflect measures largely adopted in non-technology-supported activities, especially in the negotiation of formal and informal roles in collective endeavours. In this sense, the intent of exploring the condition for designing a technology-supported political spaces led to identify as a priority the possibility of modulating visible and invisible in the representation of the goals of groups, the boundaries of communities, the protocols of organisations and the nodes of territorial networks.

RQ2_What factors should be considered for matching the specificity and uniqueness of local development actions in urban environments with the openness and generality of the online environment provided by a City Mirror?

RQ2 aimed to understand how to create a common ground for technology-mediated communications, decisions, and actions despite the variety of domains, purposes, scales, and timings of local activities in cities. The mainstream approaches for the design of current urban technologies and web-based technologies applied in urban environments are a) reducing the "users' online playfield" to a limited set of physical or visible components linked to offline actions and b) recurring virtually everywhere, or focusing on one specific domain and a narrow set of activities technologically supported within a "silos-platform". These approaches are grounded, respectively, on 1) a lack of operational conceptual models to handle the non-visible components of the city and 2) a lack of systemic accounts concerning the interrelation among actions configured in various domains. On the contrary, the proposal of the City Mirror points in the direction of considering the generality of non-visible aspects of the reality (taken at the appropriate granularity and level of abstraction) and the openness to the plurality of local actions, handling the specificity of each urban environment and the uniqueness of each local development process.

Analogously to the sequence of steps needed to answer RQ1, this research question was addressed by proceeding from the development of the core model of the City Ecosystem (Chapter 5) to its use as a conceptual device in the three case studies (Chapter 7 to 9), and then as an infrastructure to build on the core concepts of City Mirror (Chapter 10). In particular, it is worth recalling that each case study provided a wide overview of a variety of domains at all geographical scales and in different urban settings. The sum of the three case studies also allowed to investigate the connections between systems and infrasystems of the city from multiple perspectives deeply, in relation to the scope and context of use of the considered web-based technologies.

The three case studies provided the opportunity to explore three different approaches for matching the specificity of local development actions in urban environments with the generality of a multiscale and multipurpose platform.

- In the first case study, this problem had been addressed through the modular construction of each content created on the platform, that could be easily characterised to represent simple and complex urban entities and range from a single media unit (text or image) to a stratified media object composed by a set of interlinked media units, optionally also hierarchically structured. In addition, the **platform itself as a whole had been progressively configured as a toolbox of objects and components** that could be freely aggregated and reconfigured in their purpose and meanings to support several applicative scenarios, and the related coordinative or cooperative practices.

- In the second case study, developed in quite different urban settings and in relation to applicative scenarios associated with systemic challenges, the balancing between specificity of the operational framework of city stakeholders and the environment provided by the cooperative governance platform relied on the modelling of a set of **modular meta-processes covering the logical articulation of objectives and steps along cooperative initiatives, but allowing their combination and segmentation. These meta-processes worked as a flexible infrastructure to build on the specific local actions.**

- In the third case study, the balancing between specificity of local actions and generality of multiscale and multipurpose data platforms relied on the **definition of the action and data flows associated to different type of decisions to be locally supported**.

RQ3_What types of processes and decisions in local development actions could be effectively supported by a web platform having the characteristics of a City Mirror in comparison with other existing tools?

RQ3 aimed to outline the boundaries of the operational space for technologies meant to be multi-stakeholder, multi-purpose and multi-scale, highlighting the potential of covering new applications currently unsupported by commercial solutions for city activities.

This research question was addressed from two sides at the same time. On the one hand, in Chapter 4, I have presented a classification schema of the macro-families of current web-based tools applied in urban environments. On this basis, in the construction and combination of the case studies, I had the opportunity to critically analysing the forms of support provided by a set of prototypes and tools covering almost all the classes of technologies isolated in the classification schema. Indeed, FirstLife was a location-based social networking site with characteristics in between global and local social networks [Chapter 7]; WeGovNow was a City Dashboard composing seven other platforms ranging from reporting tools to voting tools [Chapter 8]; MK:Insight2.X outlined a set of alternatives to the common Open Data portals [Chapter 9].

On the other hand, RQ3 had also been addressed by developing a core model of the forms of technology support to collective actions [Chapter 5] used in the case studies to reflect on:

- the interactional patterns among users (coordination, cooperation, collaboration at different scales)
- the phases traceable in most of local development actions across programmes, projects and services (analysing, planning, designing, implementing, managing, monitoring, assessing).

While all the three platforms dealt with coexistence and competition issues, case study 1 examined in particular the modalities of supporting coordination practices at different scales, case study 2 investigated how to support cross-domain cooperation mechanisms, and case study 3 explored the boundaries of technology-mediated collaboration dynamics among different stakeholders.

Moving from the interactions among users to their actions in the city, each platform was intended to support a subset of the phases mentioned before. FirstLife envisioned support for discovering and analysing what it was happening in the city, and at the same time help in managing the documentation, organisations and communication of local actions. WeGovNow planned to support the design and implementation of urban transformations, by also providing the tools for monitoring their evolution. The three concepts developed for MK:Insight2X projected the data portal toward active support to the planning and design of data-related actions and, at the same time, toward the assessment of the local information needs and the utility of the available data for city stakeholders.

In comparison with **public dashboards**, multi-stakeholder tools such as a civic social network or a cooperative governance platform allowed to overcome the polarisation among different users' segments by limiting through specific design choices (such as parallel descriptions of the same entities in the same tools or across tools) the chances of their misrepresentation. Consequently, the two kinds of platforms made possible a communication many-to-many, relying on the public visibility of real-time contents, notifications, and alerts from multiple verified sources corresponding to the various subjects involved in the management/self-organisation/implementation of collective actions.

In comparison with other **exchange platforms** for data, votes, proposals or online services, multi-stakeholder and multi-purpose tools such as the one outlined in case studies 2 and 3 allowed to set up a plurality of dynamically changing "rules of interactions", technology-supported or only technology-mediated and then developed offline. In other words, moving beyond the single protocol toward more flexible adjustments as regarding the levels of access to information based on locality, roles, competencies, affiliation, goals. These flexible adjustments had been based on the concepts of considering the platform itself as a toolbox (concepts also used in the first case study) serving both consolidated and emerging flows of actions.

In comparison with **local-scale scouting applications**, a multi-scalar digital environment such the one examined in case study 1 allowed to better contextualising local actions in the city, helping to connect online and offline actions that could be, at the same time, distributed online and centralised offline. Place-based criteria for filtering contents and types of actions, instead than filters linked to the user profile, also helped in this direction.

In comparison with **segmentation tools** aimed at clustering users in independent and scarcely permeable aggregations, multi-purpose and multi-scale platforms made easier to avoid a static and mono-perspective representation of the city and single actions happening in the physical space or concerning local transformations. At the same time, moving beyond the spatial segregation of users by representing different types of communities, or networks, or organisations and their scale of actions, platforms such as a civic social network or an urban governance platform extended the opportunities to activate or document trans-scalar partnerships pertaining different spheres of action. In this sense, the representation of local initiatives in case study 1 and urban processes in case study 2 had been oriented to connect physical spaces and "institutional spaces".

As regarding the types of decisions that can be supported by a multi-stakeholder, multi-purpose, multi-scale, FirstLife was an online environment allowing the **activation of coordinative dynamics**, both planned and reactive, established and managed also independently by all the stakeholders involved. In other words, the platform provided the option of **making timely decisions in relation to what was happening in other areas of the city or driven by different stakeholders without the need for direct interaction**. Thus, without pre-selecting information on the basis of agents, sector of activity or scale, this kind of platform reinforced the context-awareness of users on their space of action when confronted with unpredictable collective dynamics.

Regarding more specifically processes, the WeGovNow platform instantiated a model of technology oriented to **support the entire development of local processes and multiple actions strands driven by different actors in a shared online environment**. The composition of multiple tools into a modular platform allowed to calibrate the different forms of cooperation related to the contingent goals of the actors involved phase by phase in analysing, planning, designing, implementing, managing, monitoring, and assessing urban transformations.

The three design concepts for building a City Data Open Portal, differently from the dominant solutions for Open Data Portals, provide support to plan and manage data operations based on collective information needs by distributing their collection, elaboration and dissemination among different stakeholders based on flexible and dynamic arrangements at the local level. The proposed tools, all multi-stakeholder, multi-purpose and multi-scale, allow the **clustering of users sharing similar goals and working on the same**

sources (CCSI), **the assessment of the social value and potential impact of existing and required data sources** (QBINA), **the space for optimising the management of local resources, in terms of infrastructures, expertise and institutional capital** (CDP).

Back to RQA*, the interdependence between users' representations, city context and local actions can be coherently transposed in the digital environment provided by a City Mirror connecting:

- **a socially acceptable rendering of the collective structures in which users operate, taking into account the roles of these structures respect to other stakeholders, their scale of actions, and the relationships of operational dependence in local practices**
- **the sensitive handling of the status of city resources, the nature of social relationships and the impact of particular values orienting the actions of stakeholders' clusters over the management and transformation of the physical and functional systems of urban environments**
- **the definition of flexible and modular options of technology support in local practices allowing users to strategise, organise, implement and adjust social interactions in collective endeavours.**

11.2.2 ANSWERS TO THE SECOND SET OF RESEARCH QUESTIONS

The second set of research question focused on the issues related to the design process of a City Mirror in the phases of pre-design, design and post-design of platforms meant to be multi-stakeholder, multi-scale and multi-purpose. The answers to these research questions emerged mainly from the application of actions research and research through design methods in the three case studies (see Chapter 6).

RQ4_What types of social, contextual and technological constraints could facilitate or hinder the integration of a web platform designed as a City Mirror in local development actions?

RQ4 focused on the analysis of the context and potential directions to explore, preferably in the pre-design phase, to establish **a connection between technology capabilities and the political soundness of the technology capabilities in local development actions**. The early identification of these factors is functional to defining the strategy for intervening in this kind of design space.

This research question, as well as RQ5 and RQ6, was addressed by relying on research through design methods across the case studies reported in this work. In other words, by intervening in the various geographical and operational contexts through technological artefacts co-designed, used in real-world settings, and deeply discussed with the participants involved in the design processes. In line with the transdisciplinary research framework adopted in this work, the knowledge regarding potential barriers, bypass solutions and sustainable alternatives emerged from working with the people involved in the research.

The three case studies provided a wide range of settings and situations to be analysed for highlighting the most critical aspects concerning the integration of a multistakeholder, multi-purpose and multiscale platform in local development actions. As extensively reported in Chapters 7, 8, and 9, the field activities had been conducted in Italy and in UK, due countries having opposite normative frameworks and diverse peculiarity as regarding the usual relationships among different stakeholders' clusters (two aspects absolutely central in city governance issues). Moreover, the applicative scenarios for the three city-mirrors-in-the making had been developed in cities ranging from the metropolitan level to small town and at different scales, including the regional and national scale, and in old and new urban settings. The major practical learnings from these situations can be summarised as follows.

a) Social constraints
  - facilitating the integration of City Mirrors:
    - the presence of catalyst entities ready to engage associated and related organisations and communities spatially close or thematically, both offline and online, in chains of linked local processes
    - the diffuse demand of fairer conditions and a better balancing between online effort and offline benefits (respect to current adopted solutions) by the relevant stakeholders in local actions
  - hindering the adoption of City Mirrors:
    - a high-level of social fragmentation in local communities and groups inducing to define small autarchic actions instead of interventions based on opportunities for joint actions among different stakeholders
    - instability of local networks and volatility of the human resources in city organisations

b) Contextual constraints
  - facilitating the integration of City Mirrors:
    - a consolidated set of practices to share the responsibilities and the accountability for local development actions among city stakeholders
    - the strong independence of the privates, knowledge cluster and third sector in pursuing their own agenda reacting to the change of their operational context.

  - hindering the adoption of City Mirrors:
    - the pervasiveness of public and private entities formally and informally seeking for the approval or authorisation of the local government to adopt the platform or stop its use (also replicable in the dynamics between national and local government)
    - the "immaturity" of Public Agencies to play in a shared space without having the control over the technology and supported actions (factor that seems impacting more than political support of local governments in the experiences of the case studies)
    - latent conflicts between the administrative and political sphere of actions of local governments, as well as the ones between the recognised social mission of other stakeholders and their viability needs
    - a misalignment between low-level and upper-level strategies for the negotiation over local actions among different city stakeholders

c) Technological constraints
  - facilitating the integration of City Mirrors:
    - having a provider external to city dynamics or that cannot be perceived as part of local allegiances (automatically excluding the adoption by the "non-aligned" parties)
    - possibility of downgrading and upscaling the platform functionalities, or rather configuring opt-in/opt-out choices linked to the single action to be supported and the stakeholder working for the adoption, allowing progressive levels of direct engagement and visibility on a shared virtual space
    - independence of the adoption process from the operational (and funding) framework of a specific project

  - hindering the adoption of City Mirrors:

- the over-exposition of previous failures and issues related to technological platform tested in the past, regardless of their similarities with City Mirrors
- the current unquestioned use of mainstream technology solutions formally compliant with legal requirements by the dominant stakeholders in the environment, even though not focusing on multi-side needs and perspectives (while this aspect also pushes for coalitions opened to alternatives).

RQ5_What types of approaches could be applied in the design process for balancing the functional and non-functional requirements associated with the different perspectives and goals of city stakeholders?

RQ5 aimed to explore different approaches for engaging potential users into the design process, considering the goal of designing a platform to be opened to all actors and actions and not establishing given static hierarchies between primary and secondary users, or limited to a limited set of target users. In particular, this research question focused on **understanding pros and cons of strategies and techniques for balancing between functional requirements (referred to what the system do) and non-functional requirements (how the system is perceived, its meanings, its use).** In other words, balancing not only the requests associated to different needs that the system is supposed to meet, but also the perspectives of users as individual and part of upper-level social structures in order to define a shared space of action among diverse city stakeholders. Indeed, the functional requirements for a multi-purpose, multi-stakeholder, and multi-scale web platform to support local actions need to also match with the non-functional requirements coming from the competing goals and values associated with the different purposes that they intend to pursue in the public arena. And lastly, these requirements should also be flexible enough to react and response at the changing and unpredictable use patterns defined by local activities at different scales, that inevitably dynamically refactor goals and needs.

The objective in Case Study 1 was to design a new platform, in terms of technological components, interactions and functionalities, but also as regarding the platform scope. The design objective of Case study 2 was to harmonise and mix a set of existing platforms by transforming their scope without disrupting their structure. Case study 3 pursued the objective of renovating a pre-existing platform, by keeping its scope and completely rethinking its structure. These three situations cover a wide range of circumstances recurring in the design of digital artefacts that could imply

a) developing something new from scratch focusing on the platform features and interfaces,
b) refactoring something already existing prioritising the definition of new services based on consolidated technologies, by focusing on the compliance between the workflow of these new services and the logics of the components to be assembled
c) or rethinking something that proved to do not work as intended, starting from the in-dept analysis of the information exchange among the platform users to trace and support the production and use of information.

The three case studies provided the opportunity of elaborating and testing multiple approaches for achieving the kind of balancing mentioned before.

- In the first case study, I pursued **a cyclical and iterative approach**, that can be defined people-based, or better **people-driven**, considering the different stakeholders involved in their definition as units “bringing to the table” their specific needs and interests. The engagement of several “units” belonging to the same stakeholder cluster led to the consolidation of the set of functional and non-functional requirements for that segment of potential users. However, the weight and priority of the emerging desiderata and requirement had been assessed and modulated in relation to the forms and depth of the engagement by considering

- the **uniqueness** or generality of the expressed needs
- the **depth** of the insights provided as regarding the nature and dynamics of local processes
- the **alignment** between the applicative scenarios collaboratively developed and the aim of the platform (creating a shared virtual environment for the orchestration of local development actions) beyond the contingent scope (of defining and developing a civic social network).

This **approach provided a broad and detailed account of the requirements systems suitable in a variety of city settings and type of local development actions**, not achievable with mainstream methods of requirement elicitation based on indirect contacts with potential users (e.g. surveys) or through common participatory design methods in small groups. On the other hand, this approach is certainly time consuming and resource-demanding (human resources). Another critical aspect of this approach is the systematisation of the findings to orient the design process. The strategies developed along the design process to make this approach more manageable relied on the **general segmentation of the involved stakeholders in homogeneous clusters based on the similarities of their pursued goals, type of actions, compatible value-system.**

- In the second case study, partially overlapping the first case study timewise, I could leverage on the lesson learned from the on-going activities in the other case study. In this situation, I opted for an approach that can be defined as **agency-based** in the balancing of the functional and non-functional requirements to inform the platform development. In other words, the people involved in the process had been considered primarily as agents of their organisations, taking into account the cluster of goals, internal and external responsibilities, and competencies and protocols of the organisations they were representing. Thus, the **requirements had been linked to the specific boundaries of the agency of each organisation** in the virtual shared space represented by the City Mirror. Again, I had to elicit and interpret the needs of a plurality of subjects belonging to the same class of stakeholders (e.g., multiple municipalities), mediating the access to the exploration of the needs of other stakeholders related to them in the same processes supposed to be supported by the City Mirror.

This approach allowed to efficiently and effectively "extracting" the relevant inputs for proceeding in the definition of the platform's functional and non-functional requirements and the associated services, grounded on the negotiation of the ones expressed by each segment of the organisations representing the prospective platform users. Or rather, performing this extraction relatively quickly, with limited rounds of multi-party negotiation, and without collecting redundant materials. Another advantage of this method consisted of the advantage of easily comparing the set of requirements coming from organisations operating in different contexts. For instance, by taking into account the difference of the normative frameworks between different countries in the definition of the responsibilities and competencies, but focusing on the direct implications of these frameworks over the forms of technological support provided by the platform. A shortcoming of this approach is that "treating" separately distinct relevant groups (organising them in parallel streams) exclude the possibility of finding through dialogue other compromise options among conflicting goals and priorities that could eventually emerge from the reciprocal understanding of other groups' needs. This possibility is though bound to the willingness of one or more organisations of sacrificing, for instance, part of a competitive advantage or investing more resources. Thus, the potential existence of this condition should be evaluated case by case against the advantages of a quick process, more predictable in its outcomes.

- In the third case study, the radical approach to the requirement elicitation relied on “silencing” the public discourse around the reciprocal stereotyped representations of different stakeholders by focusing instead on identifying and comparing the structures and practices leading to the definition of socially robust requirements across organisations. While in the previous two case studies I always tried to consider the bundle of discourses, practices, and structures defining the applicative scenarios for a City Mirror, the gap between wishes and actual operations to be supported was so extended in this case study to make it blocking for the purpose of outlining a balanced set of requirements to provide alternative forms of technological support to local development actions.

  This approach narrowed down the information to be considered relevant in the stakeholder engagement output, keeping aside the constraints related to the consistence of the public discourse and the online environment provided by a City Mirror till the end of the process. However, the uncertainty related to the possibility of collecting the appropriate type of information and the selection of the relevant information required a significant amount of preparation work and ex-post analysis aimed to carefully separate individual perspectives from the ones of specific classes of stakeholders. Help in this direction came from the choice of setting the requirements elicitation around a challenge-based process, calling the involved stakeholders to focus on concrete actions and strategies to overcome a specific challenge, but keeping the option of setting their challenges for themselves. The analytic effort then went in the direction of generalising the criticalities and opportunities related to different types of challenges.

In all the three circumstances, the essential element for balancing different perspectives and goals of city stakeholders in the requirements’ definition had been the identification of needs’ patterns linked to the similarities and differences in their operational framework, responsibilities, competencies, or more in general, their agency to overcome potential sources of conflicts. The needs’ patterns have been outlined by generalising the specific patterners developed with the participants in the case study and as part of the research activities.

The **composition of the design and development team** deeply influenced the choice and results connected to the three approaches providing some additional insights about pros and cons of different strategies given the working setting.

- The approach pursued in the first case study relied on a moderated availability of human and technological resources for the implementation of the platform, composed by a group of web developers and another nucleus conducting all the “non-coding” activities, working independently while coordinating their activities. In this setting, the high commitment of team members (at a personal, professional, ideological level) resulted essential to deal with the uncertainty and limited planning of day-to-day operations, driven mostly by the ongoing collaborations in the process. This “extreme agile” approach cannot be sustained indefinitely on the software development side, periodically requiring splitting the two strands of development and engagement. Or rather, this approach required to manage in parallel the activities devoted to R&D and strictly linked to the platform development, and the engagement activities needed to keep the collaboration continuously active for avoiding long discontinuities in the mutual relationships between platform providers and city stakeholders.

- The approach for the requirements elicitation and definition in the second case study had been developed in a setting characterised by good availability of human and technological resources such as a large EU project, involving seven teams for the technological part of the project coordinated by one of them, and two separated teams dedicated to public participation and communication activities. Nevertheless, the apparently fortunate operational frame of this case study had been under-exploited because of the need to prioritise project contractual duties and responsibilities and a low commitment of team members. In this setting, the approach based on the principle of segmenting the subjects involved in the requirement definition and assessment and indirectly mediating and reconnecting their instances facilitates to achieve meaningful and viable results, without scarifying the effectiveness and rapidity of the process (in compliance with the requests and priorities of the involved parties).

- The approach followed in the third case study relied on a limited availability of dedicated resources, composed by a small and highly committed team working simultaneously on the project's technological and urban aspects. However, there were asymmetries in favour of research goals more than development goals. In this setting, balancing the requirements definition against the plurality of interests and goals extensively relied on analytic methods, compressing the time devoted to local stakeholders' engagement. Benefiting of greater independence from day-to-day pressures in comparison with the first or second case study, the requirement definition proceeded logically and rationally from a study to another, exploring all the options at a theoretical level and systematically testing them against the insights and constraints posed by the involved stakeholders in the initial steps. On the other hand, while demanding less effort from the city stakeholders in the phase of the requirement definition, this kind of approach then imposes a significant effort on the side of the potential platform providers to make evident and transparent the bridge between the needs expressed by the relevant stakeholders and the design proposals based on those needs.

In the end, as a practitioner before than as a researcher, I would recommend to other practitioners to define their approaches for multi-stakeholder design processes by structuring agile micro-teams conceived as a "dual-side task-force", even in the working setting of larger projects.

RQ6_What aspects should be considered for evaluating the correspondence between the platform functionalities and the expectations of the city stakeholders to be supported in their actions?

RQ6 aimed to investigate the possibility of creating a bridge between system designers and city stakeholders to assess the consistency between the operational framework of the intended users and the forms of support provided by the specific platform under development, especially in a post-design phase. Establishing the correspondence between users' needs and provided services is a well-known principle in system design. But current evaluation frameworks for technology are focused on the usability of tools in a user-centred perspective, or on the efficiency and effectiveness of technology in itself. Attempting to address the research question RQ6 implies readapting and extending these evaluation frameworks to deal with needs and expectations often defined at higher level, on the basis of the reciprocal dynamics between city stakeholders predominant respect to the assessment of the platform in itself.

By focusing on the evaluation phase of the design process of some *City Mirrors-in-the making*, it is important to made explicit that this research investigated the evaluation of technologies in progress or at their early stages for identifying how to formulate the appropriate evaluation criteria emerging from the practice. In this sense, the approaches to the early evaluation of digital artefacts experienced in the three case studies necessarily differ from other evaluation approaches of finished products or trying to assess their adoption after a long time from their release. These experimental approaches had been built by considering:

- "technology providers" (i.e. the development team) and the "technology users" (i.e. local stakeholders)
- timings for the "expert" and "non-expert" assessment, as well as "technology" and "city" sides
- procedures for defining the appropriate evaluation criteria focusing on observation, active explicit negotiation, rules definition.

In case study 1, considering the iterative and cyclical nature of its design process, the cyclical evaluation of the prototype was carried out as an internal assessment within the development team based on the informal external assessment of the stakeholders involved into the design process. By testing the platform in working environments with the stakeholders, it was possible to clearly identify the "social desiderata" case by case, and then furtherly elaborate these desiderata into evaluation criteria to be proposed at the participants in the process at the following occasions and validated them together. Therefore, this retrospective analysis of the platform's functionalities in relation to the emerging social desiderata and evaluation criteria was based on observational procedures [see Chapter 7].

The experimentation of the platform with a wide range of users segments showed the importance of assessing the correspondence between:

a) **the responsibilities of single users over the interaction with the platform contents** (e.g. add, integration, editing, connection, sharing) **or in the relationship with other users mediated by the platform** (e.g. membership of a group or light-weighted cooperation)

b) and the **impact and limitations potentially imposed on other users' choices**, within or mostly outside the platform.

Another important factor to consider in the assessment is the **risks associated with giving visibility to local coalitions**, frequently associated with specific spatial patterns. Thirdly, the assessment requires to consider **competitive advantages and asymmetries of information** sometimes structurally needed for the implementation of local development actions.

In case study 2, considering the complexity of getting along multiple development teams and administrations, the evaluation of the prototype proceeded in a negotiated way, by alternating evaluation sessions with the development teams and evaluation sessions with the stakeholders involved in multiple iterations. In this way, the social desiderata of the latter group (non-experts) were compared with the needs or requests of the development team (tech experts) in an almost simultaneous way, and homogenised into a shared system of rules for their prioritisation. Desiderata, needs, and priority rules informed an analytic elaboration of evaluation criteria that could take into account both the specificities of the urban processes and the technological constraints of the platform [see Chapter 8].

A critical aspect in assessing the platform against real settings included the possibility of distinguishing between the platform's capability (in terms of provided functionalities) and the actions required to make the platform in use that are not related to the platform functionalities (e.g. dissemination, marketing). This experience also showed the importance of outlining the specific framing attributed to a technological platform, intended as the supposed boundaries for its cogency in relation to the applicative scenarios, beyond the platform scope outlined by specific applicative scenarios or its function in the supported processes.

In case study 3, considering the exploratory nature of the proposal concerning the data portal, the evaluation focused on the "rules" to shape the next prototype's functioning, not on the prototype in itself. This projective approach to the evaluation relied almost exclusively on the assessment of not-expert carried out by considering their working environments and the applications of city data. This scenario-based procedure led to identifying social desiderata, needs and constraints for assessing the future platform against the stakeholders' expectations, outlining a set of evaluation criteria looking both at the platform and its domains of application.

This case study highlighted the importance for multi-stakeholder and multi-purpose technologies of enabling different segment of users to assess the **compatibility of their goals with the frame of goals, mission, and capabilities of other stakeholders**.

Reflecting on the three case studies and the common challenges emerging from these experiences, **the main takeaway is related to the definition of the actions and not the goals to be supported as regarding the technology assessment.** Even though it could seem counterintuitive, the prerequisite for evaluating the consistency between city stakeholders' expectations and platform functionalities of City Mirrors is excluding the explicit definition of the users' goals. This principle moves in the opposite direction of the majority of design and evaluation frameworks centred on the definition of the users' goals to meet their needs better. **Working without relying on the statement of explicit goals emerged as the most important and characterising aspects of pursuing a stakeholder-centred design.**

In the case of local development actions in urban settings, **the gap between explicit goals and implicit goals in multi-stakeholder actions could lead to misinterpreting the priority order and nature of the needs that city technologies are called to cover**. Indeed, as emerging from the research, providing technological solutions "politically sound", intended to define a pluralistic and fluid virtual space for collective actions of different stakeholders, implies to allow users flexibly readjusting their goals at the level of the social structure or the area in which there are operating. Given a specific framing of the social structures involved in local development actions and their framing of the role of technology in them, the desired form of technological support is bounded to the contingent and temporary configuration of:

- the discourses linked to specific actions, both internal to the actors and target-oriented
- the structural constraints directly limiting the agency of the user in that action over space and time (e.g. formal or informal public attribution of responsibilities)
- the nature of the practices (e.g. consolidated, experimental) linked to the action and the modalities for their implementation and representation.

These aspects correspond, respectively, to the appropriate solutions for the content management on web-based platforms, the patterns for the use of the platform, and the function of the platform of its components into the dynamics of the action, independently from the single stakeholder. Thus, excluding the possibility to know what the goals to be supported are, a proposal for the assessment of the correspondence between expectations and technology solutions based on this principle is schematised in Fig. 11.2.

Back to RQB*, ***the plurality of interests, goals, types of activities and settings of local development processes can be taken into account during the design of a platform intended to be multi-stakeholder, multi-purpose and multi-scale:***

- **in pre-design phase, by distinguishing between opportunities for operational allegiances and sources of local conflicts that could be amplified by the platform and likely hindering its use**
- **in the design phase, by identifying the needs' patterns of the various stakeholders' clusters linked to the similarities and differences in their operational framework, responsibilities, competencies, or more in general, their agency to overcome potential sources of conflicts.**
- **in the post-design, by assessing technology's capability to malleably meet the contingent and temporary configurations of interests, constraints, and practices in local actions.**

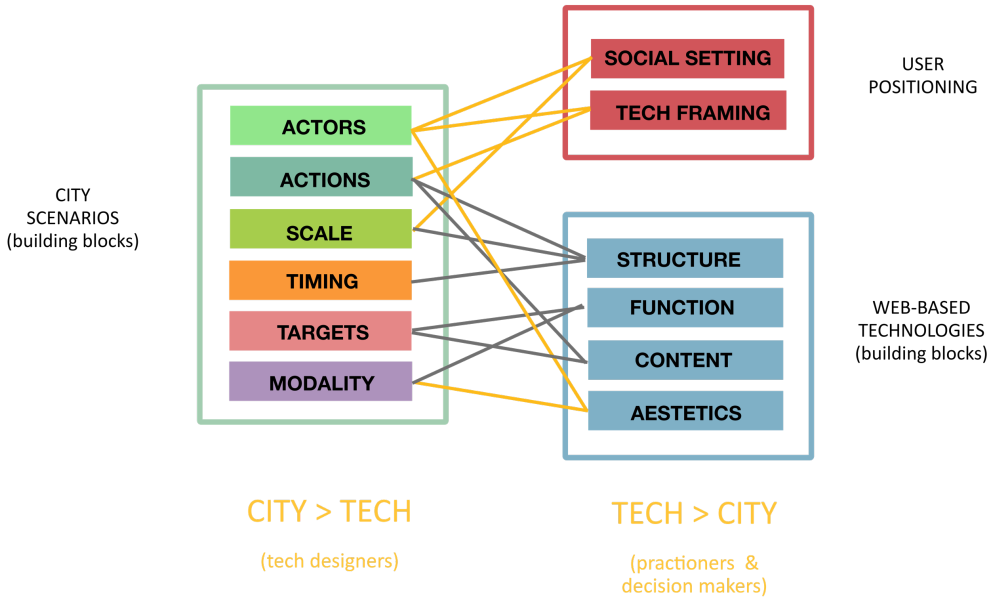

Fig. 11.2 Correspondence between the aspects for evaluating the expectations of city stakeholders and the platform functionalities. On the left, the box "city>tech" includes the main building blocks outlined in Chapter 10.

11.2.3 ANSWERS TO THE RESEARCH QUESTIONS AND GOALS OF THE WORK

As indicated in Chapter 4 [section 4.6], the two groups of sub-research questions are respectively linked to the "substantive" and "procedural" part of the Theory of the City Mirror capabilities outlined in Chapter 10. In other words, the substantive part of the theory refers to the corpus of concepts and relations among concepts included in the core models [Chapter 5] and the propositions of the theory [Chapter 10]. The procedural part to the principles for managing these contents at a practical level in terms of assessment and decisions, as experimented in the Case studies [Chapters 7 to 9].

The answers to those research questions allowed me to meet the goals of the work [see section 1.3.3., Chapter 1]. Specifically:

- G1. understanding what factors in the context of use and in the design of a multi-stakeholder, multi-scale and multi-purpose platform could **facilitate the coexistence of divergent or conflicting goals, practices, constraints, discourses in a shared virtual environment** (RQ1, RQ4, RQ6)
- G2. studying how **local stakeholders could interact with/in/through this digital shared environment,** overcoming part of the current limitations of standard web-based technologies to infrastructure multi-actor actions in local development processes (RQ2,RQ3)
- G3. analysing the **implications of design choices and solutions** for web-based technologies intended to support these processes to formulate an organic set of reccomendations and operational propositions (RQ2, RQ4, RQ5, RQ6).

11.2.4 AN ASPIRATIONAL ANSWER TO THE OVERALL RESEARCH QUESTION

Adopting a transdisciplinary research framework [see Chapter 2] and defining a stringent research protocol [see section 2.4, Chapter 2] allowed me to coherently handle the different aspects of the problem in the navigation of multiple disciplines and along the engagement with multiple artefacts and stakeholders, up to the formulation of the answers on the basis of theoretical, empirical and practical work. However, the overall questions recalled at the beginning of this section is basically an aspirational and normative question. Thus, beyond the answers provided above, the overall question also requires an aspirational answer matured at a personal level during the PhD journey. From my perspective, **designing a City Mirror means** intentionally designing a platform able to support city stakeholders in:

- **enlightening the richness of places** where they live by reading the city
- **monitoring shared material and immaterial resources** by observing the city change
- **knowing what is on-going** by dialoguing with other city stakeholders
- **navigating across practices, services, and connections** to understand the city functioning
- **being aware of evolving local needs** to take care of the city
- **creating a dialogue space** for competing values to transform the city.

More in general, **designing a City Mirror implies the commitment to provide real support to a plurality of stakeholders for their decisions and actions, recognising each of them as legitimate and central political actors in local development**.

In such a platform, the **orchestration of local development actions** is the potential outcome of:

- mediating **meanings, projections and priorities** of city transformations for its inhabitants
- **enhancing the social capital** in the city to better exploit local resources and opportunities
- **supporting complementarieties and interdependences** across different sectors and organisations
- **enabling new practices**, services, social norms reactive to local changes
- **opening up current urban governance models** to address local needs
- generating a shared virtual space where **each stakeholder can make evident its contribution** to the city development, beyond the dominating public discourse.

11.3 REFLECTIONS ON THE TRANSDISCIPLINARY RESEARCH FRAMEWORK

In this section, I will critically revise the transdisciplinary research framework developed and used as an infrastructure for this work.

11.3.1 SURVIVING TRANSDISCIPLINARY RESEARCH

I start by sharing some personal considerations based on my experience of Transdisciplinarity during the PhD, perhaps relevant for other researchers that might be tempted to follow the same path. Indeed, beyond the intrinsic commitment that TD research requires, I can point five other practical challenges scarcely or unaddressed in the TD literature, appearing evident by direct experience.

- *The lack of trans-perspectives about Transdisciplinarity.* As I discovered at the beginning of my literature review on Transdisciplinary meta-research, three main schools of thoughts aggregate the contributions defining the TD landscape: the French/Balcans nucleus, the Swiss/German school, and the Australian vision of TD. Respectively, we can identify:

1. "the founders" prioritising the development of the theoretical and philosophical foundations of TD, producing extremely dense texts, sometimes perceived as almost esoteric
2. the researchers committed to frame and proceduralise TD for normalising its tools and applications, while focusing on a clearly defined set of topics related to sustainability
3. the educators engaged in supporting students and research community to face TD projects by establishing relational modalities among the various subjects involved in the research, including methods and criteria for assessing TD work quality.

Quite surprisingly, these three schools of thoughts (and other branches) are scarcely integrated. However, the construction of a TD research framework undoubtedly requires the contributions of all of them, in terms of theory, practice, examples and evaluation methods. Thus, **the identification, mapping and reinterpretation of the various aspects of a TD research infrastructure imply the navigation of three separate literature clusters.** In Chapter 2, I presented my own composition of the inputs selected and reinterpreted from this study.

- *The need for "transdisciplinary devices" applied intra-discipline.* The choice of trying to hybridise disciplines that have an interdisciplinary nature, such as Urban Planning or HCI, revealed additional difficulties related to the internal diversity of orientations, school of thoughts, theoretical and methodological approaches. Thus, **while rationalising process and procedures for connecting concepts and methods across disciplines, the confrontation intra-disciplines remained hard because of the coexistence of irreconcilable ontologies, epistemologies, preferred methods and tools.** For instance, even within urban disciplines, positivistic stances continue to have strong traction in a number of sub-domains, especially when we come to the relationships between cities and technologies. Unavoidable frictions make it necessary to firmly argue in support of research choices based on different assumptions, leading to other methods and kind of findings. In the end, aside the hybridisation and connections strategies across-disciplines directly used and presented in the work, a similar path of clarification and rationalisation happened "behind the scenes" in the opposite direction of distinguishing the subset of theory and methods selected within a specific domain from other mainstream flows in the very same domain.

a) *Cultural walls in Transdisciplinarity.* Analogously to the various geographical polarities identified for TD meta-research, there are significant differences in the representation of urban phenomena resulting from different socio-cultural contexts also in urban disciplines. For instance, as I mentioned in Chapter two, even Urban Planning itself is derived from social sciences in countries such as the UK or architecture practice in most other European countries. Thus, while united under the same labels, these two kinds of national traditions are two entirely different disciplines, built upon a distinct set of institutions, values, and aims. HCI studies on community and civic technologies are another example of this context-dependency. A large majority of them are strictly limited to Anglo-Saxon countries that have very peculiar arrangements for local services and in the definition of democracy. To overcome this wall, that does not surround only the disciplines selected as roots for this work, **the main challenge in TD research consists in separating what is specific of the context in which a research is produced (not in term of the context of the empirical studies, but mostly in cultural terms) and what keeps transcultural properties. The separation must be done regarding both the insights from the literature and the one gathered on the field to work at a higher level on trans-cultural aspects only toward understanding a more general problem.** Even such aim is a matter subjected to a dispute in cultural traditions deeply anchored to empiricism, but considered perfectly obvious in other with an idealistic imprint. Anyway, the sorting operation requires a rigorous work behind the scenes again to confirm this parallel reasoning process that has almost a philological nature. Indeed, it is based on the identification of the set of institutions regulating city life and local development dynamics, in this case.

- *The effort for Trans-linguism.* Similarly to the cultural issues, linguistic differences can represent a barrier for the correct or synthetic expression of concepts across languages, especially in Transdisciplinary research that is highly participative and oriented to transfer knowledge in society. This research was developed in Italy and in the UK, using Italian and English in distinct case studies (the first and third one) and the two languages combined in the second case study carried out with partners from seven countries and speaking other languages. This thesis had been written in English using it as a *lingua franca*, but not as a system of thoughts and reasoning. These circumstances required **continuous linguistic coding and decoding**, from the engagement activities to the data analysis, and from the theoretical models directly developed in English and their use in the case studies. Indeed, **not necessarily there is a good correspondence of terms, especially as regarding their semantics and mode of use**, even when it seems that the correspondence is quite straightforward such as for "community" or "local government". Things get more complicated when the **direct translation of central terms can be misleading** for a large part of the audience and participants. For instance, the verb "to design" recurs hundreds of times in this thesis, but hardly many stakeholders in Italy would be completely comfortable in seeing this term associated with their activity, while it is obvious that what they do is *"progettare"* [it.]. I have opted for the conventional use of "to design" because of the lack of a more appropriate correspondence for *"progettare"* in English, knowing that I mean *"progettare"*. This kind of **trans-linguistic choices can appear marginal, but it requires an attentive reflection about the trade-off between clarity and adherence to the reality, accessibility of the text and meaning.**

- *The limited "academic permeability" to Transdisciplinary research.* A practical issue is the scarse permeability of research communities to Transdisciplinary research; an issue serious enough to become distressing for TD researchers actively engaged in promoting this kind of research's value and academic relevence. Still, there are **pressures for decomposing, fragmenting and "repackaging" TD research, disguising the hybridisation of disciplines in more conventional interdisciplinary forms.**

Each of these points would open a more extended discussion that is out of the purpose of this section, even though it would surely benefit from a debate with other researchers adopting or developing TD approaches.

11.3.2 NAVIGATING TRANSDISCIPLINARY RESEARCH

Despite the practical difficulties related to finding creative working solutions to the five challenges indicated above, I also acknowledge that a solid TD research framework's support resulted essential to make this research feasible.

The **schema for the hybridisation of different disciplines** [see sections 2.2 and 2.3., Chapter 2] simplified the organisation of the inputs from them in developing the core models [Chapter 5] and in the implementation and analysis of the case studies. In particular, the **hybridisation through concepts clarification** provided a strategy for dealing with the daunting task of finding a path toward my research objectives passing through a vast corpus of literature. The **hybridisation of methods** allowed to generate or creatively rethinking techniques and tools case by case, regardless of the disciplinary origin of their antecedents. The use of the **prototypes of City Mirrors as boundary objects** helped in the hybridisation of different understandings of the world by discussing potential alternatives to existing technologies with a diversified range of people, going from children to elders, academic to social workers, migrants to city managers.

The **TIDS protocol supported the conceptual preparation and reflective analysis of the empirical and applied work**, especially facing the unpredictability of numerous aspects of the case studies. At the same time, the TIDS protocol provided a grid to **render in a systematic way the progression** going from the problem reframing to the implementation of multiple design and research activities [see section 2.4 Chapter 2].

Moving to the four key characteristics of Transdisciplinary research presented in Chapter 2 [Section 2.1.3], this work had been a) **problem-focused**; b) strongly socially oriented; c) **collaborative in its nature**; d) and informed by an **evolving methodology throughout the research process**.

b) Regarding the first point, TD's research goal is to create new integrated knowledge to advance the possibility of collaboratively reasoning on a real-world problem and addressing it at the society level. The choice of investigating the problem of the gap between expectations and reality of city technologies does not emerge in relation to specific knowledge gaps within urban or informatics disciplines. It is indeed a problem usually associated with market pressures, political openness to change, and overdetermined issues. Thus, dismissed in a class of problems not compatible with common research processes, unless for assessing a specific aspect at the time.

   On the contrary, my position is that this kind of problem demands enormous research efforts to connect their multiple aspects and understand the relations among them, or rather by pursuing the aim of the "unity of knowledge" [Max-Neef 2005, Nicolescu 2006, Klein 2015]. In this sense, I think that this kind of problems is exciting from a research perspective because able to stress and recombine approaches and current models to look at the reality in new ways. For instance, I have experimented in this work how to reframe the real-world problem into a knowledge problem moving from a multi-thematic analysis to a rigorous process of abstraction and reformulations of the practical constraints in the use of city technologies nowadays.

   Moreover, the call for design research attention wants to underline that the identification and design of alternative paths to the status quo are anchored to knowledge creation instead than driven by political or market pressures. For instance, this work pointed out the need for generating appropriate technology-mediated representations of the intermediate spaces between governments and citizens, between top-down and bottom-up initiatives in the city, between repeatable global solutions and hyperlocal not scalable prototypes. I have proposed a way to produce this kind of representation through the City Mirror design proposal. Nevertheless, several other options could come out looking at these challenges from a design perspective.

c) Regarding the second point (i.e. pursuing socially-oriented research), this work had been motivated by the personal intention of contributing to improving local development processes, by exploring how to better match the unavoidable socio-political constraints of the city environment with the capabilities of web-based technologies. At the same time, the social robustness of the research findings had been built on the top of an intense involvement of all classes of stakeholders in different contexts and for an extended period of almost four years. With them, I have analysed, discussed, reflected about their needs and expectations concerning technology, but most importantly invited them to test and revise their positions against the possibility of designing or using alternatives.

   These alternatives consisted of the instantiation of the City Mirror proposed in the case studies. They were designed as more open, more inclusive, fairer, but at the same time demanding to trade control over social and practical benefits other challenges to current tools. The pragmatic stance adopted in the process precisely tried to identify the boundaries between what was considered acceptable and what would lead to a refusal of these alternatives, looking at additional intervention spaces to mitigate shifts in opposite directions. I have firmly avoided morally-driven or moralistic positions to relate myself as a person and as a researcher to the applicative scenarios and practical implications and constraints emerging from the work done with city stakeholders. In other words, the contextual definition of "the good", "common good", or "public interest(s)" prevented self-selection of the materials to analyse and reductive interpretations of the insights gathered through the fieldwork.

d) Besides the involvement of several groups, organisations, communities and networks' representatives in the cities associated with the case studies, the collaborative nature of this research also relied on the possibility to work with and within multiple development teams. While my research agenda remained independent from the specific objectives of the case studies projects and the related software development achievements, being constantly exposed to the technology developers' instances helped me always have direct feedback, view and opinions about the concepts and propositions elaborated along the research process.

e) At the same time, being involved in the development of the prototypes also as a design researcher (professionally speaking) and designer led me to challenge my methods against the need of covering multiple positions at the same time, and even keeping an external view on my own design work for research purposes. Indeed, the research was not aimed at the evaluation of specific prototypes, but at using the prototypes to discover the interdependence between city dynamics and use of technology taking into account all existing information to build the arguments and the proposals, that is the definition of scientific rigour for TD research by Nicoleuscu [2002].

   Moreover, even though Transdisciplinarity is intrinsically characterised by evolving methods, balancing the responsiveness to the context with the requirements of a solid research process resulted in making the design process itself more demanding. For instance, because of the need of justifying research and design choices, documenting step by step research and design activities, distinguishing the materials produced for design and research purposes and so on.

11.4 RESEARCH OUTCOMES

As highlighted in Chapter 2 and recalled in the previous section, transdisciplinary research is primarily oriented to generate a kind of knowledge that can improve the understanding of a problem in itself, potentially enabling different stakeholders to act for developing viable solutions to the common problem. The three “outcome spaces” of situation, knowledge and learning defined by Mitchell et al. [2015] correspond exactly to these finalities, but also to three kind of research outputs defined by Pohl & Hadorn [2007] as system knowledge, target knowledge and transformation knowledge.

In this section, I will briefly summarise the contribution of this work to the **practical knowledge for the groups targeted by the research** and the options for **future transformations in the design of city technologies** grounded on the lesson learned during the study [see also Table 11.1 Part I and II].

11.4.4 TARGET KNOWLEDGE

While the production of this thesis had been an experiment in itself to connect with multiple kinds of audiences, it is important to clearly acknowledge that the direct accessibility to the relevant contents for each target group requires further refinement and probably a decomposition of this volume in more manageable chunks.

11.4.1.a. For urban practitioners

The **classification schema of the existing web tools applied in urban activities** [Chapter 4] can help to identify the most appropriate type of technology to be adopted or suggested in city planning, placemaking and local development initiatives, being aware of the kind of social relationships and power dynamics enabled and supported online.

Secondly, the direct experience I reported in my case studies [Chapter 7, 8, 9] provides some examples of how **transferring participatory design tactics used in urban environments for urban plans and projects to the design of technologies for cities**. This is a way to extend the domain of practice for urban practitioners, in particular those assisting public sector clients and consulting for technology providers. In particular, this work included:

- the discussion of the limits and potentialities of web-based technologies in everyday activities and temporary uses of city spaces [Chapter 7]
- the outline of urban governance models supported by technology, grounded on a continuous and structured engagement schema [Chapter 8]
- a path for transferring logics and approaches for building city plans to the management of issues related to city data [Chapter 9]
- a way to establish a connection between typical aspects of city dynamics to their transfer in the design of city technologies [Chapter 1]
- a practical tool to negotiate, advocate for third parties affected by specific technologies in cities, or mediate the relationship between technology providers/designers and decision-makers [Chapter 4].

11.4.1. For decision-makers (direct clients of technology providers)

The review of existing technologies usually applied to support city activities, and in particular collective processes at the local scale, provides elements for **pre-assessing the compatibility of some solutions with the pursued goals associated with the use of technology in specific cases** [Chapter 4]. Indeed, decision-makers acting as primary clients for technology providers can overlook the intrinsic limitations or risks of public engagement platforms not having clear the link between specific functionalities of these platforms and the implications of their use in multi-lateral relationships.

The experience reported in the case studies, by focusing in particular on the issues concerning the misalignment between city views and technology views, can help decision-makers in reflecting and better communicating their needs to technology providers and designers, and understanding the implications of specific configurations of technology products [Chapters 7 to 9].

11.4.1.c. For city stakeholders (direct and indirect users and/or clients)

In this work, practical inputs for different groups, organisations and communities opened to experiment and integrate new tools in their activities come from:

- a better understanding of the instances and constraints in the provision of technologies for cities [Chapter 3]
- the overview of several needs and activities currently not supported by existing technologies, and potential benefits coming from civic technologies and location-based social networks [Chapter 7]
- the understanding of the mediation of digital environments in the negotiation of competencies and agencies over places and urban resources [Chapter 8]
- the clarification of the assumptions and requirements to be filled for making city data actionable and data operations open and inclusive [Chapter 9]
- a sort of self-assessment tool to compare the different needs with the capabilities of multi-stakeholder and multi-purpose technologies [Chapter 10]

11.4.1. For technology designers

This work wants to offer practical support to the difficult endeavour of defining the design of digital technologies for cities without necessarily having mindset or conceptual tools managed by urban practitioners. The contributions in this direction are listed below.

- An operational schema for understanding the context of intervention of city technologies by mapping the economic, social, technological, political, organisational, and legal factors with the specific challenges of the design space for such technologies: a) understanding how to render the city actors "invisible" in current solutions; b) figuring out how to support open processes instead than pre-defined actions in narrow domains, c) experimenting how to address the tension between specific and general solutions [Chapter 3]
- An in-depth discussion of a selection of prototypical platforms and the implications of recurrent design choices, usually automatically assumed as standard options for web tools such as reporting and monitoring platforms or public engagement applications [Chapter 4]
- The meta-analysis of several applicative scenarios and the ways city stakeholders interact within a multi-stakeholder, multi-purpose, multi-scale online environment, taking into account the type of features recurring in platforms meant to support urban activities [Chapter 7]
- A technique for the abstraction of the functional logic of technology product from their instantiation to define non-functional requirements and option for refactoring existing tools [Chapter 8]
- The outline of alternative paradigms for the design of data portals based on a collective intelligence framework and focused on data governance [Chapter 9]
- The explanation of the rationale for some recurrent issues associated with map-based interfaces, temporalised contents, shared contents [Chapters 7 to 10]

11.4.1.e. For technology providers

The background analysis organised by using tools known in the context of management and development such as PESTLE and SWOT frameworks provides a methodological and operational input for context scanning options to technology providers approaching new social, cultural, legal, and institutional environments propose and deploy technologies for cities. The bilateral and combined analysis of the instances of city stakeholders with the one imposed by technology market can also contribute to a better understanding of the main constraints for adopting such technologies [Chapter 3].

The analytic framework formulated to connect platform functionalities to city dynamics can efficiently modulate the direction for analysis and ex-post evaluation of new products and services [Chapter 4].

More in general, this work can become relevant for the technology industry sector interested in city technology because of the (partially implicit) proposal of building solid commercial offers based on the "city profiling", instead than on the profiling of single end-users. Indeed, as extensively discussed, social and practical ties bound the action of single end-users in ways that are specific to the context, but at the same time following a discrete number of patterns recurring across contexts. Tailoring technology solutions to the "city profile" could reinforce the acceptance and impact of the proposed solutions, benefiting their marketability.

Scaling up, the understanding of city stakeholders' geometries and their topology (information that can be easily acquired) can also foster the experimentation of new business models for multi-stakeholder platforms, as standalone products or connector of other tools already adopted. In this sense, as stated as the aim of the work in Chapter 1, the exploration of other perspectives, strategies and artefacts was oriented to overcome the stringent limitations posed by a lack of structured and operational knowledge on the link between collective formation in cities and forms of technological support to their local actions. The insights gathered from the case studies are a starting point to orient future experimentation in decentralising and distributing the control over city platform among local stakeholders.

11.4.1.f For Researchers (in Urban and Informatics disciplines)

This work proposed and "tested" a general schema for bridging urban disciplines and informatics, in particular, Urban Planning, Urban Design and Urban Studies on one side, and Computer-Supported Cooperative Work, Human-Computer Interaction Design and Information Systems on the other side). This schema is based on:

- Extending the area of concern for urban research and value of inputs for technologies
- Making explicit homologies and touchpoints among the two set of disciplines in urban research and informatics.
- Outlining three directions for a joint operational research agenda.
- Hybridisating familiar concepts across urban disciplines and informatics making them accessible
- Hybridisating methods and tecniques familiar across urban disciplines and informatics.

At a practical level, the joint discussion of disciplinary fields that are often unfamiliar to urban researchers and practitioners indicated some possible entry-points to approach informatics theories and methods and experiment their application in urban research. At the same time, this work highlighted how the importance of urban disciplines for developing new theoretical foundations for city technologies do not rely on the technical and procedural knowledge usually associated with planning activities, but on the underlying models planners use for understanding of social dynamics in urban environments. A transdisciplinary research agenda on city technologies can be developed starting from a shared awareness of the contributions of each discipline across different domains.

11.2.4 TRANSFORMATIONAL KNOWLEDGE

11.4.2.a. Users

This work outlines a set of **transformation paths to recompose the disconnection between users' representation on web-based technologies and the multiplicity of social structures and city stakeholders intended as potential users of city technologies**. The start of these potential transformation paths is anticipated in the thesis by:

- Extending the **analysis of the instances of potential users of city technologies beyond the main clients** (usually public authorities) or providers, also including the perspective and needs of other stakeholders and the relevant segment of the population into the design of future city platforms [Chapter 3]

- Considering the **concept of "collective users" associated with groups, organisations, communities and networks as a frame of reference** to build multi-dimensional and multi-layer users'models, not flattening users to the role of customers of technologies and services [Chapter 5]

- Designing for platform **users seen as agents of real and concrete change in the city**, supporting the political driver and goals of individual and collective actions aimed at providing or improving or innovating essential local services impacting on the economic and social development of the city [Chapter 7]

- Defining online spaces in which **single users and structured social entities can transparently negotiating their roles online and offline in local development processes** entitled/enabled by their resources, capacities and competencies and supported by technologies built on the principle of the throughput legitimacy as key for activating cooperative dynamics in city management [Chapter 8]

- Adopting an **ecological perspective on users as part of the city data ecosystem**, actively and directly operating in one of the steps and processes going from the data collection to the communication of the knowledge incorporated in data for the large public [Chapter 9].

11.4.2.b. City

Transformation paths for overcoming the current marginality of digital technologies in the collective actions regularly implemented in cities are encapsulated in this work in the form of:

- A design proposal based on the principle that all urban activities rely on the interaction and cooperation among different social structures, operational domains, and scale [Chapter 3]

- A conceptual model of the city as an ecology of systems (physical, functional and social) and infra-systems (determining meanings, responsibilities and shared identities) meant to help in the identification of the action patterns and rules in actions to support the analysis and design of city technologies intended to be multi-stakeholder and multi-purpose [Chapter 5]

This proposal and the associated conceptual model of the city had been instantiated in three processes aimed at defining prototypes explicitly designed to support local development actions. The challenges and lesson learned from these three processes contributed to the knowledge for transforming technologies for cities in:

- Instruments rendering the definition of the city in its material and institutional reality reconfigured by concurrent and competing representations of actions, places, local actors [Chapter 7]
- Tools for enhancing the social relationships, institutional capital, and values driving local actions [Chapter 8]
- Bridge among different processes in different macro-sectors of urban activities, requiring flexible forms of support in relation to the physical constraints preponderant in some cases, the level of social integration of the organisations and networks operating in that sector, and its level of interconnection with other sectors [Chapter 9].

11.2.4.c Web-based technologies

Transformation paths for the design of web-based technologies originate from considering this class of technology as potential instruments for instantiating post-smartness collaboration-oriented visions of the role of technologies in cities. To this regard, this work:

§ Emphasises the importance of exploring the properties of the intermediate space between local and global operations that could be essential to define malleable forms of technology support on a multi-scale platform [Chapter 3]

§ Identifies limits and issues of existing technologies to support local development processes, indicating the design challenges to overcome these limitations in reference to the creation of a multi-stakeholder, multi-purpose and multi-scale digital environment. [Chapter 4]

§ Outlines a meta-framework of the role of city technology by mapping the forms of technology support across different families of urban activities, taking into account the specificity of coordinative, cooperative, and collaborative practices, but also the temporal and structural aspects of these activities that are relevant for the design of appropriate solutions [Chapter 5]

§ Examines the prototype of a civic social network to discuss the issues, limitations, and forms of appropriate support for the coordination (and in some cases cooperation) of heterogenous segments of users in a variety of domains, by highlighting the priorities for the design of city technologies as concerning the mitigation and review of online social interactions inconsistent with the nature, type, and forms of social interactions in multi-stakeholder environments [Chapter 7]

§ Reflects on the challenges of refactoring e-government tools to instrument supporting the cooperative governance in cities, but it also deal with the harmonisation of different tools that can be combined and assembled for providing the most appropriate support to the specific processes and instantiation of cooperative governance mechanisms in the medium and long term [Chapter 8]

§ Envisions three design concepts of web-based technologies dialoguing with other digital and normative tools to improve and regulating the access and exploitation of city data considered as urban assets to support their use in local development actions [Chapter 9].

Table. 11.1 Tables summarising the contribution of the work across the three outcome spaces of TD research – PART 1

	TYPE OF CONTRIBUTION	CH1	CH2	CH3	CH4	CH5
SYSTEM KNOWLEDGE	THEORETHICAL CONTRIBUTION	Problem definition as a deep design problem.	Architecture of the TD research framework.	Problem framing as a knowledge and design problem (Disconnection & Recomposing Problem) and concept of City Mirror.	Analytic framework of the invariants defining the digital environment of web-based technologies.	Core models: users as part of collective social structures, city as system of systems, technology as operation support in local actions.
	METHODOLOGICAL CONTRIBUTION	Analytic framework misalignments, convergences, potential directions.	Research Protocol and integration strategies for the disciplinary roots.	Background analysis focused on the context and the object, inspired by PESTLE & SWOT tools.	Analysis and classification of existing platforms based on goals and family resemblance principles.	
	EMPIRICAL CONTRIBUTION			Organic presentation of pieces of evidence connecting different aspects of the problem.		
TARGET KNOWLEDGE	FOR RESEARCHERS	Extending area of concern for urban research and value of inputs for technologies.	Homologies and touchpoints among the two set of disciplines in urban research and informatics.	Outline of the three directions for an operational research agenda.		Hybridisation of familiar concepts across urban disciplines and informatics making them accessible.
	FOR TECHNOLOGY DESIGNERS				In-depth discussion of a selection of prototypical platform and the implication of recurrent design choices.	
	FOR URBAN PRACTICTIONERS				Mapping of the existing web platforms applied in urban context in a limited set of solutions.	
	FOR CITY STAKEHOLDERS			Understanding of the instances and constraints in the provision of technologies for cities.		
	FOR DECISION MAKERS				Tool for pre-assessing the compatibility of some solutions with the pursued goals associated with the use of technology.	
	FOR TECHNOLOGY PROVIDERS			Understanding of the instances and constraints in the use of technologies in cities.		
TRANSFORMATIONAL KNWOLEDGE	USERS			Highlight of the missing users of technologies and proposal of a multi-stakeholder platform.	Definition of the design challenges for adapting city technologies to multiple concurrent targets of users.	Users of technologies as p multiple social structures (groups, organisations, communities, networks), as "collective users".
	CITY			Highlight of the missing local activities and proposal of a multi-purpose platform for orchestration.	Definition of the design challenges for mediating between the specificity of each local context and recurrent patterns.	City as ecology of systems (physical, functional and social) and infra-systems (determining meanings, responsibilities and shared identities).
	TECHNOLOGY			Highlight of the missing intervention space between global and hyperlocal and proposal of a multi-scale platform.	Definition of the design challenges for adapting response and focus of specific solutions across different scales.	Meta-framework for mapping the role of technology across different families of urban activities and in support to coordinative, cooperative, and collaborative practices.

Table. 11.1 Tables summarizing the contribution of the work across the three outcome spaces of TD research PART 2

CH6	CH7	CH8	CH9	CH10
				Theory organising the key concept to describe the capabilities of a City Mirror integrating the core models with the lesson learned from the case studies.
Adaptation of Action Research and Grounded theory methods to a deep design problem	Participatory Design in Agile framework at scale. Serial Action Research.	Service Design as approach for refactoring interactive systems. Bilateral Action Research.	Historical approaches to the analysis and design of interactive systems. Enacted Action Research.	Grounded theory built on the use of applicative scenarios and digital artefacts as sources for the theory development
	Applicative scenarios and requirements for a civic social network.	Applicative scenarios and requirements for a platform supporting urban cooperative governance models.	Applicative scenarios and requirements for a city data portal opened to the data ecosystem.	
Hybridisation of methods and techniques across urban disciplines and informatics.				
	Discussion of several interactional patterns associated with specific design choices and constraints	Abstraction of the functional logics of technology product from their instantiation to define non-functional requirements.	Outline of alternative paradigms for the design of data portals based on a collective intelligence framework.	Rationale for some recurrent issues associated with map-based interfaces, temporalized contents, shared contents.
	Limits and potentialities of web-based techs in everyday activities and temporary uses of city spaces.	Outline of urban governance models supported by technology based on a continuous and structured engagement schema.	Transfer of the logics and approaches for building city plans to the management of issues related to city data.	Connection between typical aspects of city dynamics to their transfer in the design of city technologies.
	Overviews of several needs and activities currently not supported by existing technologies, and potential benefits coming from civic techs.	Understanding of the mediation of digital environments in the negotiation of competencies and agencies over places and urban resources.	Assumptions and requirements to be filled for making city data actionable and data operations open and inclusive.	
	Redefinition of Users as agents of change at the local level, engaged in action always having a political value in the public domain.	Throughput legitimacy as key concept in shaping the relationships among collective users operating in the same space and over shared resources.	Effect and implications of the attribution of formal and operational roles in the city context and within interactive systems.	
	City as malleable entity, reconfigured by concurrent and competing representations of actions, places, local actors.	City as space for the negotiation of competencies and agencies over places and urban resources.	City as data ecosystem for the production, processing, communication and use of data, and not just as a "data production machine".	
	Technology as operational support to structure collective actions in the public domain and supporting social innovation processes.	Technology enabling governance models based on the openness of local processes.	Technology dialoguing with other instruments for regulating the access and exploitation of urban resources.	

11.5 RESEARCH CONTRIBUTION TO URBAN DISCIPLINES

In this section, I am going to summarise the theoretical, methodological and empirical contribution of this work to the **system knowledge** [Pohl & Hadorn 2007] in the **urban disciplines** selected as roots for the study [see also Chapter 2, section 2.2.2.a]. I had incorporated in this research inputs coming from Urban Planning, Urban Design and Urban Studies. In return, part of my research outputs can also contribute to urban research, especially as regarding planning theory and future transformational planning practices.

11.5.1 THEORETICAL CONTRIBUTIONS

This thesis delivers a **theoretical framing of the real-world problem of the marginality of digital technologies in supporting local development process**, by focusing on web-based technologies that are specifically meant to connect people and nowadays widely used in city planning and placemaking practices (see Chapter 3). The conceptual framing of the problem as a knowledge problem had been articulated along the three axes of:

- the representation of the roles and identities of technology users within the social structures regulating city life
- the interdependence of city activities across the various city systems and the different scales of action in urban environments
- the complex strategic, social, and political role of digital technologies in enabling coordinative, cooperative or collaborative practices among different stakeholders.

This framing of the problem envisioned research explorations focused on understanding how to render:

- the complexity of **urban social structures in between individuals and public administrations**, currently defining the main focus of technologies for cities, but obfuscating the nature of social interactions contributing to local development processes
- the **recurrent patterns of the city functioning**, in particular as regarding inter-organisational and cross-network interactions needed for managing local services and implementing every project from the neighbourhood to the metropolitan scale
- the value and role of **technology as urban infrastructure** in the setting of competing goals, unbalanced power relationships, and conflictual agendas of different stakeholders.

By outlining the framing of the marginality of city technologies as a problem of formalisation of city dynamics in virtual spaces, this work opens **future lines of research in the domain of planning theory and urban studies**. Indeed, the outlined directions constitutes a solid alternative to move forward the critique of the current technology-centred paradigm in smart cities. At the same time, these directions enhance the transformative and actionable value of planning knowledge in a new area of interest, the one of technologies for cities, that are determinant for future policies and development strategies of cities.

Starting my own path along these three directions, I developed **three conceptual models of users, city ecosystem and forms of technology support to urban actions** that constitute additional theoretical contributions to urban research (see Chapter 5).

Indeed, I connected the organic vision of individuals operating in the city context, typical of collaborative and communicative planning approaches [Friedmann 1987, Forester 1988, Healey 2003, Innes & Booher

2010], with the layered conceptualisation of urban social structures [Alexander 2014] and the social identity theory [Hornsey 2008] used as a bridge with individual-centred perspectives. The result is a conceptual and operational schema of individuals as embodied in groups, organisations, communities, and networks that constitute the spheres of collective actions into the public domain contributing to local development processes.

As regarding the city as a system of systems working ecologically, I build a conceptual model grounded on:

- the distinction between levels of Reality and levels of organisations established by the ontological axiom of Transdisciplinarity [Nicoleuscu 2006]
- the conventional vision of urban systems as a combination of physical, functional and social systems
- the definition of the in-between areas among these three systems, called infra-systems, determining the experience of the city at an individual and collective level.

The third theoretical model concerning the forms of support of technology in urban actions required the meta-analysis and conceptualisation of the underlying logic and patterns of programmes, projects and services structuring all local activities.

Lastly, the **design theory of the capabilities of City Mirrors** can also be considered as a theorethical contribution to planning research. Indeed, that theory is both substantive and procedural as most of planning theories and it is focused on the ways to integrate technologies in local activities [see Chapter 10]. At the same time, that theory describes the **principles of a kind of technology that could potentially support new planning paradigms** [Hillier 2017], advocating for fluid forms of planning [Nyseth 2012], opened to multiple actors and articulated in multiple scales and multiple timeframes [Alexander et al. 2012], having explicit transformative aims [Healey 2007]. These new planning practices cannot be developed without the support of technology to manage the complexity of social settings and the rapidity of urban changes. On the other hand, appropriate support to these practices requires technologies overcoming the limitations of current instruments (as the purpose of the proposal of the City Mirror), informed by deep reflections on the implications of their use over power dynamics and critical social relationships at the local scale [Lupi & Antonini 2019].

11.5.2 METHODOLOGICAL CONTRIBUTIONS

The methodological contribution to Urban Design and Planning is two-fold.

First, I redefined and extended the pre-existing research protocol for transdisciplinary research, TIPS, to be suitable for action-driven, future-oriented and practice-based disciplines such as the ones of urban design and planning (but also technology design). Indeed, the TIPS protocol, while ideally intended to structure every research on transdisciplinary topics, is still focused on social sciences approaches and goals, only providing limited support to applied research. In this work, **I provide an alternative definition, the TIDS protocol, oriented to support the process of knowledge generation in design-driven processes** dealing with the complexity of city dynamics [see Chapter 2]. I effectively applied the protocol throughout the research process. The same research protocol can be easily used to structure research and design explorations such as the ones related to urban design, as well as participatory design practices and policy-making.

The second methodological contribution is the **rationalisation of the flow of planning practice into a design-based system of inquiry** built on the alignment between ontological, epistemological and axiological assumptions characterising the act of generating knowledge through planning [see Chapter 6]. The same flow also allows to match planning approaches and technology design approaches at a methodological level. The relevance of this contribution emerges from the rising attention to the need of bringing back design-based methods into planning research and practice, to overcome the strong limitations of qualitative or quantitative research in providing the kind of knowledge fuelling planning normative reflections. For the first time, an entire track dedicated to the application of design-driven and creative methods in urban research was planned at the EURA-European Urban Research Association- Conference 2020, unfortunately cancelled due to Covid 2019, but still providing evidence of the rising attention toward this kind of methods. At a personal level, structuring this system of inquiry for the purpose of this work exposed me to the fact that strong theoretical foundations of design-based methods are completely missing in urban design and planning literature, if we exclude the outdated works on the technicalities of physical urban design that do not take into account in any way the generation of knowledge form the process of design. Indeed, they are outdated in comparison with the current framing of design-driven methods and the expectations associated with the transformation of cities. Thus, the rationalisation of planning practice as strategic design, systemic design and institutional design is still a potential path for future urban research.

11.5.3 EMPIRICAL CONTRIBUTIONS

The main empirical contribution of this work for Urban Studies is the extensive set of applicative scenarios of city technologies providing new elements for the investigation of the relationship between digital technologies and social innovation processes at the local scale, cooperative governance models and new policy instrument for the management of city data as urban assets [see Chapter 7,8,9]. These types of applicative scenarios are still rarely discussed in the literature in urban studies, despite the centrality of the topics related to social innovation and governance models.

11.6 RESEARCH CONTRIBUTION TO INFORMATICS

In this section, I am going to summarise the theoretical, methodological and empirical contribution of this work to the **system knowledge** [Pohl & Hadorn 2007] in the domain of **Informatics**. In this study, I focused my attention on the inputs coming from Human-Computer Interaction Design, Computer-supported Cooperative Work, and Information Systems [see also Chapter 2, section 2.2.2.b]. Part of my research outputs can contribute to emerging areas of interests in these disciplines.

11.6.1 THEORETICAL CONTRIBUTIONS

The core models presented in Chapter 5 are the three main theoretical contributions to these disciplines.

The first model of the user of city technology organises several aspects for the representation of users and structuring user's models that are still vague and ill-managed. The double formulation of the individual users as part of multiple social structures and the concept of collective user can support the opening of research exploration moving beyond the dimension of individuals that is predominant in HCI and CSCW communities, but recognised as not entirely appropriate for the challenges of investigating technologies for social change. From the perspective of Information Systems, the core model is useful instead for the distinction among the properties of different social structures and the framing of power relationships (recognised as important, but difficult to be framed) in topological terms.

The second core model concerning the city as an ecology of systems and infrasystems clarifies the aspects to be modelled for the understanding of the context of technology intervention in a holistic way, that is also operationalisable to a certain extent. Indeed, at a lower level, the model supports overcoming the fictitious contraposition between spaces and place, to embrace a multi-dimensional account of the interdependence between material and immaterial aspects of the context. At a higher level, the model clearly identifies the infrasystems of the city as the space of intervention for the design of city technologies, while the integration of the city system remains the space for the implementation of technology. Considering the City itself as the implicit or underlying user of city technologies, instead than only as a background, could help to outline better interactions patterns also for human users (possibly relevant for HCI studies). On the other side, the relations among systems and infrasystems of the city could help to structure the information architecture of city technologies.

The third core model proposes an analytic schema to navigate the multitude of city practices (and meta-practices) and the forms of support to collective dynamics. The model clearly distinguishes between coordinative, cooperative and collaborative practices in relation to the institutional profile of multi-actor interactions and joint work, that takes into account also nature of the rules, risks, power relationships, advantages distribution. The benefit of this core model for the CSCW community is two-fold: first, it provides the rationale for integrating the classical aspects of practices usually considered for studying working environments with new elements needed to investigate collective practices in city settings considering the centrality of their political dimension; secondly, it outlines a strategy for the study of meta-practices that could be transferred to unite and reorganise existing studies of practices in working environments, contributing to the critical problem of the fragmentation of the inputs coming from the in-depth study of single practices in single contexts.

Another relevant theoretical contribution, transversal to the selected disciplines, is a design theory of the capabilities of web-based technologies mirroring the city presented in Chapter 10, built by reintegrating and connecting the three core models of users, city, and role of technology under the light of the findings emerged from the empirical and applied research activities. The design theory developed along the entire work includes: the definition of the purpose and scope of city mirror technologies as design and research objects, the conceptual constructs organising the underlying knowledge for their development, a set of testable propositions, the implementation principles and examples of instantiation corresponding to the three case studies.

11.6.2 METHODOLOGICAL CONTRIBUTIONS

A methodological contribution specific to the domain of **Information Systems** is the approach proposed and experimented in Chapter 3 inspired by the readaptation of the PESTEL and SWOT frameworks, but based on the **hybridisation between the conventional approaches used in urban disciplines to analyse the context of intervention with the ones used in informatics to outline the type of intervention to address a specific problem**. The background analysis resulting from the application of this method provided indeed a comprehensive account of the context and object of intervention, suitable for its integration in emerging systemic vision of information systems as part of more complex ecosystems.

A methodological contribution that could benefit the HCI community concerns the **analysis of interactional patterns among users and between users and web-platform based on the invariants** corresponding to the hierarchies set by design among users interacting with the platform and the interplay between Spatio-temporal properties of online and offline context of technology-mediated actions and online interactions. The use of these invariants is to be intended as lenses for the critical analysis of digital artefacts, but also as assessment and generative devices for speculative design hypothesis and tailoring of existing solutions.

Differently from the common approach to survey existing digital tools, the methodology defined in this chapter focused on identifying the high-level resemblances among the main families of technologies applied in urban settings and the invariants in the definition of a particular interaction space. The same approach and schema can be readapted to other domains of technology applications.

Other methodological contributions are related to the construction and readaptation of design and research methods in the three case studies.

Chapter 7 presents, dissects and discuss a **large-scale participatory design process** as multi-stakeholders centred-design and as result of the hybridisation of tactics and tools coming from the tradition of participatory design in planning and technology design. In particular, the novelty of this hybridisation is linked to the fact that is not associated with the design of tools supporting urban planning practices (as in other related works), but oriented to deal with city processes and the integration of digital technologies (relevant for HCI and CSCW) By presenting this methodological approach, chapters also enlightened the mechanisms and challenges for successfully combining a complex **participatory design process within an Agile development framework**, detailing the practical arrangements to coordinate development and engagement activities (relevant for IS).

Chapter 8 analyses the use of **service design methods** experimented in application related to city planning and urban transformations, as well as their potentialities for system design currently explored in the domain of Interaction Design Practices. Building on this analysis, the chapter presents a hybridisation of standard service design tools with the inputs coming from their adaptation in urban and informatics disciplines to refactor web-based technologies having city applications (relevant for HCI and IS).

Chapter 9 presents the rationale and use of **historical approaches to the analysis and design of interactive systems**. This kind of approach is particularly useful in the cases of interactive systems consolidated and widely used, but not addressing the misalignment between the scope of technology and the goals of using technology. The historical approach allows identifying the key choices, transfer of meaning among unrelated dynamics due to contingent reasons, and external constraints impacting the definition of the underlying models of interactive systems.

The three chapters of the case studies also introduce multiple variants of Action Research, combined with participatory design research, a method for generating socially robust knowledge, but also for implementing strategies of requirement elicitation and scenario building for city technologies based on in-depth exchanges with the participants involved in the design and research process. The three variants correspond to:

- **"Serial Action Research"**, intended as the application of action research principles and techniques with multiple groups in parallel and in sequence along the research process

- **"Bilateral Action Research"** as a double parallel process of independent framing of the problem, formulation of potential solutions, planning and implementation that involves two groups of subjects having distinct visions, needs, roles, priorities in addressing a joint problem.

- **"Enacted Action Research"** in which the cycle of problem definition, planning, acting, observing, reflecting can be condensed in a short time, without losing the value of collective elaborations and reflections.

11.6.3 EMPIRICAL CONTRIBUTIONS

The three chapters of the case studies provide a large number of applicative scenarios for multi-stakeholders, multi-purpose, multi-scale technologies, clustered around the three axes of coordination in social innovation initiatives, cooperation in complex projects, and collaboration mechanisms over city-data.

11.7 OPEN ISSUES

The intrinsic limitations of the research were stated in Chapter 6, section 6.7. Here, I want to mention some important open issues related to the aspect of the real-world problem of getting city technologies supporting the collective dimension of local development actions. These issues had not been addressed or marginally addressed by this work, which focused instead on exploring the knowledge problem derived from the initial analysis of the context presented in Chapter 3. Referring to the main dimensions used in that context analysis, the open issues are:

- the definition of **alternative business models** making the implementation of City Mirrors financially sustainable for technology providers, and for city stakeholders with limited resources, such as non-profit organisation or local businesses or knowledge professionals (*Economic aspects*)

- the outline of the **distribution chain for web-based technologies modelled as City Mirrors** that could be considered acceptable and not exposing users to risks related to their privacy or to threats of control (*Socio-cultural aspects*)

- the criticalities related to the **reliability and high risks of independent technology development initiatives** oriented to implement City Mirror technologies (*Technology aspects*)

- the natural resistance to change and the **type of incentives for prioritising operational goals** instead than political purposes in the use of technology by local governments and public agencies (*Political aspects*)

- the **tension between ownership and commoning** as regarding technologies meant to be multi-stakeholder, especially in organisations of the public and private sector (*Organisational aspects*)

- the real impact of **legal reforms and measures promoted at the scale of cities** against the relative "anarchy" and "autarchy" of web-based technologies (*Legal aspects*)

As regarding the three dimensions of Users, City and Technologies considered for the proposal of the City Mirror, other open issues unaddressed by this work, but partially investigable concern:

- The desirability or avoidance of **latent conflicts among city stakeholders** that could emerge giving them visibility and a common space for action
- The **compatibility between smart city visions and implementations** (probably keeping their dominant position in terms of funding, policies and technologies) and **alternative city visions** oriented toward self-organisation, pluralistic governance of local actions and distributed models of technology support
- The **ethical positioning of technology respect to the consolidation or disruption of strategic advantages and asymmetry of information** among its users belonging to different stakeholder clusters.

11.8 FUTURE WORK

The experimental approach and the exploratory nature of this study open up several options for future works both in the domain of informatics or urban disciplines. Following, some research strands that could furtherly develop and consolidate the contribution of this work.

Transdisciplinarity

- **Generalising the TIDS protocol** as a guideline for addressing deep design problems or systemic design research.

Users

- Progressing from the multi-layered conceptual model of the user toward a **computational user model** connecting the available data sources for each layer to a system of inferences linked to the properties of the social structures included in the conceptual models, and enriched by the insights on the limitations and opportunities for their representation in the city context.
- Furtherly detailing the **properties of communities and organisations** across a wider range of urban contexts outside European countries, as the two layers of the model more complex **from a cultural and political perspective**.

City

- Analogously to what mentioned for the user model, working toward a **computational version of the ecosystemic model of the City** to support city profiling operations aimed at facilitating contextualised technology enablement operations and policies. Also in this case, I think it is advisable to turn the attention toward cities in the Middle East, India, Africa or Latin America where the fluidity of urban arrangments and the rapid urbanisation represent the major bedtest for future city technologies.

- Producing and testing into/against the world **new prototypes of City Mirrors** incorporating the insights coming from the cross-case analysis and continuing the iterative process of revising and/or generalising the testable propositions.

Technology

- Even though this work focused mainly on Web 2.0 technologies for a wide range of practical reasons exposed in Chapter 1 and 4, the most promising line for future research on City technologies (that could integrate, combine and push forward the theoretical inputs and practical implications of this work) is the one linked to the research on the *"Symbiotic web"* or Web 5.0 [see Chapter 4]. Or rather investigating how and to what extend Artificial Intelligence technologies could facilitate an effective support to multi-stakeholder orchestration in urban settings, acting as mediator and broker among their interests. A preliminary attempt to transfer the findings of this work toward **City AI solutions** is currently on-going and will be expanded in the future, considering that the mainstream paradigm for AI technologies in cities is still limited to Urban AI solutions.

- Implementing support tools for the **City Data Plan**, and studying its potential impacts over the city data governance, theme that is increasingly becoming crucial.

11.9 CONCLUDING REMARKS

Everyone experienced mirrors both as physical objects and intermediaries in our relationships with others and ourselves. Philosophers, artists and writers across many cultures have used mirrors as polyvalent symbols connecting multiple layers of our material and spiritual life. **The various interpretations of mirrors as objects have always been intertwined with the personal and societal sphere of human actions, thoughts, feelings**. Similarly, thinking about what does mean mirroring the city implies going beyond to figuratively express the potential similarities between digital platforms and mirrors simply as objects.

In this sense, the expression "City Mirror" was not intended in this work as a metaphor, but as an emblem to orient in a holistic way the design of future technologies integrated with city dynamics embracing their socio-political complexity. An emblem is a way to allegorically represent through one single image an object or an idea in its physical and phenomenological aspects, looking at the same time at its abstract and theoretical nature. Therefore, **using the image of the City Mirror as an emblem implied to explore its materiality, capabilities, and meanings as inseparable elements.** It implied to investigate how it is or should be designed, what are the processes it can activate or be integrated into, who should own the mirror and who should watch at the reflection, why and for which purposes it is supposed to be used, and finally what values would be embodied in this kind of artefact and to what extent they could deviate through its misuse. And first of all, how it could help in understanding the subject to be reflected. The City.

As stated at the beginning of this thesis, this work is just the starting point of a research path that can virtually continue indefinitely. Thus, the **results and research outputs presented here are not intended to be conclusive on the nature, architecture and applications of City Mirrors**. Instead, they are provisional materials in a research path that necessarily needs to be collective and extended in the long term. Nevertheless, I deliberately decided to start exploring the emblem of the City Mirror in its implications during the three years of my PhD. The product of this first step is just **a thin surface to support future**

research and design explorations on the relationship between technologies and **cities as complex socio-political entities**.

I hope these future explorations will be jointly undertaken with people committed to designing appropriate technologies for activating the absolute fabulous potential of cities to face the unprecedented challenges of our times. This commitment inevitably requires going beyond our comfort zone as urban or informatics researchers, but also as urban practitioners and technology designers. This commitment probably also implies a profound faith in the humankind, in our ability to think and create what is useful, beautiful, meaningful, fulfilling, and even just sometimes. This commitment should definitely be driven by an ardent passion for posterity that urge to ask ourselves what kind of cities and what kind of technologies we really want in the future.

So many other people are fighting already against technologies reducing and limiting humans will and agency, and oppressing the most vulnerable, especially in these hard times. A part of these people is also engaged (or ready to be) in the endeavour of imaging, designing and reaching out people with technologies able to make our human adaptability, sociability, understanding of complexity become the fuel for innovation in cities. Borrowing the words of Wagner [2018] about the concept of **concrete utopia**, these people are already working for making real "*a place beyond reach but within view*". A digital and physical place that is not here yet, but it could be. A place that is approachable by designing the change that is reasonable consider as something we all aspire to.

I look forward to crossing their path and continuing together, likely in unusual ways and settings.

PUBLICATIONS

The following publications are starting to explore the topics indicated in the future lines of research.

- *Under Review.* Lupi L., Antonini A., *Developing the concept of City AI: a preliminary framework.* Journal Paper
- Antonini A., Lupi L., (2019) *Social AI for engaging Ubicomp technologies.* Half-way to the Future Conference 2019 – ACM Proceedings

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