Data flow in living contexts: a systemic analysis for an unsustainable model

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Abstract: Contemporary residential contexts are characterized by new ICT products and services, which collect data about user behaviours. These data are rarely used to develop services for the user or community wellbeing. By contrast, designers typically focus on these goals in contemporary design. An analysis using Systemic Design tools was carried out to understand the type of data flow that is generated by users in contemporary living contexts, to identify the main stakeholders of this data flow and to highlight the main data collection issues for the users, the community and the local area. This study aims to contribute to this growing area of research, highlighting its most important problem, which designers have to solve to realise an appropriate user-generated data flow system.

Keywords: Living Contexts, Data, Systemic Design, Ethic, Real Estate

Introduction

In 2000, a group of computer scientists and engineers from Georgia Tech collaborated on a program called Aware Home. The goal was to create a "living laboratory" to study the use of computerization in every place in the home (Kidd et. al. 1999). The team decided it was its duty to ensure that occupants knew and controlled the distribution of accumulated information. Contemporary house design and conformation suggests that these principles have not been respected.
In the past decade, after an initial phase of blind faith and submission to technology, a fervent discussion has started concerning the repercussions on society that this entails. This involved different issues and technologies (Autonomous driving, Artificial Intelligence, Robotics, etc.) but this paper is focused on the collection and management of user data generated in a contemporary living context.
The Smart home sector is growing strongly within this broad field of research. (Internet of Things Observatory, 2019). Despite this, in the scientific community, the discussion about the relationship between users and stakeholders and the data generated in residential contexts is almost absent. On the contrary, at the urban level, numerous municipalities have acted in this field and have recently united in the movement 'Cities Coalition for Digital Rights'.
Contemporary housing contexts are changing. There are new values for the urban plan that stimulate alternative socio-economic models. These changes also affect data collection and management. This research is based on two assumptions: users must have control over the data they generate and these data should be used to promote sustainable and ethical development of the local areas and to encourage the well-being of users and their community. The authors identified research questions that can be answered using the characteristic methodology and tools of Systemic Design:

RQ1: Who are the main stakeholders connected to data flow generated by users in contemporary residential living contexts?

RQ2: What are the problems of this system that prevent the development of a sustainable and ethical data model?

This article is structured as follows: the first paragraph outlines the Theoretical framework, in terms of the evolution of trends related to housing, the data usage within housing contexts, the influences that favoured the development of alternative socio-economic models and a snapshot of Systemic design. The second paragraph highlights the methodology used for the analysis. In the third paragraph, models are developed through tools typical of Systemic Design that are useful for the analysis of the user-generated data flow within living contexts. The developed models are discussed in the following paragraph.
This article aims to support designers who deal with the development of processes and services for residential contexts. The objectives are to highlight the main challenges for designers in order to encourage an appropriate and sustainable use of user-generated data and to suggest a series of tools for analysis and a design methodology to promote the design of systems based on users, the community, and territorial wellbeing.

Theoretical framework

Technology innovation for Smart homes

Indeterminacy characterizes the living context today. Homes are looking for a new connotation capable of responding to the changes taking place in society. Today, the term 'Smart home' defines new kinds of domestic spaces. The first theories on the goals and structure of the Smart Home date back to the 1990s. (Satpathy, 2006). Technology plays a fundamental role in the Smart home definition. The Internet of Things (IoT) has provided a fundamental technology for data communication within the home, making it possible for connected objects to interact using network technologies (Tan & Wang,2010; Kamilaris & Pitsillides, 2016). In the past decade, machine learning and pervasive computing technologies developed to the point of providing context-sensitive integrated and automated support in domestic environments, contributing to the evolution of the Smart Home. The ability to collect these data makes it possible to perceive and to reflect on the state of the domestic environment and its residents, and consequently to prompt feedback actions (Gorniak and Poole, 2000; Porkodi & Bhuvaneswari, 2014). In the perception phase, the sensors in the house collect data about residents' daily routines from a computer network and store them in a database. An intelligent agent uses these data to generate useful information such as patterns, forecasts and trends (Cook et al., 2003; Augusto & Nugent, 2006).
For this reason, today the literature is generally in agreement in defining an intelligent environment as a space in which all the generated data is stored and analysed collectively, where models are extracted and decisions are made without user intervention (Mocrii, Chen, and Musilek, 2018; O. Bhat, S. Bhat, and Gokhale, 2017). AI and machine learning systems allow a degree of autonomous choice that has levied much criticism from an ethical point of view (Allan et al., 2006; Floridi, 2010; Floridi & Taddeo, 2016; Ruttkamp-Bloem, 2021). However this issue is beyond the scope of the present article.

Collection and management of user generated data in living contexts

Currently while data pervades every sector and field related to human activity, some scientists are realizing the problems related to the current model of data collection and management.
Numerous papers concerning the functioning of smart products (Hernandez et al. 2014; Noto La Diega and Walden, 2016) highlighted the non-compliance of ethical criteria in the management of user data. The emergence of the problem is evidenced by the creation of special names to identify it (Surveillance Capitalism, Digital Feudalism, Extrapolative Model). The most famous is Surveillance Capitalism (Zuboff, 2019), which highlights the unethical uses carried out by large tech companies on user-generated data in each contest.
The studies and analyses on the extrapolative model refer to the entire sector of IoT objects and the related Big Data generated. Despite this, this research is focused on residential contexts. In this field, the system of relationships between stakeholders is still in the development process.
Different mechanisms will contribute to the configuration of this system. The first model developed by early Smart Home scholars and scientists was tarnished. The actual model is not focused on user needs, but on the extrapolation of user

information, although this goal is masked by the contribution made to the enhancement of personal well-being (Zuboff, 2019).

Living contexts trends: The home, the condominium, the neighbourhood.

The lifestyle of the modern occupant highlights how contemporary urban spaces tend to be characterized by extreme multifunctionality. This applies to any context from the home to the city, and it is favoured by the advent of technologies and the digital world.
The new trends are evident in the urban strategic plans that encourage practices aimed at the development of the compact city and at phenomena of selective densification (Indovina, 2017). Another trend is the need to find solutions and services that favour the creation of cohesive communities. Citizens should be active members of the community, interested in how it is designed, organized, or improved (Michelucci and De Marco, 2017). The pandemic in progress has limited movement. It underlined the need for services and infrastructures around the users living context (Roccella, 2020). The concepts of the polycentric city are based on the same assumptions of simplification and proximity to services. The idea of a 15-minute City summarizes these changes (Moreno, 2021). The general objective is to bring the occupants demand closer to the offer to ensure a functional mix capable of encouraging social, economic, and cultural interactions in the polycentric city district.

Rise of democratic movements and critique of capitalism.

Contemporary societies tend to follow environmental and social goals through an economic system that lays its foundations in capitalism, as comprehensively explained by countless experts. This is one of the reasons that led many authors to question themselves about possible future trajectories of capitalism. In general, the different visions agree on a need to re-establish the ethics of the economic system. The guidelines are highlighted for the new capitalism: dignity and reciprocity prevail over aggression, fear, and humiliation, based on the progressive acquisition of society's ability to go beyond the market and live in a more empathethic and sustainable way in an increasingly interdependent, global collaborative "commons" (Stiglitz, 2009; Rojas, 2011; Rifkin, 2014; Collier, 2018). The importance of these trends is confirmed by the identification of the five main challenges for humanity that will determine the shape of the socio-political-cultural context worldwide in the next forty years: capitalism, economic growth, democracy, intergenerational equity, and our impact on the global climate (Randers, 2012).
These analyses are part of a bibliography of proposals. These principles favoured a series of activities and services in very different and distant fields under the common issue of Ethics.
For an ethical data management system, numerous initiatives act to create public and decentralized data infrastructures whose ownership and control are in the hands of citizens. They can contribute to the creation of a system able to interpret those data and use them to carry out projects that pursue collective well-being objectives within specific communities through the voluntary sharing of these data (Bria and Mozorov, 2018).
Such movements require an alternative future in the composition of the systems that guide daily activities. The definition of an alternative data management model linked to living can help create the coordinative smart city that allows citizens to

know how to use their home, how to live in their neighbourhood, and consequently connect with the movements taking place in the urban fabric (Sennet, 2015).

Systemic Design

This background highlights the need to think of the profound transformations in the functioning mechanisms of society, in particular of anthropic processes. The literature on this topic underlines the need for a paradigm shift based on the abandonment of a linear concept in favour of a systemic one (Capra, 1988). This change favoured a new approach to complexity: systemic and interconnected problems require systemic and interconnected solutions (Brown & Wyatt.2010). These changes also favoured a transformation of the designer's role. In recent decades, the designer's focus has shifted to the themes of co-design and the facilitation of new processes, services, systems, and ways of living (Boehnert, 2018).
The Systemic Designer is an emblematic figure who analyses the complexity with a focus on the social, environmental, and economic implications of the project. The systemic designer organizes and optimizes all the actors and parts within the analysed system (service or process). This operation aims to establish a balance among stakeholders of the system. This new structure defines a virtuous and autopoietic network of relationships between the flows of matter, energy, and information (Bistagnino, 2011).

Methodology

This article aims to investigate user-generated data systems in residential contexts. It analyses the current system of stakeholders, the flow of data, and highlights the problems that make the sustainable and appropriate functioning of this flow difficult.
The authors chose classic Systemic Design tools to analyse the user-generated data system (Bistagnino, 2011; Battistoni, Nohra and Barbero, 2019). Particularly:

- holistic analysis: it sets the reference context and analyses the main stakeholders that characterize this System;
- gigamapping; it verifies how the flow of information generated by users in residential contexts moves between its stakeholders;
- zip analysis; in this case, it identifies the focus area on the Gigamap (Z) and the main problems (P) that characterize this System.

These actions aim to favour the paradigm change requested by various studies.
The use of the systemic methodology (Fig.1) and the application of its guidelines chosen to identify the main current limitations.

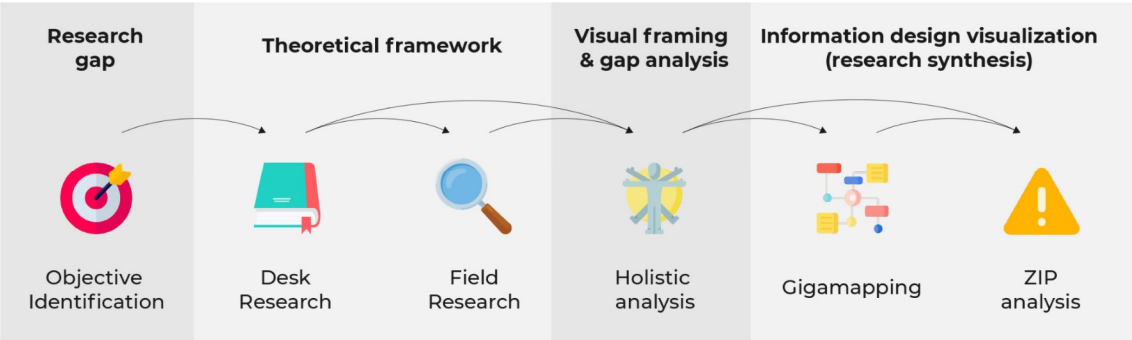

Fig.1. Methodology utilized to analyse user-generated data system in the living context. Edited by the authors.

The paper aims to provide a general analysis of user-generated data systems in the living context. For this reason, it was necessary to disengage the research from a specific territory and project. The first step contemplated a generic mapping of the user's actions to understand what kind of services and products characterize contemporary living contexts. This model was developed by an analysis of certain case studies representing innovative examples of contemporary housing trends. Identification of the case studies was started with the projects selected by the curators of the NUB (New Urban Bodies) exhibition. Furthermore, an application (Smart Projects Map) developed by Planet Smart City was used to map private and municipal smart projects. The choice of limiting research to the European area is due both to the morphological features of the cities and their similar socio-economic and cultural contexts.
Another useful experience for mapping was the opportunity to spend a set number of hours in a sample apartment in an innovative Smart District under construction in Milan. This phase of the Field Research was especially useful to understand and to map the actions that a user can perform in a contemporary domestic automation environment.
These analyses allowed the researchers to draw a map of the precise actions that the users can perform (products and services) in a general contemporary living context. The different actions were clustered on a qualitative basis in macro-categories, which were useful for the successive analysis.
Subsequently, it was possible to work on the realization of a holistic analysis of the field of investigation. To do this, the authors analysed reports concerning the Smart Home field to investigate the role and the goals of the different stakeholders who belong to the sector. Scopus and WoS (Web of Science) databases were used for this goal.
To summarize this research, the authors developed a Gigamap of the data flow system. This analysis focused on the flow that user-generated data have in a generic contemporary living context.
At this point, it was possible to identify the main specific problems that characterize the system by a ZIP analysis focused on specific areas (zoom) and their issues. This activity provided answers to the RQs which are subsequently reported in the discussion and conclusions sections.

Models

Holistic analysis - Set the reference context

Holistic analysis is a relevant tool to analyse complex scenarios within an innovative and transdisciplinary approach (Battistoni, Nohra & Barbero, 2019). It is a proper methodology that integrates different tools (including gigamapping) to define the system analysed (Pereno & Barbero, 2020).
As mentioned, it is possible to notice a relationship of mutual influence between building projects and municipal strategic choices. A series of case studies related to innovative projects in residential contexts were collected (Tab.1). An analysis was then carried out on these to understand the main trends relating to this field and to outline a general conformation of the services characterizing contemporary living contexts (Tab.2).

No.	Case study	City	Country	Condition	Delivery
1	Bike city	Wien	Austria	Inhabited	2008
2	Borgo sostenibile	Milan	Italy	Inhabited	2016
3	Brainport Smart District	Brainport	Netherland	Uninhabited	2030
4	Cascina Merlata	Milan	Italy	Inhabited	2025
5	Centrum Odorf	Innsbruck	Austria	Inhabited	2006
6	Chorus Life	Bergamo	Italy	Uninhabited	2023
7	City Life	Milan	Italy	Inhabited	2023
8	Collective Old Oak	London	England	Inhabited	2016
9	EMS Le Nouveau Prieuré	Geneva	Switzerland	Inhabited	2015
10	Hafen City	Hamburg	Germany	Inhabited	2030
11	Kalasatama	Helsinki	Finland	Inhabited	2030
12	Kalkbraite	Zurich	Switzerland	Inhabited	2014
13	Low2No	Helsinki	Finland	Inhabited	2012
14	Mehr Als Wohnen	Zurich	Switzerland	Inhabited	2015
15	Santa Giulia	Milan	Italy	Uninhabited	2024
16	Smart City Malta	Kalkara	Malta	Uninhabited	2021
17	Regen Villages	Almond	Netherland	Uninhabited	2025
18	Residenza Porta Nuova	Milan	Italy	Inhabited	2021
19	Vrijburcht	Amsterdam	Netherlands	Inhabited	2007

Tab.1. List of case studies identified with their names and main characteristics.

Case studies ->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SHARED SPACES																			
Living area	■	■		■		■		■			■	■	■						
Study room	■							■				■		■					
Children's play area	■			■				■				■		■					■
Meeting space	■			■								■		■			■	■	■
Shared kitchen				■								■				■			
Garden	■											■		■					
Laundry		■		■				■			■	■	■						
Internal square				■	■														
Working area				■				■				■							
Multipurpose room									■										■
Drop-off point				■															
Club room																			
SUSTAINABLE SERVICES																			
Bicycle deposit	■			■															
Teaching garden		■	■	■			■						■	■			■		■
Ethical purchasing group		■																	
Cycle-pedestrian paths			■	■			■	■		■							■	■	
Shared vehicles			■	■						■	■		■						
Living handbook				■															
Tree library																		■	
SPORT & FITNESS																			
Fitness room	■													■		■			

Gym	■	■		■	■	■						■						■	
Group activities				■															
Swimming pool				■		■										■			
Squash & Padel court				■			■									■			
Area yoga																		■	
Surf park											■								
BODY CARE																			
Solarium	■					■													
Relaxation area	■																		
Spa	■			■		■		■								■			
Sauna				■									■						
NEIGHBOURHOOD SHOPS																			
Pharmacy	■						■							■					
Grocery shop	■	■		■	■		■							■	■				
Optician		■					■												
Pet care		■																	
Appliance repair		■			■														
Library		■																	
Hypermarket				■											■				
Offices			■				■					■			■	■			
Children’s museum															■				
Seasonal market				■							■		■		■				
Cafè			■	■			■	■	■		■	■	■	■	■	■			■
Restaurant			■	■			■	■	■		■	■	■	■	■	■			■
SERVICES																			
Nursery	■		■		■		■		■					■	■				■
Dance school		■																	
Cinema		■		■	■	■						■		■	■				
Cultural associations		■		■															
Youth centre					■														
Day-care centre			■		■														
Rehearsal room					■														
Theatre					■														■
Dog area				■															
School			■	■						■	■								
Mall			■	■		■													
Hotel						■						■			■	■			

Tab.2. Matrix for identifying types and frequency of services available to district residents (Case studies).

These new trends are the result of a deep investigation that has led the real estate development sector to question itself on a redefinition of the project. New construction dynamics are emerging, which show the attention of builders and Real Estate companies to the services available to living contexts and the development of solutions that may encourage community dynamics in the area.
Based on this observation, authors draw a general mapping of the services, products and functions available to the occupants of a general contemporary living context. The new trends related to living contexts highlight the presence of common areas and services for the dweller both in the condominium and in the neighbourhood in addition to the classic domestic environment. Finally, the municipality and the city were identified for the implementation of other actions subsequently categorized in the areas of mobility and daily actions.

Once this mapping was obtained, it was useful to carry out clustering of the actions of the occupants of the "model district", which led to the identification of 9 macro-areas: Home management, Time management, Wellness, Fitness, Nutrition, Waste management, Domestic cleaning, Personal hygiene, and Mobility (Fig. 2).

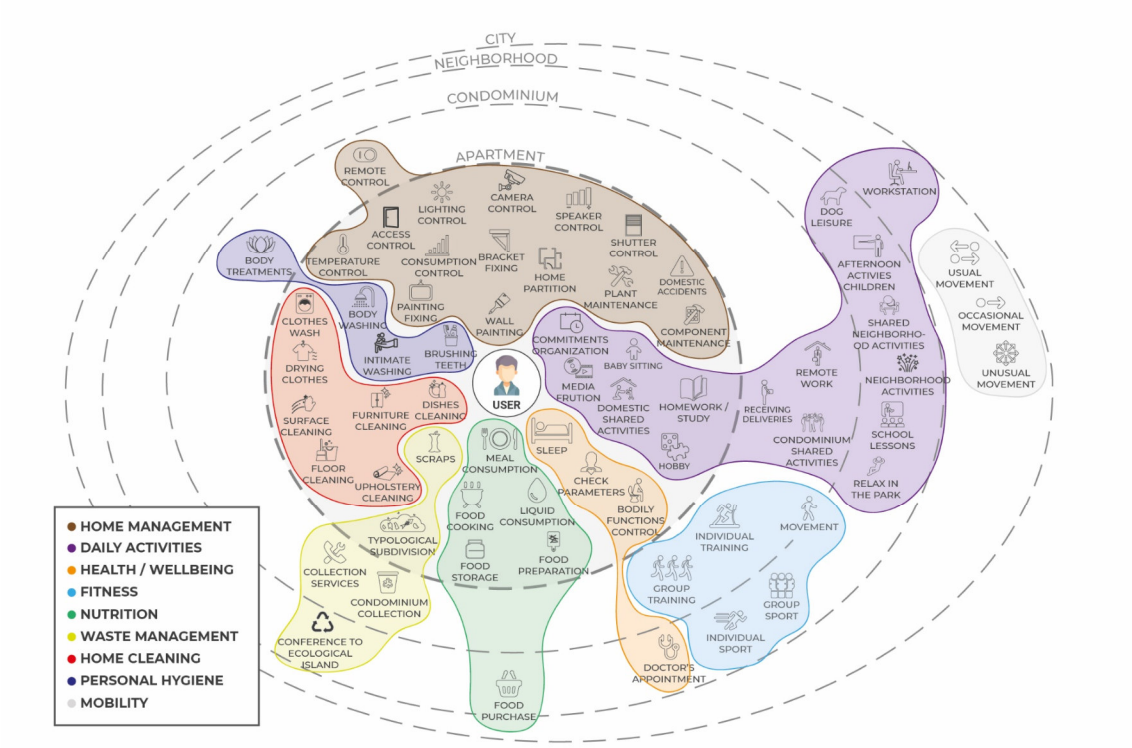

Fig.2. User action model in a general contemporary living context. Edited by authors.

Holistic analysis - The main stakeholders that characterize the system

Users

Users perceive a lack of respect for their privacy compared to the data they generate and moreover, they are not aware of the use of their data (Internet of Things Observatory and Doxa, 2019).
The users concern derives both from the lack of clarity on the topic and from the continuous cases of unaware transfer of data to third parties that they become aware of through the media. For this reason, the discussion on sharing the data generated inside the apartment becomes an ethical issue for users.
User distrust in sharing their data is increasing as they are aware of the ability of smart products to collect information (Ogury, 2019), even if they rarely know the purpose of such collection (Internet of Things Observatory, 2019). From these data, it is possible to underline the correspondence between the awareness rate of users with respect to the actual use made of their data and the rise in the national market of Smart Home Products. The users are more aware when the market percentage is higher.
This growing awareness, combined with the rising ethical movements that characterize the economy, the city, and the relationship with user data provides a margin of manoeuvre and a starting point to think about an ethical data system linked to the housing context.

Tech companies

The so-called "Big Tech Companies" are playing a fundamental role in the rise of home automation and data collection in the activities highlighted in the mapping.
These companies launched home speakers on the market at very low prices, evidently aiming to generate a business that goes far beyond the sale of hardware: more accurate user profiling, support for purchases, leverage on third-party retailers (Internet of Things Observatory, 2019; Internet of Things Observatory, 2020).
A report highlights how Google collects data on consumers and their most personal habits (Schmidt, 2018). In addition to profiling purposes, an interest of the Big Tech Companies lies in the development of AI (Artificial Intelligence) technologies. The amount of data collected makes it possible to revolutionize the approaches of this technology with solutions such as neural networks, previously less effective (Bria and Mozorov, 2018). Users often do not understand the actual use that is made of their data, despite the most recent directives and laws issued at a European level. Furthermore, if they are interested in setting limitations on the collection of certain products, they would risk undermining a series of functionalities due to the settings of some smart home products (Hernandez et al. 2014; Noto La Diega and Walden, 2016).
Smaller tech companies and Start-Ups also fall into the Tech Companies category: they collect and use the data produced by users through IoT objects characterizing the mapped actions. In this case, the more vertical the sector in which the company is inserted, the more likely it will be that the use of the data collected by its users will be linked to the marketing of the same. There have been numerous cases of Start-ups that sold the collected data to third-party companies or to "Big Tech Companies" (Isaac, 2020).

Insurance companies

IoT can be used by the insurance company to collect actual customer data in real-time. Customer data can help insurance companies to analyse customer risk. The insurance company can provide the customer with an even more customized rate based on their habits (Wang, Adams and Anggraeni, 2019). Modern retes use sensor data to offer the user suitable pricing models adapted to their character (Roth et al. 2020). Insurance companies use the data collected from different macro-areas to create specific life, car, and home policies. The Smart Home will be one of the 4 most important technological ecosystems in the future for insurance. It will be the one in which more innovative services can be developed, for example, regarding Ambient Assisted Living technologies. This sector will be connected to smart health, a particularly relevant field given the aging population (Beham et al., 2019).

Data and regulation

Government bodies constitute a fundamental stakeholder in this system. They set the rules. They must develop systems, solutions, and laws for the protection of user-generated data at different levels. The activity carried out with this purpose can be summarized in the GDPR (General Data Protection Regulation), the European Union regulation on the processing of personal data and privacy.

Another important law is the "Cyber Security Act" which specifies the role and mandate of Enisa and introduces a European system for IT security certification of Internet-connected devices and other digital products and services.

Policy makers, Public administrations, and Public companies

These three subjects are treated together for the relationships often existing between them and for their common purpose: to provide efficient services to citizens while maintaining an economic balance between investments and expenses.
Public administrations and public companies are the Stakeholders who enjoy direct interaction with the daily actions of citizens related to the use of public services. The policymakers deal with the modification of existing services or the creation of new ones to meet the different needs encountered. They do this by collecting feedback from the various stakeholders and observing the functioning of specific services and the system as a whole. The rise of data collection and management tools favoured the development of new operating methods in the role of these stakeholders and the development of services or interventions on existing ones, starting from the analysis of the collected data (Neves, de Castro Neto and Aparicio, 2020). One of the most evident consequences of the increase in data on the public administration has been the development of Open Data (Ojo, Curry, and Zeleti, 2015).
This trend favoured the rise of Big Tech Companies in city administrations through the technique subsequently referred to as 'extractivism' (The Economist, 2017; Bria and Mozorov, 2018).
Thanks to these experiences, it has been possible to realize how much the outsourcing and privatization of these services increasingly limited the availability of data to policymakers (Grimshaw, 2017).
The interrogation on the possibility to build an alternative model started in different fields. This favoured the rapid growth of municipal case studies active on these issues (Calzada and Almirall, 2020). Work began on alternative models capable of countering the advance of what had been identified as digital feudalism in favour of decentralized, sustainable models based on common goods. Today, these models first launched at the municipal experimental level represent solid experiences associated with each other in the "Cities for Digital Rights" movement made up of more than 60 cities.

Gigamapping - Data flow

At this point, it is possible to assert that the analysis carried out allowed to highlight:
- a general view on the relationship between users and data;
- the contextualization of the discussion within contemporary living contexts;
- the existing relationships between the main stakeholders;
- the flow of information between the actors of this system.

Gigamapping is a tool that supports designers to work on a vision on complexity in large-scale projects (Sevaldson, 2018). The following Gigamap describes the user-generated data flow in a general contemporary living context. It summarizes the goals of every stakeholder and the relationship between the flow generated by the latter and users. (Fig. 3).

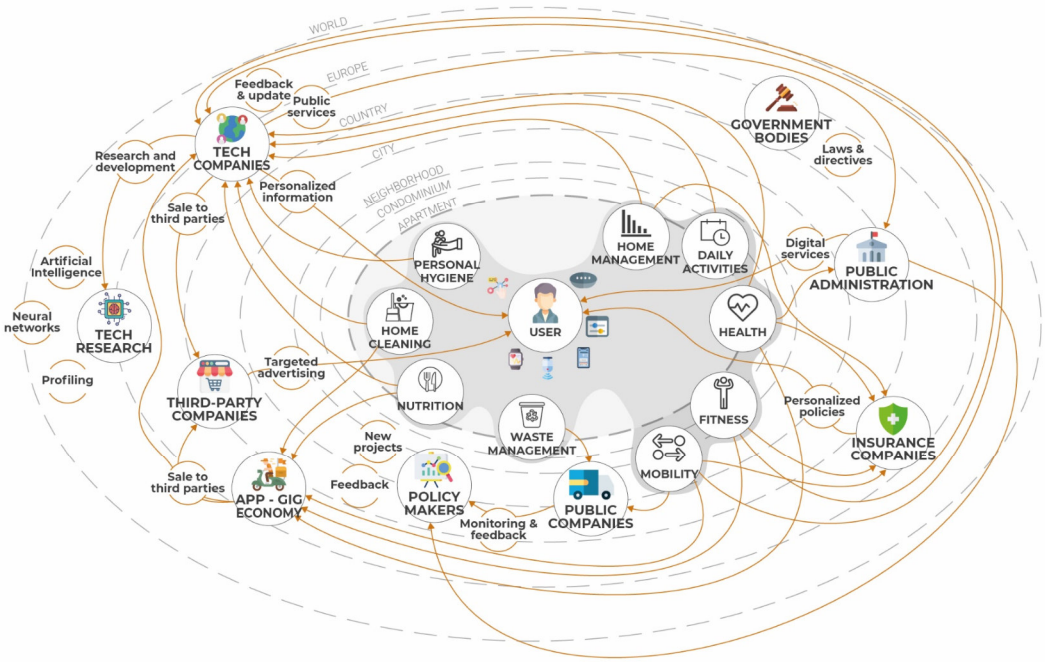

Fig.3. Gigamap, of the user-generated data flow in a general contemporary living context. Edited by the authors.

Zip analysis - Problems and criticalities

A ZIP analysis is a simple method to identify 'zoom' areas, problems, and potential or ideas that stand out on the map. ZIP stands for zoom, innovation (idea, intervention, innovation), and potential (problem or 'painpoint'). A ZIP analysis is conducted by marking the Gigamap with ZIP points.
These analyses have precisely identified certain points that prevent the creation of a sustainable and ethical data collection system based on the users, community, and territorial well-being. These are identified by a focus on two areas in the Gigamap (Fig.4)(Fig.5):
Z1. The analysis of the relationship between users and smart products-services which occupants have in their homes.
Z2. The smart services used by users in the district or city where they live.

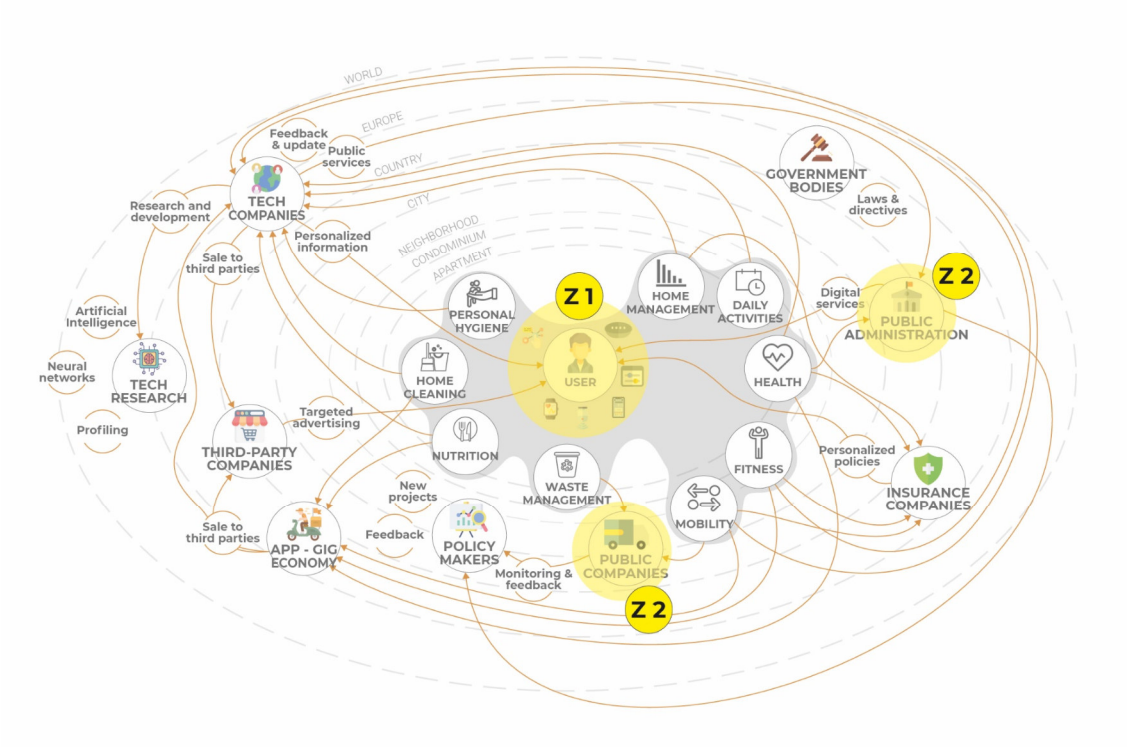

Fig.4. Identification of the system's ZOOM points. Edited by the authors.

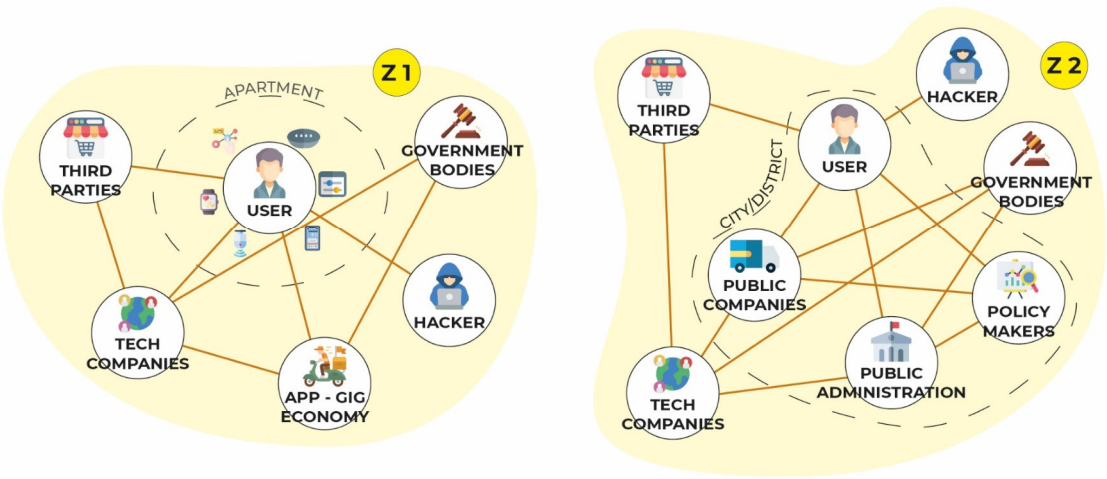

Fig.5. Stakeholders' relationship analysis in ZOOM points. Edited by the authors.

The focus on these two zoom areas highlights some important problems that characterize the system of user-generated data in contemporary living contexts. This first Zoom area highlights the following problems (P) (Fig.6):

(P1) The difficulty of identifying reliable data collectors.
(P2) The digital system of the IoT paradigm is highly fragmented with many non-interoperable vertical solutions.
(P3) The monopoly of data creates inefficiency and inequality.
(P4) The complexity of policies and privacy acceptance procedures to achieve efficient use of products.

(P5) The incorrect functioning of smart products when privacy transfer is denied.
(P6) The lack of user control over the personal information generated.
(P7) The vulnerability of personal information.
(P8) The commercial interests related to the mapping of user behaviour.

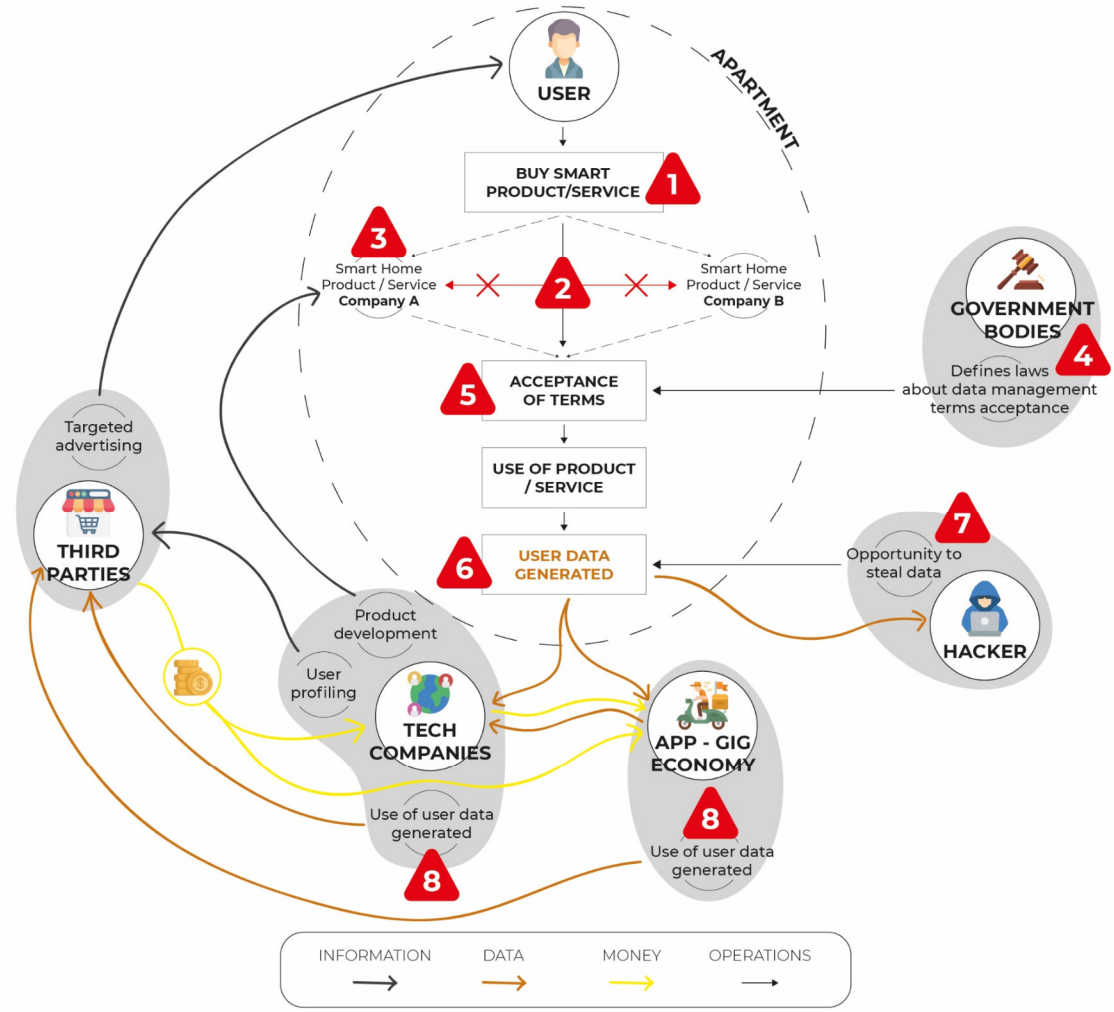

Fig.6. The analysis on the relationship between users and smart/product services which inhabitans have in their home. Edited by authors.

This second Zoom area highlights the following problems (P) (Fig.7):

(P1) The difficulty of identifying reliable data collectors.
(P4) The complexity of policies and privacy acceptance procedures to achieve efficient use of products.
(P7) The vulnerability of personal information.
(P9) The lack of occupant awareness of the flow and purpose of their data.
(P10) The penetration of Big Tech Companies in public administrations.
(P11) The dominating trend towards the design of a ‘Prescriptive’ smart city.

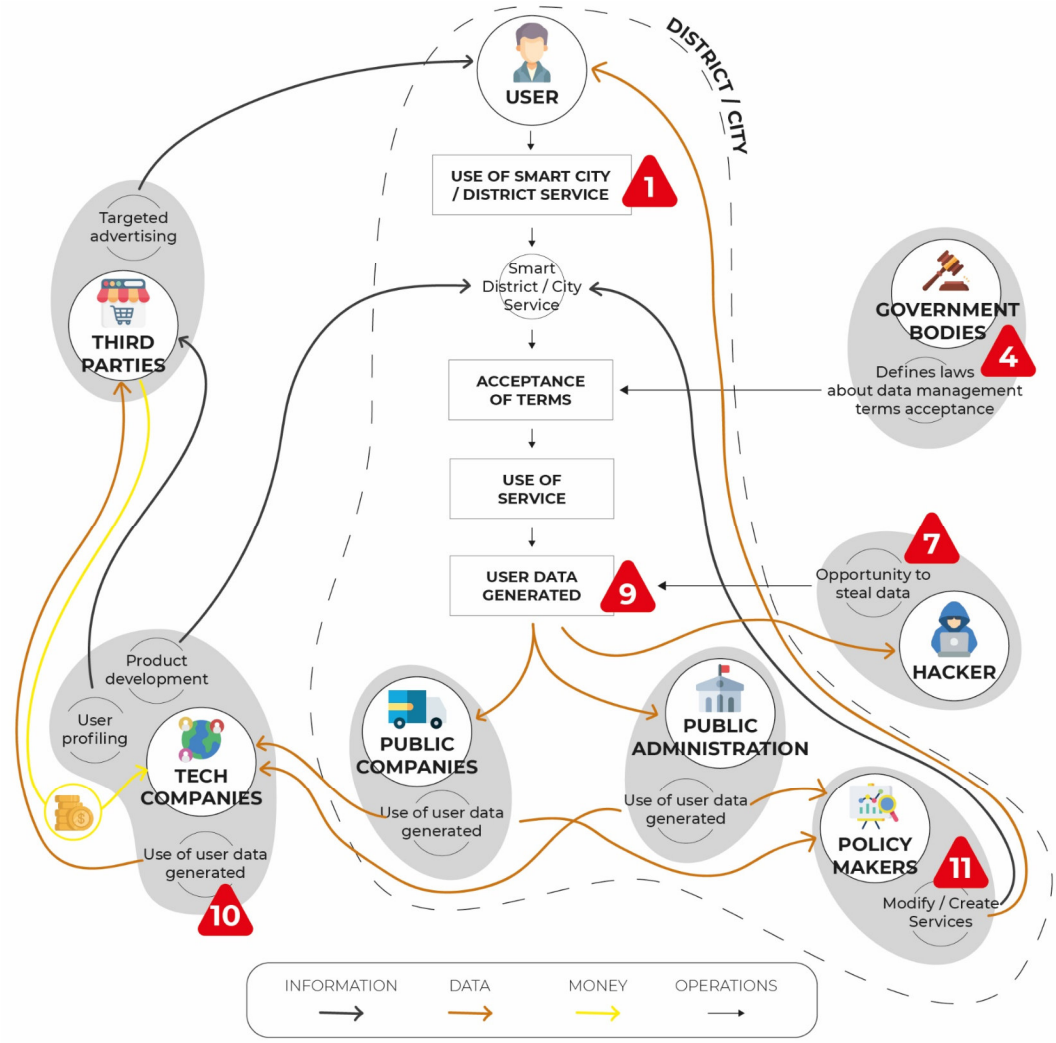

Fig.7 The smart services used by users in the district or city where they live. Edited by authors.

Discussion

The Systemic Designer designs the system, service, or product for a specific social, cultural, political, and economic context (Peruccio, 2018). He may be able to highlight the potentialities linked to the development of an appropriate model to the stakeholders who are part of the system and possibly identify new ones to involve. In production processes, the link between place of production and consumption is fundamental for the sustainability of the project (Bistagnino, 2011).
Similarly, the analysis developed shows that as the distance between users and stakeholders increases, the interest of stakeholders is more based on economic aspects and technological development. The benefits for the individual are only functional and apparent, as amply demonstrated in the theoretical framework. Oppositely, the case studies related to virtuous administrations and the Gigamap (Fig. 4) show how the actors operating in the territories are interested in data. Policymakers, public companies and public administrations have a different consideration of data. They consider data to be an element that favours the creation of new services based on the monitoring of user habits and choices. The developing trends related to living contexts and the rise of democratic and participatory movements highlight the need to develop new solutions linked to the housing context which can also regulate the relationship between data and users. The case

study analysis highlights the changes taking place in the Real Estate field. Real Estate companies are transforming into urban developers and maintainers of after-sales services linked to daily activities. At the same time, the relationship between design and democracy is emerging in new residential projects. Occupants are looking for greater inclusion: they want to belong to the housing context. Following the initiatives taken by the 'Cities Coalition for Digital Rights' movement, Real Estate companies should become mediators of the relationship between users and Tech companies. This could contribute to reducing some of the issues analysed in this paper. Moreover, Real Estate companies should resume the founding principles that led the research in the sector of smart homes at the beginning of the century. These stakeholders must guarantee the ownership of the information generated by users and allow it to be shared voluntarily within projects set up on a territorial scale. This could be the way to exploit the potential of observation and monitoring inherent in the data and finally make them an active tool for a more conscious design and better quality of life.
This analysis suggests the need for a coordinating role by these actors concerning the tenants right of ownership over the data they generate at home. Real Estate companies today are increasingly seekingto build partnership with entities, companies, and public administrations to bring useful services to citizens in contemporary residential contexts. The creation of these ecosystems would allow the collection of a variety of data which will broaden the vision of specific housing contexts. The concept of the house as a computer to inhabit could be overcome in this way. Real Estate companies can thus become precursors in initiating this process.
The text by Francesca Bria on the role of municipalities concerning data management proved that constant experiments and small-scale pilot projects will be necessary to focus on programs that generate real value for the occupants and to discard the experiments that do not bring tangible benefits. The community, whether it is the condominium, a set of neighbouring buildings, or a neighbourhood, must appropriate the data regarding user activity in their homes, spaces, and common services, and consider them common goods.
In a process of this type, the role of the Systemic Designer is considered fundamental. He/she can act as a mediator between the needs of the various stakeholders and pursue the creation of services and projects contextualized to the reference territory (Celaschi, 2007). The skills and abilities of the designer are fundamental to developing virtuous alternative models focused on social, environmental and economic aspects. These should also be able to pursue the well-being of individuals, communities, and the territory to which they belong.

Conclusions

This paper aims to stimulate the discussion in the scientific community on the design of alternative models for data management within living contexts. The goal of this article is to help designers by providing an analysis of the problems of user-generated-data in housing contexts (Holistic diagnosis, Gigamap and ZIP analysis). Moreover, it proposes specific tools to analyse specific contexts and to develop systemic data collection and management processes in living contexts.
The paper aims to encourage the application of research principles and tools to real case studies. An analysis is provided of how living contexts are currently in a transition phase influenced by the rise of IoT objects. The dilemmas presented here

and the challenges that characterize this sector must be addressed as soon as possible at a systemic level. The design community should also work on the problems highlighted in order to develop virtuous alternative models.
The actors interested in developing suitable services must present a common front through solutions that provide an ethical system for home data collection. In this kind of approach, designers could use these data to develop services based on local peculiarities from a social, environmental, and economic point of view.
Real Estate companies can play a key role in developing a different approach. They can emulate the actions of certain municipalities regarding the use of data in the housing sector. Encouraging these dynamics would allow the development of a new way of living within their districts. Solutions of this type would help incentivize a paradigm shift in the exploitation of data concerning housing and the general relationship between data and users.

Conflicts of interest:

The authors declare no conflict of interest.

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TABLE CAPTION

Tab.1. List of case studies identified with their names and main characteristics.

Tab.2. Matrix for identifying types and frequency of services available to district residents (Case studies).

FIGURE CAPTION

Fig.1 Methodology utilized to analyse user-generated data systems in the living context. Edited by the authors.

Fig.2 User action model in a general contemporary living context. Edited by authors.

Fig.3 Gigamap of the user-generated data flow in a general contemporary living context. Edited by authors.

Fig.4 Identification of the system's ZOOM points. Edited by the authors.

Fig.5 Stakeholders' relationship analysis in ZOOM points. Edited by the authors.

Fig.6 The analysis of the relationship between users and smart product-services which occupants have in their homes. Edited by the authors.

Fig.7 The smart services used by users in the district or city where they live. Edited by the authors.