



Politecnico
di Torino

Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio
Eccellenza MIUR 2018-2022



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U R D

PhD in Urban and Regional Development
IN VARIETATE CONCORDIA

Doctoral Dissertation
Doctoral Program in Urban and Regional Development (XXXVI Cycle)

Blockchain for civic initiatives in the urban space

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Politecnico di Torino - Università degli Studi di Torino
May 24th, 2024

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Cristina Viano
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Summary

Processes of civic participation and social economies in local and urban communities are increasingly affected by digitalization, and in turn contribute to redefining technological paradigms towards more participatory digital tools. Blockchain technologies have only recently appeared in this domain. The reason why blockchain is of interest is that it allows community members to digitally represent (tokenize) and transfer assets of value without intermediaries. There is much debate concerning blockchain technology due to its potential for disintermediating established governance models, and lack of evidence concerning its socio-political implications especially in social and civic domains. The technology is mostly associated with global speculative cryptocurrencies, or with complex systems for automated tracking of transactions.

This research focuses instead on how blockchains can be developed and used for civic, social and collaborative economies in local communities, which represents an innovative understanding of the technology affordances. The study focuses on the case of CommonsHood, a blockchain-based wallet app developed by the Department of Computer Science at the University of Turin for an experimental research project of which the author of this research is an active member. The application aims to make blockchain functionalities accessible and adaptable to the socio-economic needs of different communities, by allowing non-expert users to create cryptographic tokens and model the desired exchange systems.

The overall goal of the research is to contribute to better understanding, design and development of blockchain-based tools for digital social innovation. The geographical perspective contributes to understanding the socio-spatial implications of using blockchain as a civic technology, and to embedding the technical developments in local socio-economic contexts. The research builds on interdisciplinary literature from digital, urban and economic geography; from

computer science, human-computer interaction (HCI) and design, and from policy analysis. Technical and functional explanations of the technology are considered together with a critical investigation into its implications. The concepts of digital social innovation, digitally-enabled co-production, alternative urban digitalization, and urban digital platforms are mobilised together with the “reading for difference” approach to frame a multidimensional analysis of the app pilots, using qualitative methods.

The study starts by defining the civic blockchain approach advanced by the CommonsHood project. It analyses how this approach interprets blockchain properties in a way that is oriented towards civic purposes, and how it addresses some of the risks associated with tokenized economies and governance, risks such as commodification and algorithmic control.

The empirical investigation focuses first on how the digital tool is shaped by local contexts (how it is designed and developed to be context-based). The communities of users co-design both the socio-economic models and their associated tokens and smart contracts. Such profound adaptability to different socio-economic contexts requires a challenging process of context-based co-design. It also implies distinction as to which interactions can be tokenized, and which ones should not due to risks of excessive commodification.

Second, the experimentation looks at how this digital tool can shape local contexts (its effects on their socio-economic spaces and spatialities). Two models of tokenized social economies are considered: rewards for civic participation, and a community sharing economy. They are expected to foster socio-economic interactions characterised by geographical proximity. Transactional, relational and transformational approaches to social interactions coexist. This is reflected in the way urban places are defined. Communities with an intermediate extension and level of cohesion among members are those in which the application appears more relevant, since tokenized transactions can strengthen weak forms of trust.

This research shows a viable methodology for redeploying blockchain as a civic technology and for implementing context-based design and use of blockchain-based wallet applications. Interdisciplinary action research plays an important role in matching social needs to technical developments.

Acknowledgments

The research presented in this dissertation was carried out as part of a significant teamwork. The collaboration with Irene Domenicale and Sowelu Avanzo was fundamental for the implementation of the pilot projects and for data collection. We undertook a stimulating dialogue on how to study blockchain technology by crossing geographical, economic, philosophical and computer science perspectives, also together with Flavia Fredda. Knowledge of the CommonsHood app and of the possibilities of its development and adaptation was possible thanks to participation in the activities of the development and design team, which is coordinated by Claudio Schifanella: Alex Cordero, Alessandro De Marco, Lucrezia De Zuanne, Shao Hao Hu, Lucia Labanca, Ailin Optiz, Emanuele Spadaro, Michele Staffieri, Nicolò Vanzo. Participatory research, public engagement and educational activities were done thanks to continuous collaboration with the members of the Digital Territories and Communities research group, guided by Guido Boella: Monica Cerutti, Sara Filippelli, Eloheh Mason, Sonia Migliore, Chiara Nota, Alberto Rondelli, Alice Ruggeri, Luigi Sanasi, Chiara Sonzogni, Alice Zanasi. The dialogue with them allowed me to get passionate about the potential of action research on digital civic technologies. The support by Llio Humphreys in editing texts in English was an opportunity to reflect in depth on lexical choices and translations. A special thanks go to the supervisors of this research, for their guidance and encouragement: Chiara Certomà, Guido Boella and Marco Santangelo. I acknowledge the generous work of the people who actively dedicated their time to the implementation of the pilot projects, accepting the challenge of designing and experimenting with new uses of blockchain technology. Specifically: the members of the Les Petites Madeleines Association and the “COSO” community, and the team of the Mufant Museum in Turin; the educators and volunteers of the San Donato Cooperative in Collegno; the researchers of the DIGGEO@ESOMAS research group of the Department of Economics and Social Studies at the University of Turin.

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Introduction

Processes of civic participation and social and solidarity economies in local communities are increasingly affected by digitalisation, and in turn contribute to redefining technological paradigms. These processes challenge mainstream models of smart cities and platform urbanism, which are based on neoliberal and technology-led paradigms (Di Bella, 2015; McFarlane and Sodestrom, 2017; Lynch, 2020). Instead, they foster the development and adoption of digital tools that are more participatory and human-centred (Vadiati, 2022). Such digital tools involve multiple technologies and overlapping application domains: crowd mapping, volunteer geographic information (VGI), crowdsourcing tools, and/or databases to share information about an urban topic or geographical area, and these are used for government-citizen co-production of services or for citizen-led/commoning initiatives. The same tools are used to map and exchange material or immaterial resources, which enables the development of non-monetary micro-economies or complementary welfare measures. Crowdfunding platforms enable community monetary transactions to take place. Opinion formation and e-voting platforms support more complex e-democracy and e-deliberation processes (See Article 3). Blockchain technologies have only recently appeared in the domain of civic participation, social and solidarity economies, and alternative urban digitalization. Therefore, its impact on the redefinition of participatory processes and of technology paradigms is still limited.

Blockchain is a distributed ledger made of a chain of immutable blocks of data, replicated in identical copies over a network of nodes. This makes it possible to record data transactions in a secure way, even in the absence of a third party or intermediary to certify the transactions. The reason why blockchain is of interest for solidarity economies and financial inclusion is not only because it could reduce the times and costs associated with providing a trust layer, but above all because it offers a way to tokenize and transfer assets without intermediaries.

Microtransactions that would simply not be feasible when factoring in traditional costs become worthwhile with blockchain, and this makes more assets liquid. Some experimentations have begun on blockchains for local communities and for civic participation in the framework of: solidarity economies and social finance (see, for instance, the work of Howitt et al. (2021), Circles (n.d.) and Mattson et al. (2023)), urban commoning, peer-to-peer economies (see for instance the proposals made by Pazaitis et al., 2017; Rozas et al., 2021), and participatory urban planning (Ietto, 2023).

Researchers from the field of economic and political geography have studied the political, economic and environmental implications of blockchain mainly by looking at cryptocurrencies at the macro/global level (Caliskan, 2020; Parkin 2020; Zook, McCanless, 2022). Likewise, there are not many empirical studies in the social sciences about the socio-spatial implications of blockchain applications designed for the local level or more recent application sectors such as civic participation and social innovation. Researchers from the fields of urban studies and digital geography have recently started to study blockchains for civic actions or for alternative or grassroots digital urbanism in local communities (Chiappini, 2022; Balaguer Rasillo, 2023).

This thesis is intended to contribute to this strand of literature with an empirical approach of experimenting firsthand with the design, development and testing of a blockchain-based platform rather than just observing it. A geographical perspective can make a significant contribution to understanding the socio-political implications of blockchain technologies in these domains, particularly with regard to the (re)production or disruption of socio-economic spatialities and power relationships. It can also provide useful insights for the design of blockchain-based applications for civic participation and for local communities.

The research described in this thesis revolves around a case study of the CommonsHood app (Balbo et al., 2020; Viano et al., 2022; Viano et al., 2023a) developed by the Digital Territories and Communities research group at the Department of Computer Science, University of Turin, to which I belong. CommonsHood is intended to support social collaborative economies on a local level. It is a blockchain-based wallet app¹ that, through a simple interface, allows

¹ Blockchain wallets are digital wallets that allow the storage and transfer of tokens such as cryptocurrencies and non-fungible tokens (NFT).

users to create new types of cryptographic tokens² representing assets of value (and not only in a monetary sense), via customisable smart contracts³. Its stated objectives are to facilitate the circulation of latent social and economic local resources, activate collaborative economy practices, and bring certain blockchain benefits that are often associated with global, virtual, delocalised dimensions to situations on a local scale (Balbo et al, 2019). More specifically, the technical development goals are about making complex blockchain technologies *accessible* to the general public, and making tokenization⁴ and tokenized economy models *adaptable* to the specific needs of different local communities. Through the app, citizens, economic actors, associations, and local institutions can create in their own wallets cryptographic tokens that digitally represent assets of value for the local community. Tokens can represent local coins, prepaid cards, discount coupons, tickets allowing access to shared tools and structures, or purpose-driven tokens to reward civic behaviours. Users assign a value to the tokens and decide the rules for exchanging them. Users are also responsible for designing and implementing schemes such as complementary welfare measures, time banks, loyalty systems for proximity retail and local production, and for managing access to urban commons. The experimental applications of CommonsHood considered in this research crosscut the fields of public/private coproduction of services and citizen self-organisation, and includes: welfare services provision, promotion of local economic activities, urban commoning, volunteering, solidarity initiatives. Different public/private/civil society components are mobilised in different combinations.

The Digital Territories and Communities group (hereinafter the DTC research group) develops digital tools to enable civic and participatory practices in urban communities using an inter- and transdisciplinary approach. Its origins lie in the development of the FirstLife civic social network⁵ (Boella et al., 2019). Since then, geographers and volunteer geographic information (VGI) experts have contributed to the definition of research lines and strategies focused on bringing the advantages of global mainstream technologies to local communities. The research presented in this thesis comes from my work as a project manager in that

² Cryptographic tokens are the digital representation of values, or rights (property, access) over an asset.

³ Smart contracts are computer programs that operate over a blockchain, automatically executing the terms of a contract when certain conditions are met.

⁴ Tokenization is the representation of assets of value in the form of digital tokens.

⁵ <https://www.firstlife.org/>

group, and is inspired by its general attention to socio-economic local contexts and territorial dynamics. As a member of the group, I designed the research presented in this thesis with two purposes in mind. On one hand, in order to contribute to advancements in urban and digital geography on understanding the potential and socio-spatial implications of blockchain as a civic technology. On the other hand, in order to contribute to applied research in computer science by providing developers with iterative feedback from experimentations in real-life contexts.

I regard the CommonsHood experimentations as a case of digital social innovation driven by interdisciplinary academic research and based on a participatory approach. The experimentations shade light on the potentials and challenges of blockchain for civic and collaborative practices in local communities. I investigate how this blockchain-based tool is shaped by, and shapes, the local socio-economic contexts where it is developed and used. Based on iterative co-design and testing of the app in different local contexts, I provide an interdisciplinary methodology for embedding blockchain as a civic and context-based technology in local socio-economic spaces.

The study started from the following research questions:

- How can blockchain technology be used to enable and support processes of co-production and civic participation?
- How can blockchain technology be made adaptable to the needs and resources of different local socio-economic contexts?
- What are its effects, in those contexts, in terms of changes in socio-economic interactions, spaces and spatialities?

Addressing these questions required an interdisciplinary approach to first understand the specificities of blockchain and define the research group's particular approach to this technology, before delving into the empirical analysis of how the wallet app under consideration relates to urban spaces and local contexts. The geographical perspective adopted allowed us to study the socio-spatial implications of using blockchain as a civic technology, and to embed the technical developments in local socio-economic contexts. Specifically, adopting a digital geographical approach meant focusing on how the digital mediates, augments, and transforms the production of space and socio-spatial relations (Ash et al., 2016); considering augmented spaces (Aurigi and De Cindio, 2008) and digital spatialities (Leszczynski, 2015); and contributing to recent research lines on the spatialities of digital social innovation (Certomà, 2020). Moreover, the

study was carried out as action research within the relevant urban spaces and communities, thus allowing a direct knowledge of the contexts taken into consideration. This framing implied adopting also a transdisciplinary approach, including the design and management of collaborative research projects at the European level and at the local level⁶ together with other research groups, local authorities, civil society organisations and groups of citizens.

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This thesis is based on a collection of three articles. Their sequence and the additional findings reported in this document refine the three initial research questions mentioned above. These articles are part of a broader plan which led also to other publications. Specifically, one additional article⁷ and two book chapters⁸, that provide methodological reflections related to the broader work of the research group.

PART I of this thesis introduces the topics and methodology of the research. In Section 1, I introduce blockchain technology from a social science perspective and describe its applications in public, social and civic domains. I then explain the geographical approach guiding this research and its relevance for studying blockchain-based digital social innovations. Section 2 presents the methodological and analytical framework of the research: my position as an insider in a software development research group, the case study, and the research phases and methods. The three additional papers mentioned above are introduced in this section.

PART II presents the three core articles, and explains their overall rationale, which aims at introducing the blockchain technology, outlining its potentials for civic actions, and studying in depth its socio-spatial implications. Section 3

⁶ Detailed information is provided in Sections 2.1, 2.2 and 6.3.

⁷ Viano C., Tsardanidis G., Dorato L., Ruggeri A., Zanasi A., Zgeras G., Mylona V., Efthymiou I. and Vlachokyriakos V. (2023) Living labs for civic technologies: a case study. Community infrastructuring for a volunteer firefighting service. *Front. Public Health*. 11:1189226. doi: 10.3389/fpubh.2023.1189226.

⁸ Viano, C.; Boella, G; Schifanella, C. (2024) Embedding sustainability in software design and development: accessible digital tools for local communities. In Certomà C., Iapaolo F., Martellozzo F. (eds.) (2024). "Digital Technologies for Sustainable Futures: Promises and Pitfalls2 (1st ed.). Routledge.

Boella, G., Viano, C., Schifanella, C., Blockchain and tokenisation for local communities. Chapter submitted for the book "Blockchain for Good: The Transformative Impacts on Industry, Community and the Planet.", edited by Marcus Foth and Shoufeng Cao. Currently under review at the date of finalization of this document (May 2024).

focuses on the first phase of the research, which delved into blockchain technology, drawing on literature from different disciplines. The *first article*, “Blockchain tools for socio-economic interactions in local communities”⁹, introduces the specificities of blockchain technology with respect to information and communications technologies, and how they are relevant for co-producing public services in accordance with “Governance as a Platform” models. The *second article*, “Civic Blockchain: Making the blockchain accessible for social collaborative economies”¹⁰, defines the Civic Blockchain approach that underpins the CommonsHood app and explains how it is reflected in the app’s design and technical features. The article also identifies open issues of specific interest for digital geography research, which bridges with the second phase of the research. Section 4 focuses on the second phase of the research focused on empirical analysis. First, it shows how the CommonsHood app is context-based in its design and development (*third article*: “Context-based Civic Blockchain: Re-localizing the blockchain for local civic participation”¹¹). Second, it sets the conceptual framework for studying how this blockchain-based tool can shape the local socio-economic spatialities of social collaborative economies. This assessment is reported in Section 5, which presents further findings from the pilot experiments in addition to those presented in the third article. This constitutes the foundation for a future paper with a digital and economic geography perspective.

PART III. Section 6 summarises the theoretical, empirical and methodological contributions of the research, and discusses its conceptual and methodological framework as well as open issues. It suggests future research lines along five thematic areas (pilot experimentation, modelling of tokenized economies, analysis of community needs, transdisciplinary research on civic technologies, and educational activities). It describes planned or ongoing related projects following on from this research.

⁹ Viano C., Avanzo S., Cerutti M., Cordero A., Schifanella C., & Boella G. (2022). Blockchain tools for socio-economic interactions in local communities. *Policy and Society*, 41(3), 373–385. <https://doi.org/10.1093/polsoc/puac007>.

¹⁰ Viano C., Avanzo S., Boella G. Schifanella C. (2023). Civic Blockchain: Making blockchains accessible for social collaborative economies. *Journal of Responsible Technology*, 15, 2023, 100066, <https://doi.org/10.1016/j.jrt.2023.100066> .

¹¹ Viano, C. (2024). Context-based Civic Blockchain: localising blockchain for local civic participation. *Digital Geography and Society*, 6, 100090, <https://doi.org/10.1016/j.diggeo.2024.100090>

PART I

Chapter 1

Background

1.1 Blockchain: novelty, debates and research gaps

Blockchain is a distributed ledger technology (DLT) that allows permanent and verifiable records to be kept containing data about digital transactions between parties without the need for any intermediary or central authority. This is made possible by a combination of different technologies. Blockchains are operated by a peer-to-peer network of computers (nodes), each of which maintains a copy of the ledger, so that there is no “single point of failure”. When confirmed by all the nodes, new data records (“blocks”) are added to previous ones using cryptographic techniques, and these are joined together in a kind of “chain” that is very difficult to tamper with (Elsden et al, 2019). Data validation is made possible by protocols (consensus algorithms) that guarantee agreement among network nodes about the state of the records (Zook and Blankenship, 2018). Unlike centralised databases, no single node can alter the data alone. Transactions are traceable and transparent, while preserving the pseudonymity of the actors involved (Yli-Hummo, et al. 2016; Zheng, et al, 2018; Cila, et al, 2020). While the original vision that spread with Bitcoin is associated with fully decentralised and permissionless *public* blockchains, since then *consortium* and *private* blockchains (Buterin, 2015) have been developed (such as Hyperledger) where the possibility of joining and acting as a node is restricted, which in fact restores some form of centralised control over transactions. Blockchain is considered an essential technology¹² for enabling the next Internet’s evolution defined as Web3 or Decentralized Web, which consists in the disintermediated management of digital data and assets and is based on the principles of data sovereignty and immutability, transparency and decentralization.

¹² Together with technologies such as Artificial Intelligence, Metaverse, Digital Identities, Big Data.

The core innovation of the technology lies in the possibility of transferring of digital assets of values or property rights (e.g. currencies, certificates) between internet users in a secure way, without the need for third parties (e.g. banks, notaries) to authenticate and certify transactions (Andreessen, 2014). This has been defined as the promise of a ‘trustless trust’, since it makes certain activities trustworthy without the need to trust any person or institution in particular (Werbach, 2017). Instead, trust is built into the consensus or governance rules pre-written in the code (Lapointe and Fishbane, 2015). Blockchain 1.0 started with Bitcoin (Nakamoto, 2008). Cryptocurrencies were made possible by enabling transaction of digital properties in the form of *tokens* (digital representation of rights over an assets). Blockchain 2.0 such as Ethereum (Buterin, 2014) enabled automated interactions and decentralised economies based on *smart contracts* (pieces of software written on the blockchain that self-execute the terms of an agreement when certain conditions are met). Blockchain 3.0 should enable even more complex models of decentralised and automated governance via decentralised autonomous organisations (DAO): these are digital organisations whose functioning rules and governance mechanisms are encoded in smart contracts, and whose control is exercised collectively by their members; their decision are automatically executed by the software (Swan, 2015; Rikken et al., 2023).

After blockchain technology was applied in fields such as decentralised finance (DeFi), trade, logistics, supply-chain management, copyright, and energy grids, experiments with the technology were made in the public and civic realms. On the public services side we have e-government and provision of public services: for instance for notarization, identity management, health data management, and voting (Olmes et al., 2017; Cagigas et al., 2021). On the civic participation side, we have activities targeting social needs, community-based economies, financial inclusion, and commoning. These kinds of applications are sometimes labelled DLTs or blockchain “for social good” or “for social impact”. However, some clarification is needed. Projects defined as such are referred to in different reports and repositories (Bartoletti, 2018; Galen et al., 2018 and 2019; Polvora et al. 2020, Voshmgir et al., 2019; Fines Schlumberger, 2022) that include different production and service sectors (agriculture, energy communities, fair trade, health, identity management, and financial inclusion). Note that local-level applications for community-based actions and civic initiatives are still hardly represented in these reports, being one of the most recent applications of the technology. Note also that the terms “social good” and “social impact” are used in

a fairly uncritical way (Semenzin, 2023). As such, approaches to blockchain technology targeting social needs range from simple application of mainstream solutions to social ends (e.g. platforms that rely on established cryptocurrencies for decentralised donations, money transfer, and crowdfunding services) to radical redesign of blockchains so that their digital architectures encode the principles of solidarity, commoning, and digital sovereignty. These more radical redesign involve using blockchain affordances of tokenization, disintermediation and automation to enable solidarity and financial inclusion, as is the case with basic income schemes, mutual lending schemes, or foreign remittances (see, for instance, Circles (n.d.); Howitt et al. (2021); and Calzada (2023)), community or complementary currencies (see, for instance, Mattson et al. (2023), and Balaguer Rasillo (2023)), commons-based peer production networks (see, for instance, Rozas et al. (2021)). However, each of these blockchain applications is based on a different token economy model that is mostly hard-coded in the system, which limits the interoperability and customizability of each system to the specific needs of different local communities. Hence, the goal of the CommonsHood research project is to make tokenization not only accessible to the general public, via a no-code approach, but also adaptable to the social needs of different local communities.

The potential to disintermediate and decentralise long-established modes of business and governance is the reason why there is great hype about blockchain technology. The debate between advocates and critics cuts across liberal, libertarian and community-oriented visions of markets, democracy, citizen participation, and management of digital innovation (Garrod, 2019; Husain, 2020). Advocates consider blockchain to be the foundation for true peer-to-peer economies, automated decisions, self-organisation, and secure accounting of resources (Elsden et al., 2018). They expect it to distribute value creation and ownership and solve problems such as financial exclusion, fake news, monopolies of big tech corporations, and intermediation costs. Critics argue that it could reproduce rather than disrupt capitalism by providing the techno-institutional framework for general datafication, commodification and financialisation of relationships and that this is inherent in attempts to engineer governance and encode social norms in smart contracts (see, for instance, the work of Sotoudehnia (2021) and Semenzin (2023)). Research in economic and political geography has studied the socio-political and environmental implications of blockchain mainly by looking at cryptocurrencies and applications on a global scale (Caliskan, 2020; Parkin 2020; Zook and McCannless, 2022). Critical geographers question blockchain's potential for decentralisation (Brekke, 2019; Zook, 2023) and

critically analyse imaginaries and discourses about algorithmic governance based on simplistic expectations of how technology, society and spaces are co-constituted and how socially-based trust can be substituted (Zook and Blankenship, 2018; Zook, 2023; Lynch and Munoz Viso, 2023).

Much of this debate has remained on a theoretical level so far, with little attention paid to how blockchain could become embedded in existing legal, economic, and political contexts (Garrod, 2019). In the social sciences in general, there is little empirical evidence yet about whether this technology is actually applicable, about where it can have significant societal effects (Risius, 2017), and about what are its relations to contextual factors (Tomor 2019; Tan, Rodriguez Muller 2020). Empirical gaps exist particularly with regard to the most recent sectors of application in public, social and participatory domains (Semenzin, 2023). More recently, geographers and urban scholars have looked at concrete experiments with blockchains at the local level on citizen engagement in digital commoning and alternative currencies (Chiappini, 2022; Balaguer Rasillo, 2021 and 2023) as forms of alternative urban digitalization (see Article 3).

Conversely, recent works in HCI and design (Elsden et al., 2018; Eldsen et al., 2019; Gloerich et al., 2020; Cila et al., 2020; Murray-Rust et al., 2022) are characterised by an empirical approach and more attention to the socio-political implications of using blockchains on a daily basis. Indeed, the design of digital applications is a strategic phase where not only practical purposes, but also imaginaries and political visions are embedded in the technology's functionalities, and where the technology can potentially be adapted to contextual social, economic, and organisational needs. It is important to remark that issues related to technology design are particularly relevant in the case of blockchain since this technology implies processes that, once set up, are characterised by different degrees of automation and immutability, some of which can clash with the mutability of social processes.

To conclude this introduction on blockchains, it's worth mentioning the specific fields of DAOs¹³. At present, DAOs are mainly designed for the management of financial resources and experimented with in the field of Decentralized Finance (DeFi) and corporate investment (for an overview on their developments, see Rikken et al., 2023). However, their potential for enabling

¹³ As anticipated before, DAOs allow organizations without a central authority to record and track decisions made by their members, and to manage resources accordingly (e.g. a treasury) thank to smart contracts (Calzada, 2023; Rikken et al., 2023).

community-based, traceable, and efficient decentralized governance is explored in the field of (digital) commons and commons-based peer production (Benkler and Nissenbaum, 2006). Scholars are studying how to design DAO so that they are compliant with the Ostrom's principles of commoning (Ostrom, 1990) and contribute to their implementation, while solving problems such as free riding and the tragedy of the commons (see for instance Almeida et al., 2020; Cila et al. 2020; Rozas et al., 2021). Rikken et al. (2023) provide an exhaustive review of 16 works in this field. Similarly to the research in HCI and design mentioned above, these studies adopt a more critical stance towards blockchain's properties and affordances. They attempt to clarify where automated processes and cryptocurrencies are useful for commons governance, whose communitarian and common good-oriented logics significantly differs from for profit corporate management and DeFi (where DAOs are mainly used). However, the present research does not directly address this field, since the case study under consideration leverage blockchains for managing value transactions, and not more complex governance processes (see Chapter 2). More consideration will be provided in Section 6.3 on future research.

1.2 Digital transactions in augmented spaces

As mentioned in the Introduction, the CommonsHood research project is intended to direct the affordances of blockchain technology, usually associated with global networks, towards civic applications adapted to different local communities. The research presented in this thesis started from the observation that the original approach to blockchain mentioned above raises specific issues that call for a geographical analysis. After the first design and testing phase (see the Methodology section), it was necessary to problematise the concepts of local community, local level, city and neighbourhood in order to clarify the tool's scope of action, the socio-economic processes where can be most effective, and to refine its design and functionalities accordingly. This problematisation meant conducting thorough research on the socio-spatial dimensions of this kind of blockchain application. Below I describe the approaches and concepts from digital geography employed for this purpose.

First, I built on the way in which digital geographers understand the relationship between interactive and mobile ICTs and spatial dynamics. In their article on the digital turn in geography, Ash, Kitchin, and Leszczynski (2016) distinguish between different possible relations between geography and the digital: geography *of* the digital, *through* the digital, and *by* the digital. Studies concerning the last category, where my research lies, focus on how the digital mediates, augments, and transforms the production of space and socio-spatial

relations. The digital/spaces relationship is considered to be bidirectional. Digital tools not only shape, but can also be shaped by, the social and economic spaces and spatialities that people experience in their everyday activities in a process of co-constitution.

Second, I understand the urban space we are looking at as an *augmented space*¹⁴ where the physical and the digital define one another and are no longer separate but blurred, each sphere made permeable by ICTs (Aurigi and De Cindio, 2008) enabling diverse new individual, social, economic and political experiences. These changes in urban spaces can take place at different levels, which necessitates the concept of spatiality – the way in which spaces and spatial relations are imagined and perceived. *Digital spatialities* are about the effect of social encounters with spaces mediated by digital tools and processes (Leszczynski, 2015; Gairola and Roth, 2019; Certomà, 2020). CommonsHood’s aim of activating latent resources and collaborative and inclusive local socio-economic practices (Balbo et al., 2020) implies changing or augmenting socio-economic urban spatialities i.e. the way in which people perceive certain local social and economic interactions in urban spaces. The app is used in spaces of social relationships and economic exchange which are then expected to influence the way geographical spaces are lived in by, for instance, encouraging people to privilege local shops or join social activities in their proximity as a result of the triggers and incentives that the app provides.

While building on these concepts, I observed that blockchain technology calls for a more nuanced understanding of the logics and mechanisms through which the digital mediates spatial practices. Geographical research on augmented urban spaces and digital spatialities has begun to study spatial media (De Souza e Silva, 2006; Reichert, 2017), and georeferenced information due to their direct relevance to physical spaces (Graham et al., 2013; Leszczynski, 2015), sharing platforms and social networks accessible through mobile devices and ubiquitous computing (Sutko and de Souza e Silva, 2011; Ash, 2009; Zook and Graham 2007). Scholars have already observed that the rapid pace in which new technologies (such as blockchain, augmented realities, extended realities, artificial intelligence) enter the scene makes it necessary to go beyond focusing on their informational,

¹⁴ In her chapter on digital “spatialities”, Agnieszka Leszczynski (2015) outlines the evolving theories and approaches in the field of geography on the relations between spaces, spatialities and digital technologies, including further debates on the concept of augmented space and the subsequent conceptualizations involving more than human spaces and spatialities, which go beyond the purpose of the research described in this thesis.

interactive, sensing and actuating functions (Lember et al., 2019) and to look at a broader set of properties. In particular, I am interested in how *transactional* functions supported by blockchain can shape social collaborative economies, specifically via the representation and secure transfer of assets of value. Simply classifying blockchain as an informational technology, or using the technical definition of the category of Distributed Ledger Technologies (to which blockchain belongs), does not capture its range of functions, and it does not reflect the dynamic character of the relationships we have observed (see also Article 1). This thesis studies how the app we developed can contribute to expanding the operative functionalities of the urban space (which is already augmented by other technologies), and how it allows us to do different or new things with blockchain affordances. This expansion or augmentation is mostly about the economic and social dimension of urban spaces and, in a more limited way, their physical dimension. It also concerns urban spatialities, i.e. the way in which persons using the tools perceive urban space.

1.3 Digital social innovation through blockchains

As a lens for studying local urban blockchains for civic participation, I refer to the concept of *digital social innovation* (DSI) (Ozman and Gossart, 2019; Rodrigo et al., 2019), following specific research lines suggested from both a science and technology studies perspective and from a critical digital geography perspective.

According to these research lines, first, DSI is not only about using digital technologies to support existing solutions to social needs based on co-creation. DSI processes refer to the co-constitution of digital tools and social processes (Ozman and Gossart, 2019; Cenerè and Certomà 2022). Second, the DSI concept includes heterogeneous public and private actors, and multiple socio-political discourses on both the (smart) city and the role of digital technologies in it. These discourses encompass neoliberal, reformist or radically transformative visions (Certomà, 2021). Assuming that (digital) technologies are not neutral, the same research lines invite us to consider how these diverse political aims are materialised in the design of digital artefacts (Iapaolo et al., 2023), and how they result in the reallocation of benefits, power and responsibilities, ultimately (re)producing society through governance mechanisms (Certomà, 2020). Third, Certomà argues that the spaces and spatialities of such DSI processes need to be investigated more thoroughly to better understand their potentialities and shortcomings when it comes to enabling emancipatory forms of urban digitalization. The same author suggests research lines regarding the concepts of

representation, reproduction and power from critical geography scholarship (Certomà, 2020). I refer in particular to the questions about how DSI (re)produces society through governance mechanisms. DSI intervenes in governance by “materialising political aims in the design of digital artefacts”. It allocates roles and benefits, it restructures power and responsibilities, and this shapes the augmented spaces of interactions. Certomà’s recommendation is to analyse different forms of DSI according to: their worldviews, their approaches to existing institutions, the design and implementation of the tools adopted, the actors brought together as a result, including funders, and finally who gains and who loses from the use of these tools (Certomà 2020; 2021).

This approach to DSI is particularly relevant for blockchain given contested visions on its potential for restructuring governance models (see Section 1.1). It is even more relevant for studying the civic blockchain / CommonsHood experimentation in depth. First, and following the three points mentioned above, the action research approach adopted for this experimentation acknowledges and intentionally pursues the co-constitution of digital and social processes. Second, the design of the app is shaped by different visions and goals: social and economic, expressed by the community and by the developers. Third, focusing on spaces and spatialities is necessary to critically appraise the extent to which the app can actually be embedded in local contexts and shape their economic spaces.

This way of looking at digital social innovation (Section 1.3) in augmented spaces (Section 1.2) has inspired the whole research approach and its analytical framework (Section 2.3). Furthermore, this research builds on interdisciplinary literature in order to cover the different dimensions that characterise the experimentation under consideration: socio-technical and multi-stakeholder processual aspects, technical features and affordances, contextual factors, and the socio-economic character of the interactions. The literature on *digitally enabled coproduction* (e.g. Linders, 2012; Lember et al, 2019; Yuan, 2019; Clifton et al., 2020) and *blockchain design dilemmas* (Cila et al., 2020; Gloerich et al., 2020) come from the fields of policy analysis and human computer interaction / design respectively. They address the first broad research question and bring out the specificities of the (civic) blockchain (Section 3). Specifically, in the domain of digital, urban and economic geography, the following literature provides the basis for an empirical study of the spatialities of the app and the DSI processes under consideration. This work builds upon studies of *alternative urban digitalization* (Lynch, 2020; Vadiati, 2022) and *urban digital platforms* (Falco and Kleinhans, 2018; Chiappini, 2020) in order to address the second research question on how

local contexts shape the digital tool. It then uses the *reading for difference* approach as applied to digital social innovation (Certomà, 2023) to address the third research question on how the digital tool shapes local contexts. Details on these theoretical and conceptual references are provided in Section 4. Table 1 below provides an overview of the theoretical framework of the research.

Table 1: Overall theoretical framework

Discipline	Topic / Approach	Dimension	Reference
Science and technology studies, digital geography	Digital social innovation <i>(Ozman & Gossart, 2019; Certomà, 2021)</i>	Socio-technical innovation processes	Sections 1.3 and 2.3
Policy analysis	Digitally-enabled coproduction <i>(Lember, 2019; 2020; Clifton, 2020)</i>	Multistakeholder governance	Section 3.1, Article 1
HCI, design, media studies	Blockchain for civic participation and its social implications <i>(Gloerich et al., 2020; Cila et al., 2020)</i>	Technology affordances and design	Section 3.2, Article 2
Digital geography, urban studies	Urban digital platforms <i>(Chiappini, 2020; Mello Rose, 2021)</i>	Context embeddedness	Section 4.1, Article 3
Economic geography	Reading for difference <i>(Gibson-Graham 2008; Santala & McGuirk, 2022)</i>	Socio-economic interactions and spatialities	Section 4.2 and 5

Chapter 2

Methodology

This section first introduces the wider interdisciplinary and transdisciplinary work to which our research contributes, and then provides reflections on my role as a researcher liaising between different disciplinary communities. Further information on the methodology adopted for experimenting with the CommonsHood application are provided. Based on this, I explain our choice of qualitative methods, the two phases of the research, and its analytical framework. In addition to the three core articles resulting from this research (see Sections 3 and 4), three other contributions (two book chapters and one article) are presented in this section. These address the broader methodological and empirical framework.

2.1 Reflections on interdisciplinary research

This research is an integral part of a wider research project concerning the development and implementation of the CommonsHood application as a blockchain-based tool for local communities. The CommonsHood project is led by the Digital Territories and Communities (DTC) research group of the Department of Computer Science at the University of Turin, which does applied research on civic technologies.

I joined the group in 2020 in the role of researcher and project manager of European and local research projects due to my background in political sciences and project management in the social innovation field and not-for-profit sector. I focused my own PhD research on the socio-spatial implications of the CommonsHood experimentations. The aim was to contribute to the iterative

development of the application by enhancing the social science and geographical dimensions of the wider research. As regards the CommonsHood project, I actively organised the pilots in local communities, liaising between the developers on one side, and the users and other local actors on the other side. I took care of the design and management of European projects (CO3, NLAB4CIT, Co.R.Pu.S - funded by H2020 and DUT programmes)¹⁵, of local applied research projects (VisitPiemonte, N.E.O.N., C.O.S.O., CommonsHood in the Garden, Tecnoprofezie, Futurama - funded by national, regional, municipal and private funding programmes for social innovation), and of the design and test of educational modules for young people on the civic blockchain. As regards the DTC research group more in general, I contributed to other projects (focused on the FirstLife platform¹⁶) and to a feasibility study concerning an academic spin-off¹⁷ that leverages the research results of the group and its experience in digital facilitation activities. Both the approach of the research group and my role as qualitative researcher and project manager have had significant implications on the methodology adopted for this research, as described in the following paragraphs.

Based in a Computer Science Department, the DTC research group adopts an interdisciplinary approach to deal with the complexity of socio-technical processes by integrating software developments with knowledge from computer ethics, economics, economic sociology, urban studies, geography, and pedagogy. As regards the interaction between computer science and geography, the research is based on the general assumption that “geographers are well placed to undertake inter- and transdisciplinary research” (Bracken, 2017, p 9), and that social and technical sciences can enhance one another. This second assumption not only means that “qualitative digital geographies are needed to interrogate and make sense of how we produce, experience, and know emerging digital worlds” (Cope, 2019, p. 97), thus informing the technology design to better meet social needs, but also that technology awareness is required on the part of geographers (Ash et al., 2016; Iapaolo et al. 2023) when “practising geographies in/with technical worlds” (Lin, 2023). The rationale behind my research is similar to that of other work studying alternative forms of digital urbanism; the aim is to “critically investigate the production and function of particular technological systems, everyday

¹⁵ <https://www.projectco3.eu/it/>; <https://nlab4cit.eu/>; <https://dutpartnership.eu>

¹⁶ <https://www.firstlife.org/>

¹⁷ OFF-SPIN - OFFicina di Strumenti per la Partecipazione e l'Inclusione (Laboratory on tools for participation and inclusion).

sociotechnical practices and experiences, and the possibilities for these relations to be remade through place-based digital activism” (Lynch and Farrokhi, 2022). Moreover, the research originates from the work of a blockchain development team, and so adopts an action research approach of actually developing and implementing new civic technologies with the ambition of “reconciling the project goals with the capacities of the technology” (Lynch and Farrokhi, 2022) and not just observing or experimenting with digital social innovations developed by third parties. As such, different interpretative communities influence the research methodology (Stratford and Bradshaw, 2021), which is informed by participatory design and experimentation logics focussing on the digital tools, rather than solely ethnographic approaches focussing on the practices of local communities (see Sections 2.2 and 2.3).

The DTC research group and the CommonsHood project also adopt a transdisciplinary approach, going beyond academic boundaries to include other professional expertise (in participatory design, education, community organising) and working together with local actors. Participatory methods are adopted in order to co-design and test the civic technologies of interest together with local communities. The stated aim is to co-produce knowledge about how digital technology features can be designed and developed based on public and collective interests. Specifically, local experimentations of the CommonsHood application take place in the form of urban living labs (Marvin et al., 2018). As such, the typical building blocks of the broader living lab approach to innovation (active user involvement, co-creation, real-life settings, multi-stakeholder participation, a multi-method approach) (Karvonen and van Heur, 2014), are integrated with specific attention to the socio-geographical contexts where the experimentation takes place (Viano et al., 2023b) which so far are mainly urban.

The inter- and transdisciplinary orientation results in my position as: a researcher in digital geography, an insider in the technical development team, and a facilitator in the co-design and testing activities. This requires handling different professional identities and roles, in between: scheduling and managing the implementation of projects, and doing social observations (which requires different and less predictable timelines); the strict requirements dictated by software development activities, and the creative processes of social innovation; techno-optimistic, techno-sceptical and techno-critical stances within and beyond the academic communities working on digital issues. Depending on the different CommonsHood urban living labs or pilots, on their development phases, and on the actors involved, I emphasised my background and interest in social research in

some situations, and my membership of a computer science-based research group in other situations. This was not done to hide some aspects of my work: the interdisciplinary nature of the research and the ambition to be useful for local communities through co-creation were always declared to participants, and often discussed in terms of opportunities and limitations. Conversely, playing with different roles and perspectives and striving to present blockchain features in simple terms was all part of a wider effort to create links between disciplines and communities of practices, with the ultimate goal of contributing to effective action research on civic technologies.

In parallel to the theoretical and empirical work on the Civic Blockchain approach, this research contributes to wider methodological reflections on the overall approach of the DTC research group. In particular, two publications complement the core three articles of this doctoral research.

- The book chapter **“Embedding sustainability in software design and development: accessible digital tools for local communities”**¹⁸ presents and discusses the approach of the research group, positioning its strategy within current debates in the digital geography community on the social and environmental sustainability of digital technologies.
- The article **“Living labs for civic technologies: a case study. Community infrastructuring for a volunteer firefighting service”**¹⁹ presents how the (urban) living lab approach is being adopted to bring together the domains of digital co-production of public services and civic technologies in the framework of EU-funded collaborative research projects.

2.2 Exploratory case study research

The research presented in this thesis is based on a case study of the blockchain-based wallet app CommonsHood. I consider as a case study the whole research process around CommonsHood, which is composed of different experiments and pilots. The case study is addressed in a qualitative and exploratory way “to delve

¹⁸ Viano, C.; Boella, G; Schifanella, C. (2024) Embedding sustainability in software design and development: accessible digital tools for local communities. In Certomà C., Iapaolo F., Martellozzo F. (eds.) (2024). “Digital Technologies for Sustainable Futures: Promises and Pitfalls” (1st ed.). Routledge.

¹⁹ Viano C., Tsardanidis G., Dorato L., Ruggeri A., Zanasi A., Zgeras G., Mylona V., Efthymiou I. and Vlachokyriakos V. (2023) Living labs for civic technologies: a case study. Community infrastructuring for a volunteer firefighting service. *Front. Public Health*. 11:1189226. doi: 10.3389/fpubh.2023.1189226

into under-explored and under-theorised phenomena” (Baxter, 2021) which in this case are examples of blockchain for civic participation.

As mentioned in the introduction, some aspects differentiate the CommonsHood approach from the best-known blockchain applications, such as Bitcoin and other cryptocurrencies, as well as from other blockchain-based wallets in the solidarity economy and financial inclusion sector (see also Article 2). These aspects are:

1. the aim of making blockchain affordances accessible to the wider public, including people who have no programming nor financial skills, through a simple interface (the *no-code* approach);
2. the fact that the application does not support a unique predefined economic model with predefined tokens but is iteratively co-designed to be adaptable to different exchange models. This does not mean that a new application is redesigned from scratch for every new context (which would cause unsustainable design and development costs), nor that only minimum customization is allowed (such as selecting a geographical area in crowdmapping tools). There is a standard version of the app, which is highly customisable at different levels: modular functionalities, type and value of tokens, user roles. Users (in their community) design their own tokens, which we define the *Internet of Values 2.0* principle (see Article 2);
3. the focus on the local level, on targeting specific communities (defined in administrative or geographical, social, or economic terms) and on a civic/collaborative process. These three aspects together are reflected in the development and experimentation cycle of the application, as described below.

The CommonsHood app was conceptualised, co-designed with potential users, and developed in a first version (Balbo et al., 2020) that has been tested for its usability in the framework of European research projects (see [Table 2](#)), during testing sessions in Computer Science degree courses at the University of Turin (academic years 2020/21, 2021/22, 2022/23), and during public engagement and dissemination events (e.g. European Researchers’ Nights). Pilots in real-life environments were started in 2022 (see [Table 3](#)). The Collegno Local Lab and C.O.S.O.²⁰ pilots were implemented and explored more thoroughly in the research presented in this thesis, and represent the main evidence base for the empirical

²⁰ Italian acronym for “Organised Communities for the Exchange of Objects”.

findings presented in Sections 4 and 5. The two other pilots, TecnoProfesie and CommonsHood in the Garden, were run in parallel, and provided additional and complementary evidence to corroborate the analysis.

Table 2: Projects involving co-design and initial testing (years 2019-2021).

Project name	Co-City	CO3	Blockchain for VisitPiemonte	1) N.E.O.N 2) Solitaires
Funds/ Programmes	Urban Innovative Action (EU fund)	Horizon 2020 (EU fund)	Funded by the Piedmont regional government	1) Erasmus+ (EU fund) 2) University of Turin funds
Place	Turin (Italy)	Turin (Italy)	The region of Piedmont (Italy)	1) Turin (Italy) 2) Vilnius (Lithuania)
Duration	2017-2019	2019-2021	2020-2021	2021
Type of social economy	Community currency and reward/incentive system in neighbourhoods	Community currency and reward/incentive system at the neighbourhood level	Loyalty tools to promote sustainable local tourism	Rewarding civic participation and promotion of local retail
Implementation stage (see Fig.1)²¹	Co-design and first testing	Co-design and first testing	Co-design	Co-design
Description	Initial co-design of the app's concept, standard functionalities and use scenarios.	Co-design and testing of the "economic urban commoning" scenario: tokens used as: local coins, prepaid cards, rewards, fidelity and crowdfunding tools in "neighbourhood houses" (cultural hubs in Turin)	Co-design and testing of blockchain wallets for the autonomous creation of interoperable fidelity tools by local tourism operators	Co-design of local systems of reciprocal incentives for both civic participation projects and proximity retail.

²¹ This information refers to the implementation stage reached by the project in the period 2021-2022.

Table 3: Projects involving pilots (2022-2023)

Project name	Collegno Local Lab	C.O.S.O.²² Library of Things	CommonsHood in the Garden	Tecnoprofezie
Funds/ Programme	NLAB4CIT European research project	Social innovation project funded by CRT Foundation (banking foundation in Turin)	Research project funded by CRT Foundation (banking foundation in Turin)	Social innovation project funded by the Municipality of Turin
Place	City of Collegno (metropolitan area of Turin, Italy)	The Borgo Campidoglio neighbourhood (Turin, Italy)	A collective garden in a public space near the Economics Department (University of Turin)	Science Fiction Museum and surrounding neighbourhood (Turin)
Duration	2022-2023	2023-2024	2023-2024	2023
Type of social economy	Rewarding civic participation	Circular sharing economy	Rewarding civic participation	Neighbourhood social economy
Implementation stage(see Fig. 1)²³	Testing	Testing	Testing	Contextual co-design
Description	The app is used to support the simultaneous promotion of youth volunteering, active citizenship and local retail, using “reward tokens” that can be exchanged with coupons to get access to local services	The app enables the decentralised management of a “library of things” through fungible and non-fungible tokens, for lending and borrowing objects among neighbours and encouraging social relationships	The app enables a lending, reward and incentive system (based on the Collegno and C.O.S.O. cases), revolving around a collective garden run by volunteers	Design of a community currency to support the active involvement of citizens in socio-cultural activities promoted by a local museum

²² Italian acronym for “Organised Communities for the Exchange of Objects”.

²³ This information refers to the implementation stage reached by the project during the period 2022-2023 and at the date of finalisation of this document (May 2024).

In each pilot, the broad aims are defined together with core local actors (e.g. active citizen groups or local authorities). Then, further co-design, which I define as *context-based co-design*, is carried out together with other actors on two aspects: the *socio-economic interaction model*, and the app’s *technical features and functionalities*. The app is then tested in simulation workshops and experimented with in real environments. All these steps involve context-based instances of the app, and provide iterative feedback for improving the set of modular functionalities in the standard version of the app (see Figure 1), as further explained in section 2.3

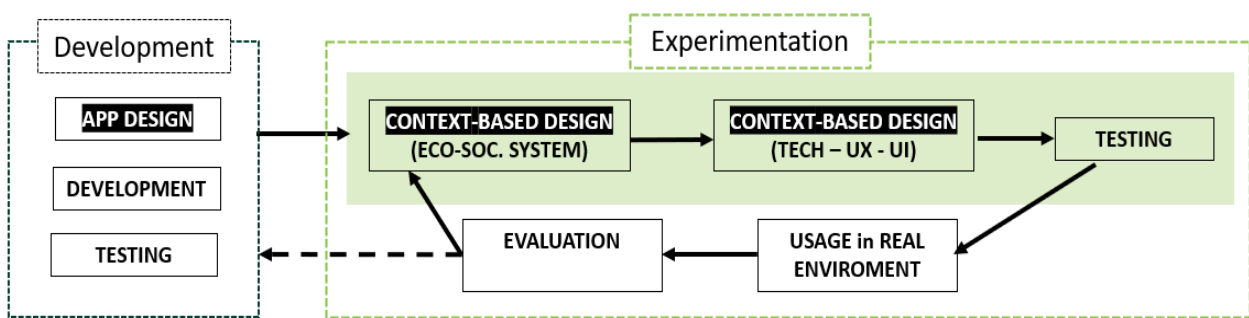


Figure 1: Development and experimentation cycle of the CommonsHood app.

- The book chapter **“Blockchain and tokenisation for local communities”**²⁴ provides an example of the iterative development and experimentation cycle of the CommonsHood application, starting from the empirical work carried out within the context of the Horizon 2020 project CO3. In this chapter, we show how a blockchain-based wallet app for urban commoning was co-designed and tested, based on the concept of augmented commoning area. We describe how the strengths and challenges of this pilot have informed subsequent work on urban tokenised economies through the development of improved features in the CommonsHood app.

²⁴ Boella, G., Viano, C., Schifanella, C, Blockchain and tokenisation for local communities. Chapter submitted for the book “Blockchain for Good: The Transformative Impacts on Industry, Community and the Planet.”, edited by Macus Foth and Shoufeng Cao. Currently under review (February 2024).

2.3 Research phases, methods and analytical framework

The research was carried out in two phases. The first phase was aimed at grounding the work in in-depth knowledge of blockchain affordances, while being aware of the interdisciplinary debate about their ethical and political implications. The second phase focussed on the actually observable contextual dynamics in which the digital tool is embedded, through pilot-based empirical work.

Phase 1 - Background work and conceptual framework. The first phase of the research was dedicated to: exploring blockchain applications in the social and civic sectors; exploring CommonsHood principles and technical features; framing the case study within the scientific debate on the societal impacts of blockchain; identifying relevant topics for a geographical analysis, in the literature on urban digital social innovation. This background work was carried out through: literature reviews; analysis of existing local blockchain projects through reports (Polvora, 2020; Galen, 2018 and 2019; Fines Schlumberger, 2022) and online mapping; document analysis of white papers and other internal documents of the CommonsHood project; participation in the CommonsHood development team's activities, and in the co-design activities of the projects listed in Table 1 above.

This phase resulted in the identification of four perspectives that I then adopted to frame the case study in the context of the interdisciplinary debate presented in Section 1. This allowed me to cover the most relevant dimensions (see Table 1: socio-technical and multi-stakeholder processual aspects, technical features and affordances, contextual factors, and the socio-economic character of the interactions) that characterise the case study, and to shed light on their interrelations. These perspectives concern: the *transactional* interactions that the technology enables, the *civic* and participatory domains of application, relations with local *contexts*, and the *urban* setting of the experimentations. The way I defined them at the start of this work was intentionally broad, in keeping with the exploratory nature of the case study and the wide range of expected use scenarios applicable to the app under consideration. This broad-ranging understanding was also aimed at bridging disciplinary domains and communities of practices. My understanding was iteratively revised and refined throughout the work, as can be seen in the sequence of three articles and in Section 6.2.

- *Transaction/transactional*: the term was firstly adopted, in this research, with reference to the peculiar properties and affordances of blockchain compared to those of well-established ICTs, i.e. the disintermediated

transactions of digital representations of assets, values or property rights (see Article 1), and how these are interpreted in CommonsHood. The concluding part of the empirical research (see Sections 4.2 and 5) uses the term *transactional* to refer to our understanding of the type of socio-economic relations triggered by the wallet app.

- *Civic participation.* The term *civic* is used in this research to encompass the types of social interactions targeted by the CommonsHood experimentations: a broad set of multi-stakeholder participatory practices in local communities including citizen engagement in institutional democratic processes, civil society initiatives, and community-based solidarity economies (Article 2). In this regard, I refer to the *civic participation* of citizens or community members as voluntary, active, and oriented towards common or social purposes (Davies and Simon, 2012). It may refer to formal participation steered by local institutions or organisations, or to informal and horizontal governance (Vlachokyriakos, 2017). It does not refer to uni-directional, top-down engagement of citizens by governments (Davies and Simon, 2012)²⁵. However, we cannot overlook the fact that participation is a strongly debated concept (see, for instance the work of Cornwall (2008)). The debate includes critical scrutiny of digital citizen participation in neoliberal smart cities (see for instance the work of Calzada (2015, 2017), Cardullo and Kitchin (2019) Cardullo et al. (2019)) and the pitfalls of digital social innovation (Certomà, 2021). The term “civic” has then become an essential component of the concept of *civic blockchain*, and is advanced by this research for positioning the CommonsHood approach. The term “civic blockchain” was also chosen to recall the concept of *civic technology* (Saldivar et al., 2019). While there is a lack of shared definition of civic technology in literature (Certomà and Corsini, 2021; Schrock, 2019), the term is understood in dialogues involving technical disciplines and non-academic stakeholders.
- *Context-based.* The term *context-based* was chosen to further specify the concept of civic blockchain, and as an operational concept to deepen the analysis of how the app is actually embedded in local social, political, economic and geographical spaces (as discussed in Article 3).

²⁵ I adopt definitions of participation that consider it as more active or empowering than engagement. However, this is a debated issue, with some authors considering participation as merely consultative, and engagement as a more active form approaching co-creation (see, for instance, the work of Baccarne et al. (2014) and Foth (2017, 2018)).

- *Urban*. So far, the CommonsHood app has been tested in urban contexts for the same reasons as those provided for many social innovation projects: the high density of socio-economic relations, the availability of skills and funds for experiments, the presence of an innovation culture and an active civil society (Certomà, 2021). The application scenarios for the CommonsHood app were designed and tested with reference to the following geographic scales: urban commons, neighbourhoods, small/medium-sized cities. So far, we have worked in neighbourhoods or smaller towns in the metropolitan area of Turin. The tool can potentially be used in other kinds of contexts which are not addressed in this thesis, such as rural areas.

This first phase of work led to the writing of Article 1 and Article 2 (see Section 3).

Phase 2 – Empirical research. The second phase of the research looked at studying interactions between the digital tool and its urban contexts. Building on specific literature in digital geographies and urban studies, I fine-tuned the second and third research questions, and I developed an analytical framework and a preliminary list of operational questions. These provided an overall guide to the data collection activity carried out during the different pilots active in the period 2022-2023 (see Table 2 above). The analytical dimensions and operational questions, presented in Table 5 below, were initially formulated based on the work of Certomà (2020, 2021) and Husain et al. (2020). Then, they were refined and adapted to delve into specific topics. Namely, questions in groups A and B below were refined building on the literature on urban digital platforms (Chiappini, 2020; Mello Rose, 2021). Questions in group C drew upon the “reading for difference” approach (Gibson-Graham, 2008) applied to (digital) local sharing economies. The results derived from this phase are presented in Section 4 (Article 3) and Section 5.

The qualitative methods adopted were:

- participant observation (Watson, 2021), conducted throughout all the project meetings and activities with the local stakeholders and with the development team. In keeping with the action-research approach of the whole research project, and with my role in implementing the pilots from within the technical development team, the participant observation practices adopted highly emphasise the “participation” side (Watson,

2021). The “observation” side of the methods does not refer to an external/detached perspective but to a reflective attitude towards the experimental practices and co-creation relationships triggered by our own research group.

- Focus group techniques (Cameron, 2021), used in some of the meetings with the core stakeholders to address research topics in a more structured way.
- Semi-structured interviews (Dunn, 2021), for delving into the opinions of the final users of the application.

The resulting field notes, memos and transcripts were put under thematic analysis based on the analytical dimensions mentioned in Table 5.

Data collection and analysis methods were chosen to be in synergy with, and adaptable to, the development and implementation cycle of the pilots (see Section 2.2). They included coordination meetings with core project partners, co-design workshops, and testing with and actual use of the application together with the end users. In turn, data collection methods have helped facilitate project meetings by indicating relevant topics and providing iterative feedback from local actors to the technical development team.

More specifically, feedback was collected through a four-steps process. Table 4 summarises the process, while also providing more details on the pilots’ cycle presented in Figure 1 above. These four steps are flexible and need to be adapted to each pilot’s needs, timelines, and feasibility constraints. It’s worth noting that, in this kind of experimental and participatory research, an essential part of the co-design process is the negotiation between the local actors’ requests and the practical feasibility of their implementation. This concerns not only technical issues (e.g. smart contracts development), including time and budget constraint. Article 2 elaborates on the results and implications of these mechanisms as implemented in the Collegno Lab and C.O.S.O. pilots (see also Section 4.1, and the conclusions in Section 6.1)

Table 4: Feedback mechanisms during the development and implementation cycle of the pilots.

	Proposal from the research team:	Feedback by local actors on:	Feedback adopted through:
1) Context-based co-design (socio-economic interaction model)	Basic scheme (actors, fluxes) of the tokenized economy.	<ul style="list-style-type: none"> - Compliance with the local values and goals. - Relevance for daily practices. 	<ul style="list-style-type: none"> - Adaptation of the model, specification of the tokenized fluxes of values. - Definition of pilot-specific technical requirements.
2) Context-based co-design (technical features and functionalities)	Demo on relevant functionalities, already existing in the app.	<ul style="list-style-type: none"> - Expected usability. - New desired functionalities. 	<ul style="list-style-type: none"> - UX/UI design for new functionalities. - Revision of the smart contracts' logic. - Code and smart contracts adaptation and development.
	Mock-up of the app functionalities and user interface	<ul style="list-style-type: none"> - Expected usability. - Texts/lexicon. 	<ul style="list-style-type: none"> - UI design. - Vocabulary and texts adaptation.
3) Testing	Beta version of the app (to be used during testing workshops)	<ul style="list-style-type: none"> - Usability 	<ul style="list-style-type: none"> - Bugs fixing.
4) Evaluation	Final version of the app.	<ul style="list-style-type: none"> - Pertinence and relevance for the pilot goals. - Usability. - Suggestions for improvements. 	<ul style="list-style-type: none"> Ideation of pilot/projects follow-up and further research.

Table 5: Analytical framework: analytical dimensions and operational questions.

DIMENSION	QUESTION
A) Case description: urban context and exchange model	
<i>Exchange model</i>	What kind of exchange/transactions are involved?
	What is the underlying vision/inspiration behind the socio-economic model?
<i>Tokenization model</i>	What VALUES should be tokenized?
	Why tokenize these values, and for what PURPOSES?
	How are these values digitally REPRESENTED?
	What are the criteria and RULES for their use and transfer?
<i>Urban context</i>	Type / extension / sociodemographic characteristics of the area
	What kind of urban activities are involved: social, economic, public services...?
B) From contexts to blockchain: how is blockchain technology made adaptable to different local socio-economic contexts? (Research Question 2)	
<i>Ecosystem of actors</i>	Which ACTORS are involved in adopting the app?
	Who proposed/suggested/chose the model? Who initiated the DSI process?
	What interests and NEEDS do they express, and how strongly did they support that?
	What are their ROLES? How are the actors active in defining the rules?
	What ACCESSIBILITY issues could actors face? What are the access points, and who is left out?
<i>Online/offline interactions</i>	How relevant is face-to-face and offline negotiations for the system to work?
	How are physical encounters and proximity in space conceived of in each application scenario?
	Which interactions are kept “OFF CHAIN” and OFFLINE?
	To what extent do actors already know/TRUST each other?
<i>The technology's openness to adaptation</i>	To what extent are tokens context-specific?
	Are certain specific functionalities customised for the local application? Which one(s)?
	Are INTEGRATIONS with other digital tools necessary/feasible/...?
	What do users think about the extent to which the tool is adaptable?
<i>Scale</i>	What is a suitable geographical SCALE for the model to work?
C) From blockchain to contexts: What are the expected effects of the blockchain technology on socio-economic interactions, spaces and spatialities? (Research Question 3)	
<i>Benefits and costs</i>	What are the expected BENEFITS for the different actors? (economic)
	What are the expected BENEFITS for the different actors? (social, others)
	What are the COSTS for the different actors?
<i>Changes to governance models</i>	What are the expected CHANGES to the way actors perform these LOCAL EXCHANGES (economic: purchase, consumption...)
	What are the expected CHANGES to the way actors perform these LOCAL EXCHANGES (social: volunteering, use of shared spaces...)
	Are socio-economic relationships created anew or expanded?
<i>Changes to urban spatialities</i>	Are people encouraged/discouraged about living in and using public/common spaces?
	Do people organise their socio-economic activities differently in the urban physical space?
<i>Digital divides and exclusion</i>	Are urban DIVIDES (expected to be) mitigated or intensified? (What is the potential/risk?)
	Are solidarity networks (expected to be) REPLACED by paid/quantified services, or vice versa?

Words in capital letters identify the core topics explicitly addressed during co-design workshops and focus groups.

PART II

Chapter 3

Understanding the (civic) blockchain

Section 3 and 4 introduces the core concepts, analytical framework and results of the research, through the sequence of three articles that constitute this thesis. The first article (Section 3) allows us to understand the paradigm changes brought by blockchain technology to the field of citizen engagement, while the second article (also in Section 3) clarifies the specificities of the civic blockchain approach as encoded in the CommonsHood application. Section 4 will introduce the third article and the empirical part of the research, exploring the relationship between the blockchain-based app CommonsHood and local contexts.

3.1 Beyond ICTs in digital coproduction (Article 1)

The research started from evidence collected in the context of European and local research projects through which the CommonsHood app had been designed and initially tested (see Table 2), all related to digitally enabled co-production of public services between local public administrations and citizens.

The initial work carried out in the context of the above-mentioned research projects, and theoretically supported by studies in policy analysis on digital coproduction (Lember, 2019; Meijer and Boon, 2021), allowed us to address the first research question (*How can blockchain technology be used to enable and support processes of co-production and civic participation?*), and thus explore the expected impacts of blockchain technology on collaborative interactions in multi-stakeholder contexts. The literature on digitally-enabled coproduction of services (Linders, 2012; Meijer and Boon, 2021; Yuan, 2019; Clifton et al., 2020) has addressed well-established ICTs extensively, while more refined analysis is

required on the impact of co-production on other later technologies such as blockchain (Cagigas, 2021), augmented reality, and artificial intelligence (Lember, 2018; Lember, 2019).

The article “***Blockchain tools for socio-economic interactions in local communities***”²⁶ is focused on the VisitPiemonte project where the CommonsHood app was co-designed to enable the co-production of services in support of the local tourism sector. Its functionalities, costs and benefits were presented and discussed. The case was analysed via Linders’s (2012) matrix on ICT-enabled co-production. First, we observed that this case covers different co-production mechanisms, and fits into category of Governance as a Platform (GaaP) (Linders, 2012; Cordella and Paletti, 2019; Millard, 2013; O’Reilly, 2011): a type of government/citizen relationship where governments provide digital platforms aimed at enabling the engagement and orchestration (Cordella and Paletti, 2019) of citizens and of economic actors. Second, we argue that the potential effects of using the blockchain-based application go beyond the co-production typologies identified by well-established analytical frameworks such as that of Linders, which need to be expanded. Indeed, all the interactions enabled among local actors and local authorities revolve around creating and transferring digital representations of values: turning illiquid assets into liquid assets, disintermediating transactions, and making them fully traceable. This represents a change of paradigm in how we understand digital co-production: the orchestration at stake is not only about exchanging information for coordination purposes.

3.2 Dilemmas concerning blockchain for civic initiatives (Article 2)

To get a comprehensive understanding of the implications of using blockchain for civic purposes, after considering the domain of digital co-production of public services (where the public actor plays a relevant role), it was necessary to broaden the investigation to other practices where multi-stakeholders ecosystems of actors target societal needs, and where civil society has a prominent role in either self-organising or collaborating with public and business actors.

In the following of this research, I refer to the above-mentioned practices as *social collaborative economies*: a set of different economic practices and models

²⁶ Viano C., Avanzo S., Cerutti M., Cordero A., Schifanella C., & Boella G. (2022). Blockchain tools for socio-economic interactions in local communities. *Policy and Society*, 41(3), 373–385. <https://doi.org/10.1093/polsoc/puac007>.

including collaborative/sharing economies, social and solidarity economies, commoning, and related participatory and civic organisational processes. Many of these experiences are based on horizontal, decentralised, peer-to-peer governance and business models, which makes blockchain's disintermediation affordance of interest. Together with public service co-production, this is one of the most recent blockchain application domains (see Section 1.1), and provides relevant hints for social sciences to investigate the potentialities and risks of blockchains in social processes. More specifically, in order to get a comprehensive overview of the ethical and design dilemmas and criticalities to be considered when developing blockchain applications that target civil society and local communities, I built on different strands of literature on design, HCI, media studies, urban studies, and development economics (Elsden et al., 2018; Elsden et al., 2019; Cila et al., 2020; Gloerich et al., 2020, Pazaitis et al. 2017, Rozas et al., 2021 Scott, 2016; Pisa and Juden, 2017). These authors critically investigate to what extent a technology's affordances²⁷ and design complies with desired social and political community or emancipatory outcomes concerning social justice, power relations, solidarity, and financial inclusion.

Building on this literature, the article **“Civic Blockchain: Making the blockchain accessible for social collaborative economies”**²⁸ bridges computer science and social science studies on the societal implications of this technology, starting from blockchain's properties and related affordances as problematized in the critical literature on the ethical and design dilemmas of blockchains (see above). In the article, we group these dilemmas into three categories: (i) quantification/informality, (ii) disintermediation/new centralization of powers, and (iii) automation/mutability of social relations. We conceptualise the civic blockchain approach behind the CommonsHood app as being based on three main dimensions that address the above-mentioned blockchain design dilemmas: (i) *Internet of Values 2.0*; (ii) *disintermediation at the level of content creation and service implementation*; (iii) its application to *civic, collaborative or solidarity economies at the local scale*. We then explain how each of these principles is embedded, through design, in the technical features and functionalities of the

²⁷ The term affordances is used by Rozas et al. with the meaning of potential uses and applications that the specific properties of the technology enable (Rozas, 2021, p.4). The authors follow the definition advanced in the STS domain by Hutchby (2001) who in turn based his on Gibson's (1979).

²⁸ Viano C., Avanzo S., Boella G. Schifanella C. (2023). Civic Blockchain: Making blockchains accessible for social collaborative economies. *Journal of Responsible Technology*, 15, 2023, 100066, <https://doi.org/10.1016/j.jrt.2023.100066> .

CommonsHood app. Based on the expectations expressed by potential users, the article discusses the extent to which this approach addresses the blockchain design dilemmas and which questions remain open.

The article outlines core aspects for proceeding with the research. The civic blockchain approach makes blockchain technology accessible to citizens by both leveraging some of its core technical properties and advancing new interpretations of their affordances focused on technical and economic accessibility as opposed to the kind of trustless and automated interactions that prevail in mainstream imaginaries on blockchains. Intentional actions on the part of both developers and users of the tools are necessary to address the societal challenges this technology brings. Moreover, we have addressed the following open issues, which are addressed in the next steps of the research:

- the need for more empirical research on how the Internet of Values 2.0 principle is actually realized in different socio-spatial contexts, and on how mutable social dynamics are encoded in smart contracts;
- the extent of flexibility in the app's design to accommodate local adaptations;
- the different effects to and changes in socio-economic interactions in the diverse social economies addressed; and
- the types of local community and system of actors that are more likely to engage in and benefit from this digital social innovation.

Figure 2: CommonsHood app: interface and functionalities. *2.a) Personal wallet containing tokens; 2.b) Tokens creation functionality; 2.c) Functionalities menu; 2.d) Search users and Send tokens functionalities; 2.e) Integrated map.*

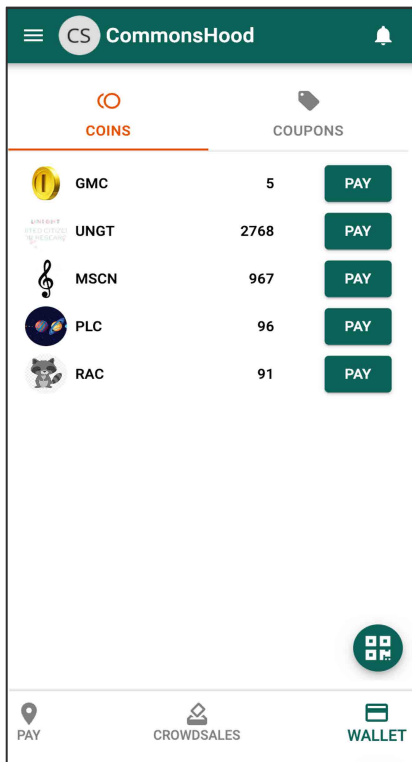


Figure 2.a

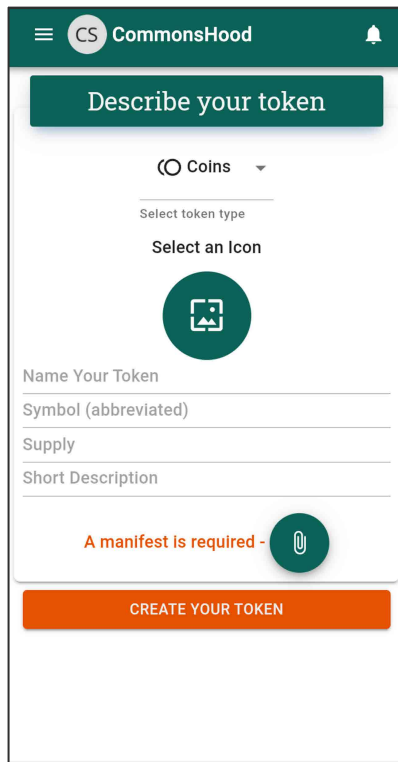


Figure 2.b

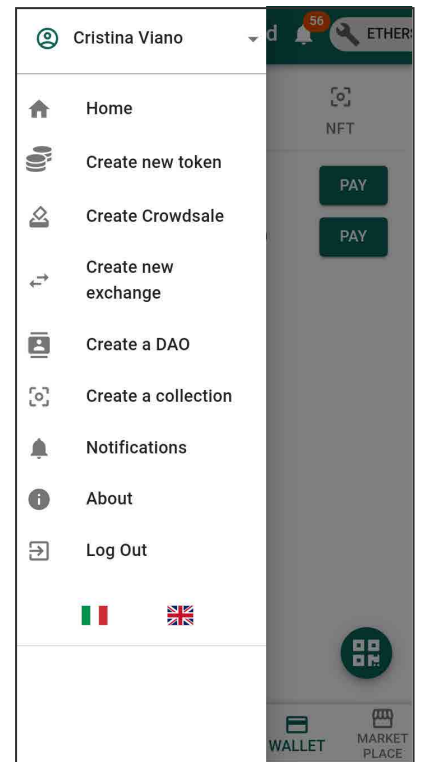


Figure 2.c

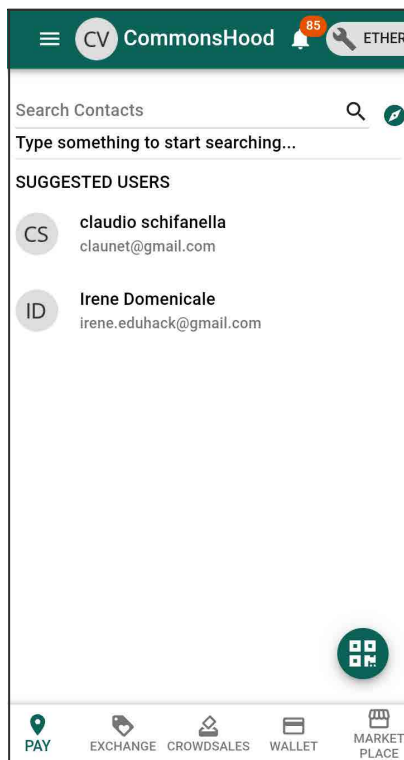


Figure 2.d

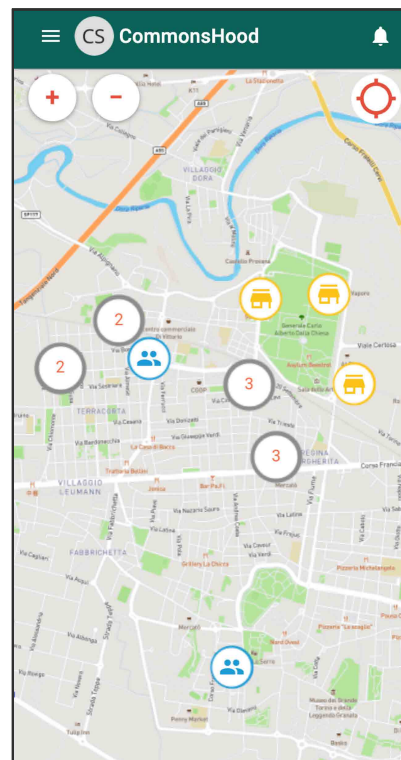


Figure 2.e

Chapter 4

Context-based civic blockchain

After clarifying the core aspects of blockchain technology and its application in participatory initiatives, the research dived into interactions between the digital tool under consideration and urban contexts. As explained in the introduction, this work is about how the digital tool under consideration is shaped by, and in turn shapes, the local contexts of its usage and their spatialities. I first identified a set of analytical dimensions, building on research lines on digital social innovation, and as suggested from a critical digital geography perspective by Certomà (2020 and 2021) (see Section 1.3 e 2.3 above). Then, I refined the specific conceptual and analytical frameworks by referring to two different strands of literature. Firstly, the *context-blockchain (or design)* side of this relation (how local contextual factors shape the digital tool), is explored building upon the literature on urban digital platforms or urban participatory platforms (Falco and Kleinhans, 2018; Chiappini 2020; Mello Rose 2021). Secondly, the *blockchain-context (or implementation)* side (how the digital tool contributes to shaping contexts) builds upon analyses of (digital) diverse economies (Gibson-Graham, 2016) through the lens of the reading for difference approach (Gibson-Graham, 2008).

4.1 How local contexts shape civic blockchains (Article 3)

In order to investigate how local contextual factors shape the digital tool, I made the second research question mentioned in the Introduction more specific by asking *how the app under consideration is made adaptable to the needs and resources of different socio-economic contexts*. Indeed, the flexibility of the blockchain wallet so as to be adaptable to different communities is one of the main goals of the experimentations on CommonsHood. Addressing this question required paying attention to the (co)design phase of the digital tool, which in the

case of CommonsHood is iterative and addresses two levels: the models of economic interactions, and the supporting functionalities (see Section 2.2).

Such a question recalls the investigation into how urban digital platforms are embedded, or place-based, or rooted in specific urban communities, and how they are aimed at addressing societal needs, in contrast to the (dis)embeddedness and extractive strategies of mainstream urban platforms (Wood et al. 20219; Graham, 2020). I refer to the literature on alternative forms of platform urbanism and alternative urban digitalization (Lynch, 2020; Vadiati, 2022) and, more specifically, urban digital platforms (e.g. Falco (2018), Chiappini (2020), Mello Rose (2021)). Urban scholars and digital geographers who have recently addressed the latter topic have not yet considered blockchain-based applications extensively. However, I consider this strand of literature a relevant starting point for studying the embeddedness of the civic blockchain. Four recurring dimensions are used to explore how urban digital platforms are locally embedded:

- the *type of intermediation* they provide,
- the *ecosystems of actors* involved in the digital social innovation processes,
- the way in which *online and offline interactions* in urban spaces complement one other, and
- the extent to which the *technology is open and flexible* for adaptations.

These four dimensions represent the backbone of the analytical framework (see Table 5, parts A and B) through which I study the co-design phase of two pilots of the CommonsHood app. More specifically, for this analysis I introduce the concept of *context-based civic blockchain*: the four aforementioned analytical dimensions are investigated while taking into account the peculiarities of (civic) blockchain technology. This allows us to refine our study of the specificities of the civic blockchain approach while critically assessing its actual embeddedness in local communities and social collaborative economies.

This part of the study resulted in the third article, **“Context-based civic blockchain: localizing blockchain for local civic participation”**²⁹. Here I analysed two pilot experimentations (in the Collegno Local Lab, and the C.O.S.O. project – see Table 2) by focusing on the methodology adopted by the research group for introducing the app into local context, and how the local actors (re)interpreted its affordances, thus contributing to making it context-based.

²⁹ Viano, C. (2024). Context-based Civic Blockchain: localising blockchain for local civic participation. *Digital Geography and Society*, 6, 100090, <https://doi.org/10.1016/j.diggeo.2024.100090>

Various strengths, limits and challenges emerged. Some of them are not dissimilar to those already detected for other urban participatory platforms. Others are rather peculiar to blockchain technology, and to the civic blockchain approach in particular.

More specifically, it arises that the Internet of Values 2.0 principle (communities of users design their own exchange models and tokens) is the main driver of local adaptation in the original conceptualisation of the app, but it is also a challenging aspect to put into practice. Firstly, it requires effort to start the collaborative model: collaborative social economies, whether they are tokenized or not, require actors that are committed and motivated to take the initiative even in the absence of traditional intermediaries or market incentives. Secondly, attention must be paid to ensuring that tokenized incentives do not simplify or commodify social relationships. It also emerges that the civic blockchain approach is effective in raising users' awareness of blockchain's potential for participation and collaboration.

This part of the empirical observation was focused on the methodology used for introducing a civic blockchain into local contexts and for iteratively co-designing it. As such, the article also focuses on the results and criticalities of the co-design methods, and of the mechanisms adopted for incorporating feedback from the local actors in the iterative development process.

In the article, I concluded that redeploying blockchain functionalities according to participatory principles and building on consolidated experience of urban participatory platforms are starting points for actuating alternative forms of urban digitalization that rely on a blockchain. Open issues concern the effects of the app on the creation of new spaces for socio-economic exchanges. This topic is addressed in Sections 4.2 and 5.

Table 6: Description of the two pilots.

Collegno Local Lab
Collegno Local Lab is an urban living lab situated in the city of Collegno (a suburban area of the city of Turin, Italy, with 48,000 inhabitants). It experiments a service that promotes youth volunteering and provides young people with access to local commercial and cultural services. Young volunteers take part in civic actions organised by local associations (named <i>participation places</i>) and receive <i>reward tokens</i> in their CommonsHood wallet, which have been issued by a social cooperative in charge of educational activities on behalf of the municipality. Through a dedicated <i>exchange</i> functionality, volunteers use their tokens to obtain digital <i>coupons</i> issued by local commercial and cultural services (named <i>exchange places</i>). The benefits or discounts represented by the coupon are redeemed by going to the local shop or service provider in person and transferring the coupon to the retailer's wallet.
C.O.S.O. Library of Things
C.O.S.O. is a grassroots project initiated by a group of citizens in the neighbourhood of Borgo Campidoglio in the city of Turin, Italy. A library of things is a circular micro-economy in which participants lend and borrow objects of daily use, by meeting directly and without the need for leaving objects in a centralised place. Each object is univocally represented in CommonsHood as a <i>non-fungible token</i> created by the lender. NFT transfers between wallets allow users to reserve objects and track exchanges. Whoever borrows an object must give community coins represented with <i>fungible tokens</i> . For all actions that contribute to the exchanges (joining the community, making an object available, accepting a loan, concluding a loan), smart contracts automatically send community coins to the wallets of the participants involved.

Figure 3: Collegno Local Lab project: co-design activities and results.

3.a) Co-design activities with young participants; 3.b) Co-design materials; 3.c) "Manifesto" of the reward token, explaining the token purposes; 3.d) App instance customized for the pilot: wallet containing reward tokens; 3.e) Functionality for exchanging tokens with coupons; 3.f) Functionalities for setting tokens/coupons exchanges; 3.g) Geolocation of actors and events on the integrated map.

Figure 4: C.O.S.O. project: co-design activities and results.

4.a) and 4.c) Community events; 4.b) Co-design activities for deciding lending and borrowing rules; 4.d) App instance customized for the pilot, desktop version: the Library of Things; 4.e) Mobile version: functionalities for managing the lending of objects; 4.f) Project website: community rules for the Library of Things.



Figure 3.a

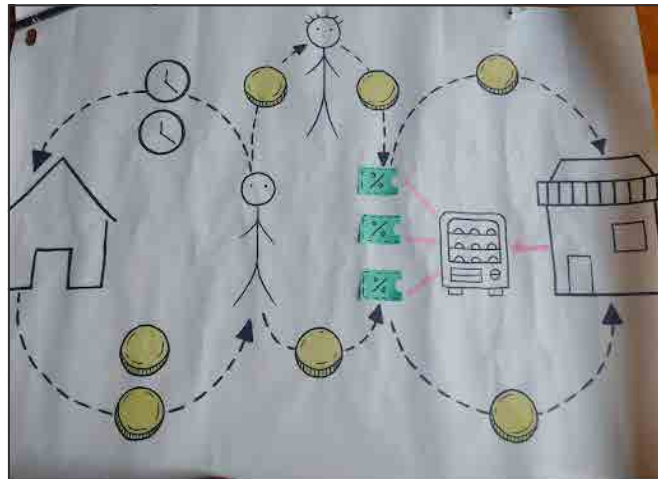


Figure 3.b

NLAB4CIT
Principi e regole per la circolazione del valore

La **partecipazione attiva** ad iniziative e proposte della Città di Collegno **permette di ottenere**

TOKEN 10093 (TOK93)

Monete digitali che costituiscono il **wallet** sull'app **Commonshood**

+5
Per l'**impegno civico a spat*** nell'ambito di:

- Portinerie di Quartiere
- Spazi AnCoRe
- progetti socio-culturali promossi dalla Città di Collegno

*evento della durata da 2 a 8 ore

+10
Per l'**impegno civico di una settimana** nell'ambito del progetto **"Piazza Ragazzabile"**

Può essere trasferita a wallet amici/che per "invitare" altri/e a partecipare alla vita di Collegno

La **disponibilità di token** nel wallet **può essere "spesa"** per ottenere

COUPON
Rappresentanti **sconti e agevolazioni**

Offerti dalle **attività commerciali** e dalle **associazioni** che partecipano al progetto visibili sulla **mappa FirstLife**

Per info: innovazione@coopassandonato.it
<https://nlab4cit.eu/>

dlumio.it CITTÀ DI COLLEGNO Funded by the European Union

Figure 3.c

CV CommonsHood

COINS COUPONS

TOK93 45 SEND

SEND EXCHANGE WALLET

Figure 3.d

CV CommonsHood

Progetto Collegno Giovani
San Donato - Progetto Collegno Giovani

1 LABORATORI PCG - LABCG
19 available exchanges

Price: 10 TOK93

Expiration: No expiration

WELL TAKE TAKE BENE
COMUNITA' ANZIANI RETI
Ancore

1 "SMARTPHONE PER TUTTI IL POSTO RISERVATO"

SEND EXCHANGE WALLET

Figure 3.e

MUD - Museo Digitale CommonsHood

Home Crea un nuovo token Crea uno scambio Notifiche About Log Out

Seleziona il coupon da offrire Seleziona la moneta accettata Crea lo scambio

AZZERA PROSSIMO

Cerca un coupon

Ingresso gratuito MUD - IMUD Saldo 100

Quantità 1

Figure 3.f

Associazioni sul territorio

Evento di San Donato

Indirizzo: Collegno, Piemonte, Italia
Proprietario: Mario Rossi

Descrizione:
Questo evento è stato creato dall'amministratore di Cooperativa san Donato. Lorem ipsum dolor sit amet,

CHIUDI

Figure 3.g



Figure 4.a

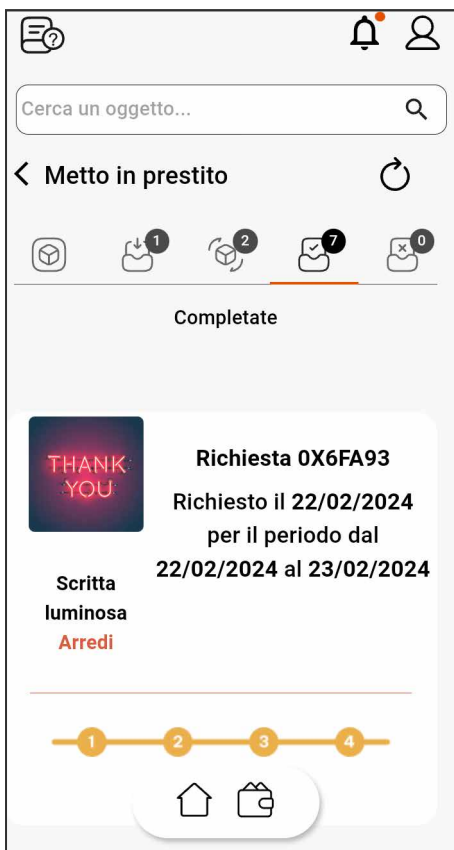


Figure 4.e

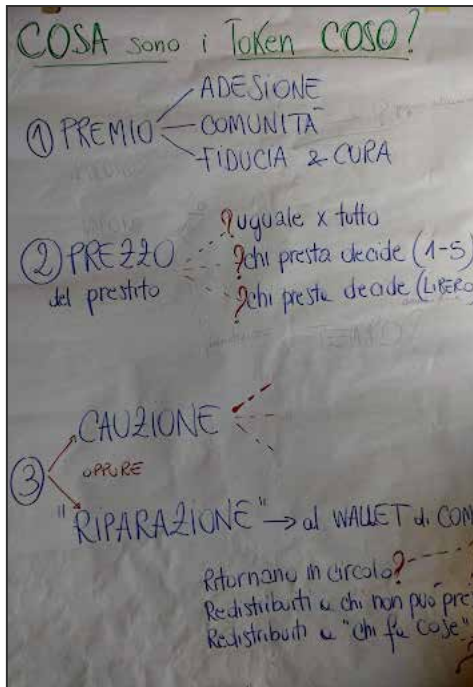


Figure 4.b



Figure 4.c

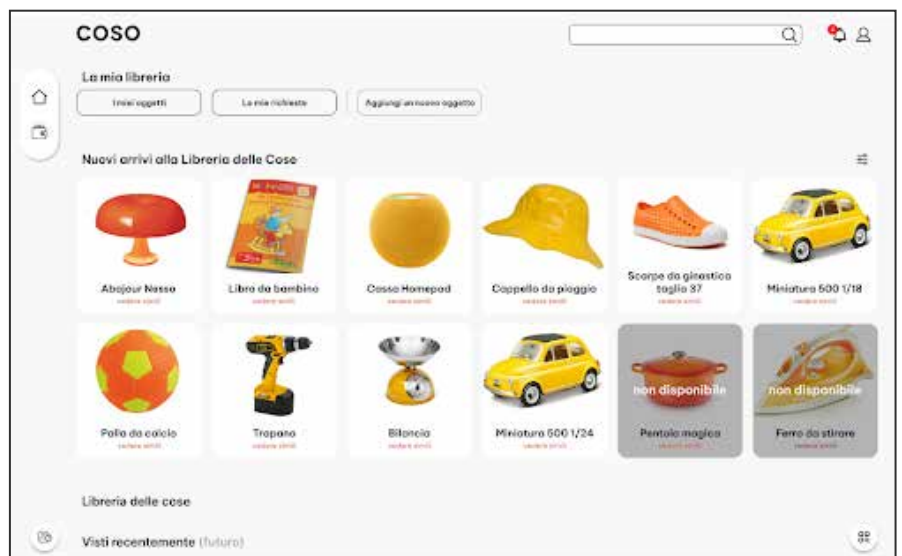


Figure 4.d



Figure 4.f

4.2 How civic blockchain shape local contexts

In order to investigate how the digital tool contributes to shaping local contexts, I made the third research question mentioned in the Introduction more specific: *what are the expected effects of the app under consideration in the local contexts, in terms of economic and social benefits, changes in socio-economic interactions, and changes to social and economic space and spatialities.*

It is important to point out that, given the timeframe of the research and the experimental nature of the pilots, consolidated and long-term effects could not be observed. The attention was focused on the *expected* changes and benefits, as expressed by local actors during the co-design process and after testing the application. In the envisaged application scenarios, tokenized mechanisms are introduced to social collaborative economies. Material and individual incentives are combined with social/moral (Van Stekelenburg, 2013) and collective incentives. The broad spectrum of application scenarios ranges from reform of existing civic and co-production practices to the advancement of economies and governance models that alternative to mainstream ones in a post-capitalist sense. This composite character requires a nuanced reading of its potential effects.

To this end, I built on studies in economic geography that follow Gibson-Graham's call to study diverse economies in a post-capitalist framework (Gibson-Graham, 2006). Gibson-Graham (2008) observed that these practices are usually read from capitalism-centric discourses that identify them as the same as, or contained within, or opposite to, or a complement of capitalism. They claim that such a dualistic "reading for dominance" of capitalism discourages the search for alternatives, and they advocate an epistemic strategy of "*reading for difference*", escaping dichotomies and blurring boundaries to give room to the diversity of emancipatory political agencies. Geographical scholarship concerned with context-specific and local transformative socio-economic practices responded to this call in different domains within and beyond diverse economies including: sharing economies (Davies et al., 2017), urban transformations (Thompson, 2019), and urban gardening (Certomà and Giaccaria, 2023). Many novel experiences have emerged in the interaction between grassroots, civic, public and private agencies, implying negotiations and ambiguities. Therefore, "reading for difference" is a promising approach for studying the digital domain (Certomà, 2023; Lynch, 2020), and has already been applied to empirical analyses. For instance, Balaguer Rasillo (2023) defined the related digital commoning cases of FairCoin and FairCoop as progressive postcapitalist experiments with cryptocurrencies, even if marked by contradictions that impeded their

continuation. Santala and McGuirk (2022) considered platforms enabling communal sharing economies whose domain of application is relevant for the research presented in this thesis. More specifically, the authors deem it necessary to overcome the binarism that depict the agency generated by these platforms as either instrumental to urban neoliberalism or as structurally disruptive means to achieve emancipation and social justice goals. Instrumental practices are associated with *transactional* social relations of sharing, i.e. activities that are mainly market-led, profit-oriented, and focussed on making existing systems more efficient. Disruptive practices are associated with *transformative* social relations, mainly civic-led or commoning-based, and having the primary goal of changing power relationships and developing social capital (Ede, 2014; Santala and McGuirk, 2022). Moreover, they observed that the new urban agency and relationships activated within communal sharing practices are characterised by *interdependence* between civic, market and government actors and domains. It is particularly appropriate to consider this ambivalence and interdependence when studying the CommonsHood civic blockchain since it is aimed at enabling tokenized transactions, and directing them to support new forms of civic and collective (if not fully emancipatory and transformational) actions at the same time.

The definition of *transaction/transactional* adopted in this phase of our research follows the distinction provided by Santala and McGuirk (see above), but is not confined to sharing economies. Nor is it limited to the meaning of “transaction” used in business domains: commercial operations or money exchanges in relation to the sale of goods or services. It refers more broadly to transfers (not necessarily bilateral) or exchanges of information, goods, services, and values (not only monetary) that are aimed at timely satisfaction of needs that are specific and individual rather than embedded in broader social and collective processes. This understanding also takes into account the ways in which the term transactional is used by other authors already mentioned in this thesis who deal with digital platforms in civic domains. Digital civics scholars (Olivier and Wright, 2015; Vlachokyriakos, 2017) distinguish between platforms that support transactional modes of service provision, delivering solutions to well-defined problems, and those that support *relational* co-production of services, where citizens leverage digital tools to envision and enact social changes. Social relations are also defined as platform transactions by Mos (2023) where, in the volunteering field, they are managed as processes of coordinating information, managing supply and demand, and timely satisfaction of specific needs, rather than long-lasting processes of social engagement.

The two pilots Collegno Local Lab and C.O.S.O., already discussed in Article 3, are further analysed here. They address two different social collaborative economies models: a system for rewarding civic participation, and a community sharing economy.³⁰ The following four analytical dimensions (see also Table 5, part C) guide the analysis:

1. *benefits*: the intertwining between economic/material and social/moral benefits (Van Stekelenburg, 2013); and between individual and collective benefits.
2. *governance models*: the extent of changes to governance arrangements, organisational forms and networks of relationships. These can be oriented towards functional improvements of existing practices and/or towards creation of new social capital. They can aim for coordination of individuals, and/or to collective collaboration within communities.
3. *urban spatialities*: the way in which the digitally mediated relationship with urban spaces and resources are envisaged: as access to, use of, and/or production of spaces; on an individual and/or collective basis; on what scale and in which type of socio-geographical community.
4. *social inclusion/exclusion*: whether tokenized models foster socially inclusive/cohesive processes, or they result in individualistic, utilitarian, techno-solutionist perspectives on the “social good” that reproduce existing social discriminations (Semenzin, 2023).

The conceptual and analytical frames adopted to address the third research question were presented in Section 4.2 in order to show how they complement the first research questions (see Section 4.1). Section 5.1 is about the results from the related empirical work, which is based on participant observation, focus groups and interviews³¹ with the participants.

³⁰ A third pilot, CommonsHood in the Garden (see Table 3) provides additional and complementary evidence which corroborates the analysis, particularly since its co-design process led to changes to the model compared to that originally envisaged. In the beginning, it was first similar to the reward system adopted in Collegno. It has since been changed into a hybrid system composed of a community sharing economy and rewards.

³¹ 10 semi-structured interviews carried out in October–November 2023.

PART III

Chapter 5

New spaces of tokenised social economies

The findings in Sections 5.1 and 5.2 below are presented according to the four analytical dimensions listed above. Section 5.1 is dedicated to the Collegno Local Lab' pilot, and Section 5.2 to the C.O.S.O. pilot. Section 5.3 discusses the findings from the perspective of the reading for difference approach.

The goals and functioning of the two pilots are described in Article 3, and summarized in Table 6 above (Section 4.1).

5.1 Rewarding civic participation

Benefits. The actors who took part in the Collegno Local Lab had different expectations from the use of the app, as declared during co-design and testing sessions, focus groups and interviews. Representatives from local social organisations and the municipality accorded great relevance to the social recognition of youth participation provided through the reward tokens, rather than to the economic value of the discounts these tokens provided. They also accorded relevance to the visibility and promotion provided to retailers and social organisations by geolocating their activities in the map integrated in the platform, and by naming them “participation places”³² and “exchange places”³³ (see below).

³² The original (Italian) term is *luoghi di partecipazione* and it refers to associations where citizens do volunteering work and are rewarded with tokens.

³³ The original (Italian) term is *luoghi di scambio* and it refers to commercial and cultural venues where, in the context of the Collegno Local Lab, citizens can exchange tokens for coupons providing certain benefits.

The consequent increase in economic revenues was considered to be an indirect benefit, which could become more significant over a long period of time. One expected benefit for the whole local community is higher awareness of local social and economic resources (for instance, where the “participation places” are in the city, and what opportunities they offer). Material economic advantages were more appreciated by the teenagers who received reward tokens and exchanged them with discount coupons. They described the system in rather transactional terms: for instance, the participants often talked about “participation places” as the places where one can get (more) tokens. On the other hand, they did not seem to consider volunteering as merely instrumental to obtaining individual and material recognition. However, the material recognition is appreciated as a way to get new experiences and make acquaintances while experimenting with some financial autonomy.

Governance models. The exchange model was aimed to widen the system of actors that intentionally take part to the co-production of the services under consideration (policies for youth participation and for supporting the local commercial and cultural services), by involving local retailers and associations, while keeping a steering role for the municipality and the social cooperative³⁴. It was not simply aimed at more efficiency through digitalization³⁵. Rather, token exchanges are expected to strengthen or activate relationships between citizens and social and economic organisations in different ways at “participation places” and “exchange places” (see below).

Urban spatialities. “Participation places” are those places where participants join collective actions, produces spaces also in a physical sense³⁶, and establish relationships in long-lasting engagement processes animated by interest for civic causes. Even though the related rewards are distributed on an individual basis, tokens do not provide a direct incentive to participate but rather reinforce a sense

³⁴ An open issue is whether more decentralised and complex systems could be implemented over a longer period as people get familiar with blockchain-enabled reward systems. For instance, participation places could issue different kinds of interoperable reward tokens (see Section 6.3, point 2).

³⁵ However, benefits in terms of efficiency and innovation are not disregarded. A possible follow up for the pilot, envisaged by the local Municipality, consists in adapting the wallet to digitalize the Youth Pass service in order to make it more attractive for young citizens. This means digitalizing the provision on benefit coupons based on the age of the beneficiaries.

³⁶ In the main project for youth participation in the city of Collegno, this happens also in physical terms: teenagers take part in micro-regeneration actions for the renewal of urban furniture.

of commitment. “Exchange places” are those places where people access and make use of goods and services to satisfy individual needs (such as shops, sports and cultural centres). In these places, economic interactions based on personal interests prevail, and they favour individual rather than collective empowerment.

Secondly, the initial goals of the pilot emphasised encouraging young people to access municipal services and local shops rather than just commercial services³⁷ and large retail chains in the metropolitan area. Conversely, young people clearly stated the system would be more interesting to them if it also provided access to exchange places beyond the municipal territory. On a more practical level, many of the actors involved, including youngsters, agreed that it is easier to set up the system by focusing first on a small territorial community. However, this has to be balanced with achieving a critical mass of users and providers in a short period of time³⁸.

Thirdly, the mediation provided by the wallet app was appreciated for providing continuity between physical and digital urban dimensions. This was intended to give young volunteers the opportunity to follow up on their participation in the youth initiative (which mainly revolved around micro-interventions for renewing urban furniture), and start new relationships. It was also intended to raise awareness among the app’s users of the possibility of using digital wallets to support social and economic activities that are usually associated exclusively with physical proximity.

Finally, the fact that participation and exchange places are geolocated on an integrated map, and that the activities and services they offer are clearly listed and described, was appreciated as a means to facilitate the discovery of and acquisition of knowledge about resources available in the area of interest.

Social in/exclusion. The risks that cultural or technical digital divides might prevent potential participants from benefiting from the system is considered similar to most other mobile applications by the participants interviewed. They think that elderly people and retailers who are not used to digital marketing are the most affected categories, and that difficulties are related to understanding token

³⁷ In the pilot under consideration, we refer to the municipality of Collegno within the metropolitan area of Turin.

³⁸ As mentioned in the third article, we changed our focus from a restricted area around the main public garden of the city to a wider scope of action so that more organisations could get involved.

fluxes rather than the usability of the interface. Some of the actors interviewed were concerned that tokenized rewards convey a transactional and individualistic vision of volunteering, crowding out solidarity networks. However, this concern was outweighed by the opportunity to socially recognize civic commitment and foster relationships, and by the awareness of the limited monetary value provided by the single coupon.

5.2 Community sharing economies

Benefits. The benefits expected by participants in the pilot include different economic and organisational aspects. Beyond allowing to save money by borrowing (rather than buying) objects, the app is expected to offer efficiency gains at the individual level (e.g. calendar and notification functionalities to help individual participants manage their own lendings and borrowings) and at the group level (allowing objects to be reserved, providing an inventory which is updated in real time). However, the core group involved emphasised much more the ultimate effects of establishing or consolidating relationships. These relationships are not only aimed for the satisfaction of material needs. They also enable behaviours that are coherent with personal or collective beliefs about sharing goods and avoiding waste. Obtaining “COSO coins” does not represent an economic benefit per se, since mechanisms of individual accumulation are limited by design³⁹ and the coins can only be used to borrow other objects at a symbolic price of 1 coin (see Article 3).

Governance models. Enabling decentralised management of the sharing system is not considered to be an objective in itself but rather a means towards fostering relationships. The decentralised operational management of the exchanges must not be confused with the collective governance of the community project, which is based on the collective decisions of the “core group”. This characteristic of community economies has implications concerning the inclusion of new participants in the process. According to the core group members, the facilitation and incentives provided by the CommonsHood Library of Things are not sufficient to attract people who are completely new to this kind of economy,

³⁹ C.O.S.O. coins are obtained in the following ways: when entering the community (10 coins); when making an object available to share via the platform (2 coin); when an object is actually lent (1 coin per day to the lender); and when concluding a loan (2 coin each to the lender and borrower). While the second and third transactions are functional to managing the loan system, the first and fourth have been explicitly designed to reward the establishment of relationships. Automated deposits and penalties for damaged objects were avoided.

only people that are already interested or are somehow connected to active members, even if the digitised and tokenised character of the service might arouse the curiosity of certain specific targets such as young people.

Urban space and communities. The peculiar aspect of the C.O.S.O. Library of Things is that exchanges of objects are not mediated by a single place (a physical library) where objects are collected for asynchronous exchanges: the parties meet directly, and decide at the time the public or private place where to meet. Due to the need to meet in person, participants consider the whole system useful if it is maintained at the neighbourhood scale and does not require travelling farther in the city. Moreover, periodical community events in public or common spaces have been confirmed as an essential part of the community engagement work.

A final relevant point emerged, and this is related to the utmost relevance given to relational goals and the focus on the neighbourhood level. Some members of the core group stated that once new relationships have been established, they would probably lose interest in the digital application as a mediator of exchanges and would prefer to contact lenders directly. Even if this is the opinion of only a few of the people interviewed, it stimulates crucial reflections on the relevance of such digital tools in relation to the type and scale of the local community involved ([see Section 6.3](#)).

Social in/exclusion. The risk of reproducing social exclusion mechanisms was tackled during the design phase in the following way. Participants receive a fixed amount of coins when they join the community, they all start all with a certain amount of coins that they can use to borrow objects. New coins are obtained not only by lending objects, but also by borrowing them, and this rewards the activation of relationships and not only the ability to lend (which implies having objects for this purpose). Moreover, redistribution mechanisms have been hypothesised such as directing penalties for damaged objects to a community wallet, in case these penalties are activated in the future. As in the Collegno Local Lab, the risk that interested people are excluded due to the digital divide was considered by the participants to be a very low risk and similar to that of any other digital application.

5.3 Transactional social collaborative economies

The CommonsHood wallet app potentially supports different models of social collaborative economies. In each of these models, (civic) blockchain affordances

play a different role in reshaping the relevant socio-economic spaces and spatialities, i.e. the way actors mean and organise socio-economic relations with reference to geographical context. In what follows, I discuss the empirical findings presented above in light of the technology-specific affordances. I will focus on three core aspects in each of the two pilots:

- 1) the *impact of the digital on social innovation* by opening spaces for new economies and governance models or modifying existing ones;
- 2) the intertwining of *economic/transactional and social/relational logics*;
- 3) the relationship with *urban spaces*.

I also provide some concluding remarks which apply to both pilots, concerning: the type of communities under consideration, and issues related to *social inequalities*.

In *systems rewarding civic participation* such as the Collegno Lab, tokenization concerns not only monetary values but also social/community values, namely the time/effort dedicated to volunteering. *Purpose-driven tokens* are used to give social value to civic commitments. They can be exchanged for coupons with an economic value to encourage further actions in social and economic community life.

- 1) The expected change is neither radical transformation of existing power structures and governance mechanisms, nor efficiency-oriented digitalization, but rather digitally-enabled enhancement of existing local social practices (volunteering) and economic practices (access to cultural and commercial services). The core objective is strengthening or activating relationships between citizens and social and economic organisations, to foster youth empowerment and the liveliness of the local social and cultural activities.
- 2) Given these ultimate goals around strengthening relationships, a relational approach to public/civic services and to socio-economic activities prevails, which is focused on social recognition. However, at the operational level, tokenized exchanges introduce transactional logics, which shifts the focus to mainly individual and material incentives. Conversely, the expected economic benefits for the actors involved do not prevail over the social ones, and serve community-building and youth empowerment goals. Moreover, the involvement of local socio-cultural services in the pilot showed the emergence of new ways of urban agency that cannot be simply understood as “market-led” or “civic-led” (Santala and McGuirk, 2022). Indeed, socio-cultural associations were more interested and

engaged than commercial services⁴⁰; they were willing to experiment with tokenized systems that are usually associated with commercial and marketing strategies to both promote their services and reward their volunteers.

- 3) The compresence of transactional/individual and relational/collective approaches to civic participation is mirrored in the way urban spaces and places are meant, in the form of “participation” or “exchange” places. Interchangeable tokens and coupons are meant to make access to urban goods and services easier or cheaper, rather than limiting rights of access to urban resources (Gloerich et al., 2020). The model is aimed at promoting at the same time proximity civic action and the proximity economy⁴¹, also in the sense of encouraging physical meetings. This is expected to affect spatialities related to daily purchase and volunteering. However, the emphasis on geographical proximity has been challenged by teenagers’ understanding of the app’s affordances, as well as by critical mass issues.

In *circular sharing economies* such as the C.O.S.O. Library of things, non-fungible tokens (NFT⁴²) are created as *digital twins* of material objects, which enables these objects to be showcased, reserved and tracked through the app, and facilitates loans in the absence of a centralised physical collection. Fungible tokens (the “COSO coins”) have so far been designed as a basic form of currency internal to the system. It is functional to borrowing objects (paying a symbolic price), but it has been also attributed an additional meaning of rewarding the establishment of relationships.

- 1) The Library of Things functionality enables a new space for exchanges and expands the possibilities for actuating diverse economies: not only providing the organisational pre-conditions, but also “stimulating us to

⁴⁰ Possible reasons for the low engagement of retailers as reported by public officers are: the absence of immediate economic gains vs the urgency of doing effective marketing; distrust in local policies by the trade sector; the digital divide; overlap with similar initiatives in which the usual active persons are already engaged.

⁴¹ This can also include encouraging frequenting specific urban areas (e.g. a city garden in the original idea for the Collegno Lab), urban commons (e.g. a collective garden) or socio-cultural hubs (e.g. the Museum in the pilot Tecno PROFEZIE).

⁴² Non-fungible tokens (NFT) represent unique digital or material objects with a unique digital identifier.

rethink the economic system we live in” (interview to participants, December 2023). While the Library of Things is not a novel concept, the particular NFT-enabled management system has made it possible to implement this sharing practice not only in the form of bilateral relationships but also through one-time events such as swap parties. The digital-enabled organisational advantages are intended to be functional to social and collective achievements. It is not a matter of coordinating individuals (Mos, 2023) but rather bringing together members of a community who share similar ethical values and political visions about private property and consumerism, and empowering them to enact alternative community economies.

- 2) The project aims at enabling economic models that are explicitly alternative to purchasing, private property and individual consumption models, and that are transformative towards community-based, sharing, and circular economies. In the C.O.S.O. project, transactional elements have been strongly limited by design. However, the Library of Things functionality in CommonsHood leaves open the possibility for other communities to customise different sharing schemes, closer to loans or to renting, according to their needs, values and goals.
- 3) The digital is functional to exchanges marked by both materiality and geographical proximity. Geographical proximity is even more marked than in the Collegno case, and focused on the neighbourhood level.

Table 7 - The main features of the two social collaborative economies

	Rewarding civic participation (Collegno Local Lab)	Community sharing economy (C.O.S.O. Library of things)
Impact of the digital tool	Enhances existing co-production model. Activates and enhances relationships.	Enables new (modalities of) sharing economies. Activates and enhances relationships.
Interaction logic	Relational + transactional	Relational + transformational
Urban space / community	Proximity civic actions and economies. (Beyond the) municipal scale.	Proximity and material exchanges. Neighbourhood scale.

The above description of proximity relationships within a community for both the pilots above (see point 3) raises an important issue: the relevance of the digital tools in relation to the *type and scale of the local community*. Findings from both the two main pilots and other projects provide pointers to what needs to be investigated further (see Section 6.3). Small, cohesive, and committed communities are fruitful contexts for in-depth co-design and testing of tokenized socio-economic models, especially when their actors are already aware of the models' expected results. Conversely, these communities are less in need of incentive systems or digitally mediated asset exchanges to provide added value to existing social bonds. At the opposite end, the primary target of the CommonsHood application are not extensive networks of individuals without any trust relationships and shared goals, which are the typical actors of blockchain-based trustless interactions (e.g. with cryptocurrencies). *Intermediate communities* in terms of numbers of components, scale, and of strength of social and trust relationships are those whose needs can be best addressed by CommonsHood: I am referring here to cases where an overall interest and commitment to a social or civic cause is there, but individual participants still need to be encouraged, and management systems need to be made more efficient or effective. Here, tokenized incentives (e.g. rewards or discounts), semi-automated value transactions (e.g. coupon exchanges or crowdsales) and decentralised management systems (like the Library of Things) can make a difference to enabling collaborative practices (Davies, 2017; Nguyen, 2023). In other words, the interactions to be implemented should have a *transactional component*, even if it is not necessarily related to economic values or individual interests (see Sections 4.2, 5.3, and 6.2). If the interaction model is only relational, blockchain, being a transactional technology, could lose its relevance.

In both the pilots, there did not appear to be any evident effects in terms of *exclusion* from or *inclusion* in the community⁴³, neither due to digital divides issues in the broad sense (related to the fact of using a mobile app), nor due to the way tokenized transactions are devised. As regards the latter, scholars have pointed out that in the so-called “blockchain for social good” projects, the notion of social good is mostly associated with value in a fundamentally financial sense (Semenzin, 2023). As such, tokenized interactions reproduce competitive, utilitarian, individualistic logics (based on economic rewards) into social

⁴³ Possible side-effects in terms of reproducing exclusion mechanisms were not evident at the present stage of experimentation, but could nevertheless appear incrementally: this needs to be monitored.

relationships, thus reproducing structural *inequalities* rather than tackling, them (Semenzin, 2023). The CommonsHood concept does rely on tokenization, but explicitly intends *value(s)* not only in a financial and monetary sense (see Article 2). Moreover, when tokens take a monetary value, the socio-economic interactions supported by these tokens can be designed for implementing economic models that are oriented to social and solidarity economies rather than to neoliberal free market principles, as shown for instance by the C.O.S.O project.

Due to their experimental nature, the pilots under consideration started to implement collaborative economies in simplified versions compared to what real life situations would require. However, the pilots do provide relevant insights on the directions and type of changes that the civic blockchain can bring to socio-economic interactions, space and spatialities. Reading the civic blockchain approach and the CommonsHood application as simply alternatives to mainstream blockchain applications, and the social collaborative economies as radical alternatives to market logic, does not help us to fully understand their potential and limits. Conversely, reading them “for difference” has allowed us to shed light on how the socio-economic models under consideration experimenti with different combinations of: *transactional*, *transformational* and *relational* approaches; *market-based* and *community-based* logics; *economic*, *social* and moral incentives; *improving existing practices* and *enabling of new spaces of exchange*.

The empirical phase of the research allowed us to address most of the issues raised in the conclusions of Article 2: the actual implementation of the Internet of Values 2.0 principle in different socio-spatial contexts; the adaptability of the app’s design; and its expected effects on the socio-economic interactions in the diverse social economies addressed. Open issues are the actual effects on the local spatialities, and the type of local communities that are more likely to engage in and benefit from the civic blockchain. These indications are relevant for orienting future empirical research, as I show in the next section.

Chapter 6

Conclusions

This section provides an overview of the theoretical, empirical and methodological contributions of the research, and discusses its conceptual and methodological choices. Moreover, it indicates future research lines including new research actions and projects that have already been defined or started following on from this research.

6.1 Lessons learnt from the experimentation with CommonsHood

The work presented in this thesis addresses the lack of empirical research on blockchain technology used in civic contexts. This means widening the scope of blockchain applications, which are now mainly related to complex automation processes and to delocalized crypto-financial transactions. More specifically, the research contributes to widening the scope of attention geographers now pay to the socio-spatial dimensions of blockchain-based platforms in the domains of digital social innovation and alternative forms of digital urbanism, and also provide recommendations for blockchain developers. In order to achieve this goal, I took part in the interdisciplinary research project on the blockchain-based wallet app CommonsHood, working on all phases from design to testing and evaluation.

The theoretical and methodological results of this study contribute to the field of blockchains in civic settings and as an alternative form of digital urbanism, and help to **better understand, design and develop blockchain-based digital tools aimed at enabling social collaborative economies at the local level**, by:

- **conceptualizing the *civic blockchain* approach, and its context-based characters;**
- providing **empirical evidence on its potentials and challenges;**
- showing the **relevance and feasibility of a participatory methodology** for redeploying blockchain as a civic and context-based technology;
- advancing reflections on the **necessity and difficulties of such an interdisciplinary research across computer science and social sciences.**

The *theoretical phase* of the research started with the introduction of concepts aimed at gaining thorough knowledge of the blockchain specifics and affordances. This served as a starting point for subsequent analysis of the way in which blockchain-based tools interact with the socio-economic contexts of their use and with their spatialities. First, I showed how they differ from well-established ICTs, and described the *transactional* character of the digital mediation they provide. Blockchain makes it possible to enact disintermediated but secure and immutable transfer of assets in the form of tokens, and to actuate automated and self-enforced decisions through smart contracts (Article 1). Second, analyses advanced in the fields of interaction design and media studies have been mobilised to bridge the *technical and functional descriptions* of the technology under consideration with the *critical study* of its socio-political and spatial implications. Scholars have observed that when blockchain platforms address social dynamics, then dilemmas, conflicts and pitfalls arise concerning: quantification of social values, automation of mutable social relationships, assumptions regarding the absence of trust and the need to overcome intermediaries. I analysed the concept and objectives of the CommonsHood research project taking into consideration these dilemmas, in order to clarify how it overcomes them, and in order to identify open issues regarding these matters. These issues have been addressed in subsequent experimentations. I defined the *civic blockchain* approach adopted by the CommonsHood project, and stated its building blocks: the Internet of Values 2.0 principle; disintermediation at the level of service implementation; its application for local civic actions and social collaborative economies (Article 2).

The *empirical phase* of the research consisted in running pilots for co-designing, further developing and testing the application in different geographical contexts and socio-economic models. This participatory action research produced empirical evidence on **how to implement *context-based* design and use of the**

civic blockchain in a way that is adaptable to the needs of different local communities, in keeping with its original purpose. Reading CommonsHood as a case of digital social innovation (Certomà, 2020), and adopting a geography *by* the digital perspective (Ash et al. 2018), I studied how the local socio-economic contexts where the tool is developed and used shape it, and vice versa.

Regarding *how local contexts shape the digital tool*, the empirical study focused on how and to which extent the app under consideration is (designed to be) adaptable to different local socio-economic contexts (Article 3). The core findings are:

- the CommonsHood experimentation shows how mechanisms of tokenization typical of blockchain can be designed to be *adaptable* to the community of users' context-specific decisions about the tokenized values and exchange models ("Internet of Values 2.0" principle).
- Adaptation to local contexts entails not only customising functionalities. The *context-based co-design* of the *technical features and functionalities* must be grounded in and integrated with the context-based co-design of the *socio-economic interaction model*. The latter requires significant effort and time, especially when the relevant civic/social economy itself, and not only its blockchain-based version, is new for the context.
- Moreover, co-designing tokenized social economies requires distinction as to which interactions can be tokenized with positive effects on the desired social or community goals, and which ones would risk excessive commodification.
- The above-mentioned dynamics are attributable to the specifics of (civic) blockchain technology. Other dynamics are common to other urban participatory platforms, such as the need for offline processes and in-person encounters in urban spaces to support digital engagement.
- All this sets the ground for matching tokenized economies with social collaborative economies where commingling between social and economic mechanisms is already in place, and for raising awareness among users of possible scenarios.

Regarding *how the digital tool shapes local contexts*, the empirical work focused on the effects of blockchain properties, as interpreted in the CommonsHood app, on local socio-economic spaces and spatialities ([Section 5](#)). Two cases of social collaborative economies were analysed, which respectively leverage purpose-driven tokens in a system rewarding civic participation, and non-fungible tokens in a community sharing economy.

- On the one hand, similarly to other urban digital platform the CommonsHood app *enhances* existing socio-economic practices by improving their management, encouraging local actors to engage, and providing continuity to and extending physical interactions. On the other hand, and thanks to typical blockchain properties, it *enables new spaces* for exchanges to emerge, meaning not only a quantitative increase in interactions, but also opening the door to new types of interactions, including a broader spectrum of combinations of transactional and relational approaches (see 6.2 below)⁴⁴.
- *Transactional, relational* and *transformational* approaches to civic participation coexist. Material, economic and individual interests and incentives are intertwined with moral, social and collective ones in different configurations depending on the collaborative economy under consideration and on how the different actors interpret the technology affordances within the same economy.
- This reflects in the way urban spaces are intended: as places to access and exchange resources to satisfy immediate individual needs, or as places to participate and contribute to social causes.
- As for many urban digital platforms, social and economic interactions characterised by *geographical proximity* are fostered at the municipal or neighbourhood level. However, the emphasis on geographical proximity is a potentially challenging factor for the long-term relevance and sustainability of tokenized systems. The geographical scale and the size of the communities for which tokenized economies and the civic blockchain are most relevant is an issue that requires further research.

On a *methodological* level, this research shows a feasible approach for **redeploying blockchain as a civic technology, and for introducing this kind of tool into different local contexts and social economy scenarios**. Concrete examples are provided from the pilots under consideration. With reference to these specific experiments, the core findings are related to both blockchain-related specificities and the civic orientation of the app more generally:

- Assuming the non-neutrality of technologies, *intentional actions* for encoding participatory principles in the wallet's smart contracts are

⁴⁴ See, for instance, the different ways in which participants in the Collegno Local Lab meant volunteering: the deputy mayor expressed a more traditional understanding (characterised by total gratuity); some youth participants expressed at the same time genuine commitment and an appreciation of moral and material recognition.

necessary on the part of the *developers*. With CommonsHood, intentionality is required also on the part of the *community/users* when deciding the rules and values of the tokens.

- As regards the co-design methodologies and the mechanisms for incorporating the local actors' feedback, some criticalities emerge that concern: the efforts required to continuously adapt a highly flexible tool, the consequent possible disorientation of the users on one side, and their high expectations on the customization process on the other side. Matching the developers' and users' perspectives is a significant challenge: for instance, when addressing contextual social requirements while considering the constraints of blockchain development (e.g. programming smart contracts); or when seeking to make the crypto jargon understandable.
- However, the pilots have shown the feasibility of intentional co-design, development and use. *Interdisciplinary action-research* approaches play a relevant role in facilitating such socio-technical processes.
- Introducing civic technologies to local socio-economic contexts shows the limits of not only mainstream imaginaries on disruptive digitalization, but also radical approaches to alternative digital urbanism, technological sovereignty and digital commons-based peer production. Digital social innovation processes are socio-technical transformations that require time, the existence of socio-cultural pre-conditions, and also strong commitment on the part of local actors.
- The implementation at full capacity of tokenized social economies enabled by the civic blockchain seems more relevant and sustainable for *intermediate communities* in terms of dimensions, cohesion, and the motivations of the actors (i.e. tokenized incentives or transactions can strengthen weak forms of trust, or attract newcomers). However, small and cohesive communities with a certain degree of awareness of social collaborative economies are fruitful contexts for co-designing the interaction models and functionalities of civic blockchains.

6.2 Discussion on the conceptual and methodological framework

The following paragraphs complete the summary of results in Section 6.1, discussing the way in which the analytical perspectives presented in Section 2.3

have evolved throughout the study and the overall limit and strengths of the methodology adopted.

As explained in Section 2.3, the theoretical and conceptual framing of the research led to the identification of certain perspectives that guided the multidimensional empirical fieldwork and analysis. These perspectives have been defined in broad terms, with two main aims that are coherent with the experimental character of the whole CommonsHood project. First, in order to provide analytical lenses that can cover the diverse set of scenarios foreseen for the CommonsHood application, which has exploratory goals. This implied accepting a certain level of generality in the definitions to avoid excluding potentially relevant aspects. Second, to facilitate the interdisciplinary and transdisciplinary action research in geography and computer science, and the involvement of non-academic actors which, which is a necessity for developing socially sustainable and civic technologies, but also difficult to put into practice. This implied starting from broad definitions that provide a common interpretative basis for different expertise, and which have been iteratively refined as follows.

The adjective *civic* has proven to be effective in communicative terms for defining the civic blockchain approach and for positioning it in relation to blockchains used for decentralised finance, logistics, notarization, and speculative cryptocurrencies. It stimulated debate and convergence when defining the experimentation objectives with the developers and local actors. However, the *civic* attribute needs to be complemented with more specific definitions of the socio-economic interactions supported by CommonsHood including local economic activities, government/citizen co-production of public services, and community-based social economies. With that aim, the second article advanced the concept of civic blockchain and complemented that by identifying its application domain as *social collaborative economies*. This term encompasses self-organisation by community members and public/private co-production of services. It also remarks on the economic/value-based component of the interactions. A debate has also started within the DTC research group on whether the civic blockchain concept could be alternated with other concepts (such as: *community blockchain* or *local blockchain*) depending on the interlocutors, and to aid clarity when communicating with blockchain adopters. Moreover, an issue that deserves further investigation is which types of *digital participation* are actually envisaged in the different application scenarios; and where they collocate in well-known (digital) participation typologies, “ladders” or “scaffolds” as

conceptualised by critical scholarship on smart cities and smart citizenship (Calzada, 2017; Cardullo and Kitchin, 2019).

The reference to *transactions* and *transactional* interactions has confirmed their centrality to understanding the implications of developing blockchain-based tools in support of social collaborative economies. This has been made possible by widening the perspective from a functional description of blockchain specifics (disintermediated and secure transaction of digital representation of data and assets), to a critical investigation of the type of social relations these properties enable (transactional, relational, transformational). Adopting a blockchain-based wallet is relevant where transactions of values are needed, even if these values are not necessarily monetary. According to binary readings, they contrast with the community-oriented or emancipatory goals of many diverse economies or civic initiatives. This is also because the current mainstream use of blockchain is speculative cryptocurrencies, and this is more known to the wider public. Implementing a *civic transactional* technology may seem like an oxymoron, but we can reframe the issue, adopting a “reading for difference” approach, by asking *what kinds* of social collaborative economies and civic actions can benefit the most from tokenized transactions, and under which conditions. This means *broadening the spectrum* of new forms of urban digitalization and leaving room for experimenting with them while acknowledging that more empirical evidence is needed to validate their potential.

The concept of *context-based* civic blockchain was initially inspired by the goal of the CommonsHood project of providing not only a set of place-based functionalities that are linked to different geographical context through geo-referred mapping, but above all a set of functionalities (the most relevant being the creation of new types of tokens) that allow us to deeply embed the application in different socio-economic local systems. As an operational concept, it has been used to critically investigate, through concrete experiments, to what extent the app is actually embeddable in local communities. The *urban* and more explicitly *spatial* perspective cuts across the different analytical dimensions through which the pilots have been studied (see Article 2 and 3). Different geographical, socio-cultural and governance factors characterise the urban local labs under consideration. From the empirical study, we can see clearly how these factors contribute to shaping the digital tools and the broader digital social innovation

process⁴⁵ (see Article 3). As regards how the digital tool in turn shapes local contexts, within the timespan of the research it was not possible to provide quantitative or qualitative measures of impacts. The attention focused on its expected effects on spaces and spatialities (expanding the possibilities for bringing about diverse economies; fostering proximity socio-economic interactions, combining individual interests and community goals — see Section 5). Long-term empirical work is needed in real-life situations in order to provide evidence on actual effects and to distinguish more thoroughly between different impacts on different spaces (geographical, physical, economic, social spaces) and spatialities.

This point leads us to summarise the limits of the methodology adopted for empirical research. First, the analysis of the actual effects of prolonged use of the application has been resized in comparison to what was originally envisaged. We had to extend the time dedicated to context-based design (see Figure 1) in each pilot, and to manage external factors related to the collaborative nature of the pilots, such as changes to the priority of project partners or delays in implementing their activities. Secondly, the pilots implemented simplified socio-economic models. Therefore, further experimentation is needed over longer period to implement more complex governance models and monetary schemes in order to guarantee the social and economic sustainability of the tokenized social economies under consideration. Thirdly, in-depth exploration of the CommonsHood app was preferred to a comparison with similar initiatives. The latter option was limited by the peculiar and experimental character of the CommonsHood project and the lack of truly comparable experiences.

6.3 Future research

Based on the above-mentioned open issues (Section 4 and 5) and discussion (Section 6.2), further interdisciplinary research lines are either in progress or have been identified as future work.

1) New experimentations and technical developments.

⁴⁵ See, for instance, the cohesion of the group of participants in the C.O.S.O. pilot. The identity of the same initiative is strongly related to its specific neighbourhood. Before the pilot, the consolidated tradition of community actions in that neighbourhood was also facilitated by urbanistic and architectural features.

Further investigation into the actual effects of using the app in local contexts requires new experiments with the CommonsHood wallet app, namely:

- a. the continuation and/or extension of ongoing pilots (e.g. CommonsHood in the Garden, C.O.S.O.) in order to validate the respective tokenized interaction models and related functionalities.
- b. the activation of new pilots on the same models (civic reward, sharing economies) in new geographical contexts and sectors to discover possibilities for proliferation (Lampinen, 2022).
- c. the activation of pilots on new models of social collaborative economies. These can include models that are more market-oriented, such as local systems of sustainable tourism, or those that are more oriented towards complementary welfare and urban commons, such as time banks⁴⁶.

As regards advancements in computer science, the continuation of the iterative cycle of development and experimentation (see Section 2.2) will lead to the deployment of new features and functionalities in the CommonsHood application that have not been presented in this work, but are planned for the future. Specifically:

- renovation of the user interface, following the usability evaluations from the pilots and based on UX and UI standards;
- improvement of interaction functionalities, such as a messaging system internal to the wallet app;
- further development of the *NFT creation* and *NFT marketplace* functionalities, first developed with the Tecno PROFEZIE pilot;
- functionalities for the collective management of wallets owned by an organization rather than just by an individual. These requires developing DAO-like functionalities, starting with the assignment of different roles and permissions to the persons involved in the management of an organization wallet.
- Governance tokens for implementing decision systems based on vote. Together with the previous point, this represents initial steps toward the development of DAOs within the CommonsHood system (see point 4 below).

⁴⁶ *Time banks* are collaborative systems where participants put at the disposal of their community their skills and time. An accounting system measures the contributions (e.g. in hours) and the related credits and debits, thus allowing to benefit from services from the community without monetary transactions. Many of the persons involved in the CommonsHood pilots on the Library of things models declared their interest for complementing it with a Time bank.

- Further integration with the crowd mapping functionalities of the FirstLife map, based on the local actors' positive evaluation of the utility of maps for enhancing the local orientation of the wallet app.

New research projects covering the three points above were launched by the DTC research group at the start of 2024, at the local level (the BLOCCHI project⁴⁷) and European level (the CO.R.PU.S project⁴⁸). The former will build on the *Visitpiemonte* pilot's feasibility study and design of functionalities (reported in Article 1) in order to further investigate blockchain-enabled fidelity and promotional tools for sustainable tourism. The latter will expand Library of Things functionalities to support models of circular urban economies in Turin and Athens.

The priorities for future technical developments are related to fine tuning existing functionalities, developing new ones, and integrating them to each other in a modular and customizable platform. This will allow to investigate more in depth the adaptability of CommonsHood to different local contexts and socio-economic models and to set the basis for its replication, proliferation and/or scaling up.

2) Modelling tokenized social economies⁴⁹.

As pointed out in Article 3, the CommonsHood pilots started with simplified versions of the intended socio-economic models.⁵⁰ At the same time, co-design activities outlined scenarios with new functionalities and new kinds of interoperable tokens: for instance, the “economic urban commoning” scenario of the CO3 project⁵¹, or the neighbourhood socio-cultural economy of the Tecnoprofezie project. In such scenarios, tokens continue to circulate as means of

⁴⁷ BLOCCHI stands for *B*lockchain per il turismo, *l'*Ospitalità e la *C*ultura delle *Com*unità *montane* (Blockchain for the tourism, hospitality and culture of mountain regions). The project is funded by the Italian Ministry of University and Research, PNRR funds, within the NODES programme. It is active in 2023-2024.

⁴⁸ The Phygital Models of Cooperation in The Retrofitting of Public Space (CO.R.PU.S) project is funded by the EU from the Driving Urban Transition (DUT) programme. It is active in 2024-2026.

⁴⁹ I'm grateful to Irene Domenicale for sharing thoughts on the research lines presented in paragraph 2) and 3), and for providing advice on the related bibliographic references.

⁵⁰ For instance, in the Collegno Local Lab, the system for further circulation of reward tokens after they are exchanged with coupons is yet to be designed. Likewise, the C.O.S.O. community would like to have a redistribution system for their community coins, but have not yet defined their requirements.

⁵¹ The “economic urban commoning” scenario of the CO3 project is described in the chapter “Embedding sustainability in software design and development”, mentioned in Section 2.2.

payment in the local community, which makes them community or complementary currency schemes. Community or complementary currencies are a complex domain where alternative and grassroots forms of local economies and financial inclusion have been tested for decades (Blanc, 2010; 2011), and to which blockchains are giving new impetus (Diniz et Al., 2019). Without going into the merits of this topic, the following remarks are relevant. The use of tokens as money is viewed with suspicion in some reward systems and sharing economies - certain actors are worried that accumulation or commodification crowds out collaborative logics. However, adopting some forms of currency seems the smoothest way of making the social economies under consideration more impactful and self-sustaining.⁵² Future scenarios involving CommonsHood will most probably involve a combination of purpose-driven tokens, community currencies and digital twins (see Figure 5).

One important methodological and operational consideration is that setting up community currencies systems requires studying their economic interaction models in depth, i.e. how value(s) are tokenized and circulated with regard to:

- a. the incentive systems: the coexistence of economic, material and moral incentives; and whether and how the latter can be tokenized (Han et al., 2022)
- b. the monetary policy: issuance, circulation and (re)distribution of the currency.
- c. the implications of possible interactions with national administrative, fiscal and trade regulations.

This research line needs an interdisciplinary approach with economic geography, token economics (Lo and Medda, 2020; Voshmgir, 2020) and token engineering (Freni et al., 2022; McConaghy, 2018). To this aim, new research projects are being launched on tokenomics in civic blockchain (see for instance Domenicale et al., 2024) involving collaboration between the Department of Computer Sciences and the Department of Economics and Social Sciences at the University of Turin, and in the framework of the European CO.R.PU.S project.

⁵² For instance, if the task of issuing reward tokens in the Collegno scheme were to be decentralised in different “participation places” and not carried out exclusively by the social cooperative that facilitates the system, then it would be necessary to have a community coin in order to make the different reward tokens interoperable.

Networking with research groups dealing with local currency issues (e.g. MonetaLab, RAMICS⁵³) is also included.

3) Types of local communities and of social collaborative economies.

As pointed out in concluding Section 5, we need further evidence to better understand what types of local communities are more likely to engage in and benefit from a civic blockchain. The research projects mentioned in point 2) above would benefit from contributions from the fields of economic anthropology and economic sociology to investigate the personal and community motivations and needs for digitally enabled and tokenized social economies. Moreover, sociologists, media scholars and geographers have been studying for a long time the way in which many contemporary societies are increasingly organised as networked individuals, networked publics, etc. rather than as communities based on local solidarities (see for instance Wellman et al., 2003; De Lange and De Waal, 2013; Calzada and Cobo, 2015). This extensive scholarship, which goes beyond the purpose of this thesis, can be complemented with studies that challenge the mainstream imaginaries on blockchain-enabled *trustless* interactions, by advancing an understanding of the blockchain affordances as *trust enabling* (see for instance De Filippi and Wright, 2018; Scott, 2016; Nguyen et al., 2023). The CommonsHood projects goes in this direction, taking up a challenge that can be summarised with the words of M. Zook and J. Blankenship: “how much more useful might blockchain be if community-based trust was tied to it rather than a coded simulacrum?” (Zook and Blankenship, 2018, p.15).

A related issue, pointed out in Section 6.2, concerns the types of digital participation that are envisaged in the different application scenarios of the observed app. Digital geography has already considered thoroughly the possible pitfalls of digital participation such as lack of inclusiveness and transparency, the manipulatory character of some top-down engagement processes, the quality of the digitally-mediated contents (see, for instance, the work of Shelton (2019), Cardullo et al. (2019), Certomà, (2021)). This knowledge base is an important benchmark for monitoring the effects of CommonsHood as an urban digital platform. However, this knowledge needs to be complemented with other approaches in order to keep into account also its specifics as a blockchain-enabled platform (see Article 2), so that civic participation relying on *tokenized* mechanisms does not result in *tokenistic* processes. The critical analyses of the imaginaries of blockchain experiments for civic participation and commoning,

⁵³ <https://ramics.org/>

mentioned in the previous sections (see for instance the work of I. Gloerich et al., S. Semenzin, M. Sotoudhenia), provide examples of both strengths and weaknesses in this regard. The civic blockchain approach advanced in this thesis complements these readings by directly experimenting with not only the design, but also the development and testing of trust-enabling smart contracts.

4) DAO, commons and local communities⁵⁴

As mentioned in the Introduction, the potential of DAOs lies in enabling automated governance of decentralized organization. Both CommonsHood and many community currency systems (see point 2 above) leverage blockchains for managing value transactions, and not more complex governance processes. Smart contracts allow to make trustable and to automate specific transactions of digital assets, while decisions on the management of the systems are taken off chain. However, the possible applications of DAOs cannot be overlooked as regards future developments of blockchain for civics and for local communities. The CommonsHood research group has already started to integrate DAO-related functionalities for allowing groups and organizations to collectively manage a wallet, and to take decisions through voting (see point 1 above). Moreover, specific research lines in computer science and economics within the same group are studying modelling languages for DAO and evaluating their applicability with local currencies (see for instance Avanzo et al., 2023).

Additional contributions from the social science can contribute to framing software modelling and development in a sound knowledge of how smart contracts and DAOs blend human and algorithmic agency (Zook and Blankenship, 2018) and of the needs of the contexts and communities that would adopt a DAO, which is useful only when common goals or the management of common resources are at stake (Van Vulpen and Jansen, 2024). They can also contribute to awareness of the limitations and shortcomings related to DAO. Among the latter: regulatory challenges, technical complexity, lack of accountability (Calzada, 2023), excess of quantification and automation (Van Vulpen and Jansen, 2024), or actual effectiveness in relation to costs (Feitchinger et al., 2023). Recent works on DAOs for the commons and common good (as reviewed by Van Vulpen and Jansen, 2023) represent a relevant starting point in this direction. Moreover, it will also be worthy to consider whether and how the digital and operational decentralization correspond to the geographical

⁵⁴ I'm grateful to Sowelu Avanzo for sharing thoughts on the research lines presented in paragraph 4), and for providing advice on the related bibliographic references.

decentralization of the organization or socio-economic system supported by a DAO. While in DeFi and corporate investments DAO do not operate on territorial basis, and the relevance and pertinence of DAO for dispersed communities is more evident (see for instance Calzada (2023) on e-diasporas), this is not necessarily the case for many commons and for local civic actions as those addressed by CommonsHood.

5) Interdisciplinary research on digital technologies for local communities.

This thesis framed the computer science-based experimentation with CommonsHood as a case of digital social innovation and alternative urban digitalization, and analysed it according to the reading for difference approach (Gibson-Graham, 2008). The same approach also advances experimental, performative, ethical and creative orientation to academic research and practices by bringing different domains together and fostering collective experimentations (Gibson-Graham, 2008). All this helps inform a reflection on the encounters between technical disciplines (blockchain software development), social sciences and digital innovation practices. This reflection entails:

- a. conducting surveys about other experiments with blockchains for local communities. This continuous investigation is aimed at not only providing technical and operational comparisons and benchmarks for the development of CommonsHood, but also fostering researchers' and policy makers' awareness of the specificities of blockchains for civic participation and social economies within the domain of "blockchain for social good" or "blockchain for social impact" (see the Introductions to Articles 2 and 3). Indeed, this domain lacks not only critical assessment of the definition of social good/impact (see, for instance, the work of Semenzin (2023)), but also reporting of specific experiments in civic domains.
- b. refining the epistemological and methodological framing of the DTC group's approach, based on the contents of the chapter **"Embedding sustainability in software design and development: accessible digital tools for local communities"** (mentioned in Section 2.1) This research contributes to identifying its strengths and challenges. I summarise some of these challenges by referring to Louise Bracken's (2017) reflections on geography and interdisciplinarity, above all the need for projects with long start-up phases and with a high degree of flexibility with regards to evolving contextual factors (Bracken, 2017). Bracken also identifies three core themes that characterise research across social

and natural sciences, which I consider also to be relevant for research across social and technical science, and as priorities for the DTC group at this stage of its development. These themes are: deconstructing disciplinary language and re-articulating shared or common concepts; iteratively framing the research scope; clearly identifying the benefits expected by the external actors and communities who take part in transdisciplinary work (see point 3 above).

- c. deepening the reflections presented in the same book chapter regarding the debate on the civic role and responsibilities of the research institutions in developing environmentally sustainable (MacLean et al., 2023) and socially sustainable digital technologies, and the role of developers and social researchers working together as digital facilitators in digital social innovation processes.

Activities planned for 2024 onwards include: mapping blockchain initiatives for citizen participation at the local level in collaboration with research networks on blockchain for social good (e.g. Positiveblockchain.io or the BC100+ initiative)⁵⁵; the organisation of interdisciplinary webinars for pedagogists, philosophers and geographers on paradigm changes brought by blockchains to social work and social economies⁵⁶; continuing with the internal debate within the DTC research group on its methodology; continuation of the OFF-SPIN project for an academic spin-off (see Section 2.1).

6) Educational activities on the civic blockchain.

The DTC research group methodology combines experimentations on digital civic technologies with educational activities targeting students in schools, universities and informal educational contexts. Since 2016, web education and citizenship education activities on the FirstLife platform⁵⁷ have involved schools (Adamoli et al., 2023). My research has included designing educational activities on the CommonsHood civic blockchain, testing short modules in degree courses

⁵⁵ An exploratory review on token economics aspects in blockchains for local communities has been submitted to *Frontiers in Blockchain* in April 2024, and is currently undergoing the peer review process. (Domenicale I., Viano C., Schifanella C., *Blockchain for local communities: an exploratory review of token economy aspects*).

⁵⁶ The first two webinars have been done in March and April 2024, organised together with Istituto Universitario Salesiano Venezia (IUSVE). Topics: “*La sostenibilità e le piattaforme digitali civiche*” and “*Blockchain technology e ambienti cooperativi online*”.

⁵⁷ <https://www.firstlife.org/categories/educazione/>

and youth training activities.⁵⁸ On the side of teachers and students, there is interest in understanding blockchain criticalities and potentials within and beyond cryptocurrencies, and there is curiosity about the collaborative economy models and participatory practices the CommonsHood app aims to enable. The latter confirms the *prefigurative* character of these digitally-enabled initiatives, which is discussed in the literature on alternative forms of urban digitalization mentioned in Article 3 (for instance, the work of Lynch (2020) and Santala and McGuirk (2022)). Even if these practices are fragile, contested and not fully realized (Santala and McGuirk, 2022), they do show the possibilities of new urban/digital norms and behaviours and they enact the socio/political/economic changes desired for by activists (Lynch, 2020).

With the Futurama⁵⁹ project, structured educational programmes are being developed and tested in high schools on the topics of blockchain technology, the civic blockchain approach, and circular/sharing urban economies. Learning modules and tools build on existing toolkits and methods (like those of Ferri and DeWaal (2017) and Murray-Rust et al. (2022)) and the co-design tools adopted in our own CommonsHood local pilots. They leverage the pilots as concrete case studies, and include testing and discussions on the app's aims and functionalities, thus providing further inputs to the app's development and experimentation cycle.

Figure 5: Context-based co-design of the socio-economic interaction model.

5.a) CommonsHood in the Garden project: exchange of gardening equipment and community tokens; 5.b) and 5.c) Tecno PROFEZIE project: study for the integration of NFTs in the museum ticketing systems; 5.d) Tecno PROFEZIE project: design of the community currency. [Author: Irene Domenicale]

⁵⁸ Introduction to the civic blockchain approach and to the CommonsHood case study, app testing and evaluation activities. 5 workshops in graduate courses at the University of Turin (academic years 2020/21, 2021/22, 2022/23). Training for 20 young volunteers and 30 high school students (as part of the *Quartier Circolare* project, May 2022). Training for 10 civil service volunteers (*DigitiAmo Solidarietà* project, 2022)

⁵⁹ Project *Futurama - Nuovi Modelli per l'Educazione Digitale e Creativa*, funded by *Fondazione con i Bambini*. Active 2024-2026.

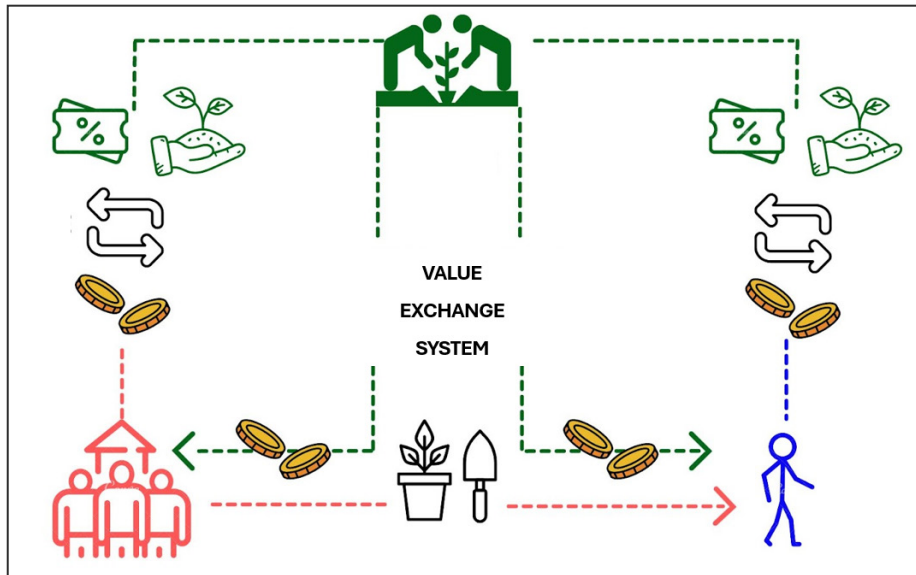


Figure 5.a

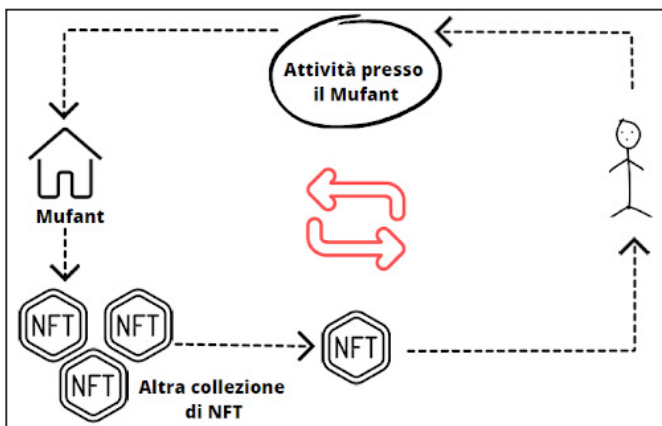


Figure 5.b

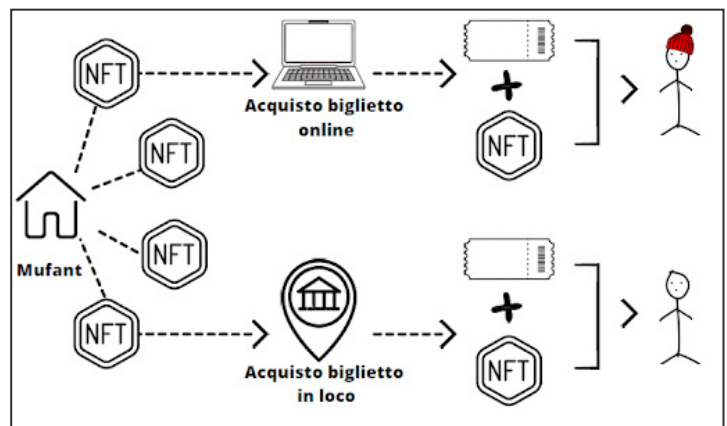


Figure 5.c

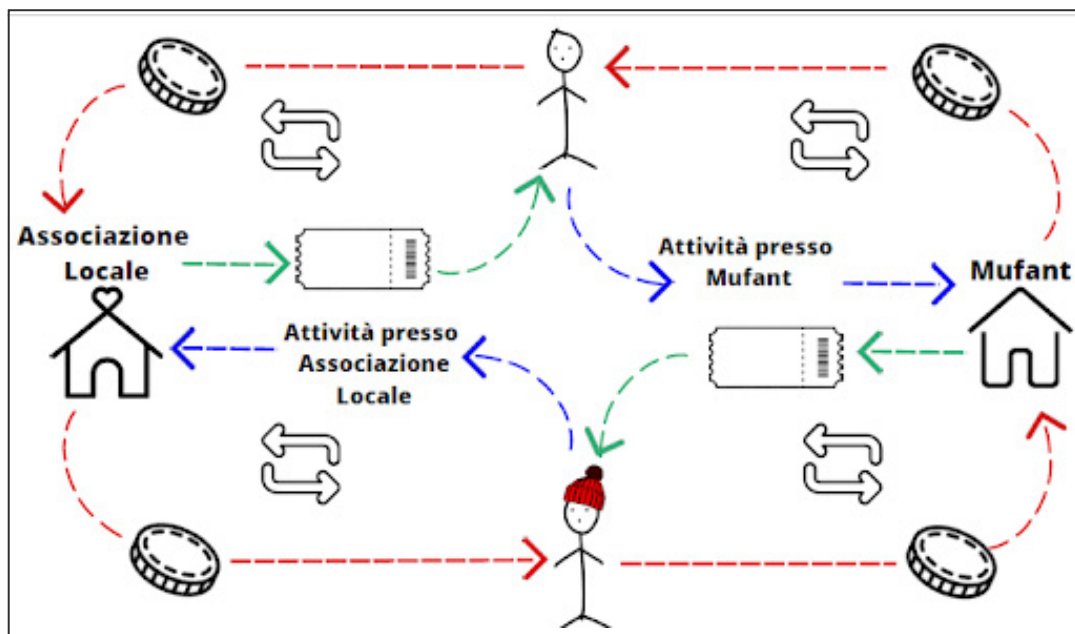


Figure 5.d

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Appendix

Article 1 - Blockchain tools for socio-economic interactions in local communities.

<https://doi.org/10.1093/polsoc/puac007>

Article 2 - Civic Blockchain: Making blockchain accessible for social collaborative economies.

<https://doi.org/10.1016/j.jrt.2023.100066>

Article 3 - Context-based civic blockchain: localising blockchain for local civic participation.

<https://doi.org/10.1016/j.diggeo.2024.100090>