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Tokenomics design for local communities. Interdisciplinary method for co-design

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Blockchain technologies are increasingly explored as tools for strengthening local, collaborative economies, yet existing tokenomics models remain rooted in financial incentives and market-based logics. This paper advances an interdisciplinary approach to the analysis and design of socially embedded tokenized systems for local communities. Drawing from token engineering, economic sociology, monetary theory, and research on digital platforms, we develop a multidimensional framework that captures the social, governance, economic, and technological dimensions of tokenized circuits of commerce. Building on this framework, we introduce a participatory co-design methodology based on four phases, from contextual framing to socioeconomic modeling, mechanism design, and technical token specification. The method emphasizes the need for aligning token design with community values, non-market forms of integration, and the relational and situated nature of money and digital artifacts. It is complemented by a civic-oriented blockchain wallet that can be customized to support different tokenized systems. The applicability of this methodology is preliminarily evaluated through a case study in the food-waste recovery domain, conducted as part of a feasibility study for a tokenized redistribution system addressing social inclusion.

KEYWORDS

blockchain, co-design method, interdisciplinarity, social and collaborative economies, tokenomics

1 Introduction

Blockchain technologies are increasingly explored in projects with social purposes, with application in sectors such as health, education, financial inclusion, humanitarian aids, open science, fair trade. These initiatives are defined as blockchain for sustainable development, for (social) good, or for social impact (Adams et al., 2017; Bartoletti et al., 2018; Diniz et al., 2021; Tomlinson et al., 2021; Calzada, 2023) and are initiated by diverse public and private actors including international organizations, IT companies, social enterprises and NGOs. Moreover, blockchains are also adopted in fields where digital activists and grassroots organizations implement community oriented and participatory economies such as: digital commons and commons-based peer-production (Benkler and Nissenbaum, 2006; Bollier and Helfrich, 2019); sharing, social and solidarity economies (Como, 2015; Krlev et al., 2021; Miller, 2010), complementary currencies (REF). As observed more extensively in a previous work of the authors (Domenicale and Viano, 2024) some criticisms and gaps can be identified in the works that study the blockchain applications mentioned above. On one hand, critics contest the notion of social good as applied to the blockchain domain (see for instance Sotoudehnia, 2021; Semenzin, 2023), or point out the risk of adopting techno-solutionist approaches to social and environmental problems, and of commodifying social norms (Tomlinson et al.,

2021; Gloerich et al., 2020; Semenzin, 2023). On the other hand, initiatives that aim at a more radical redesign of blockchains, so that their digital architectures encode the principles of solidarity, commoning, and digital sovereignty, incur in limits such as the limited interoperability and customizability of each system to the specific needs of different local communities. Therefore, we note that experimental research on tokenized systems for social purposes would benefit from putting the local level of social interactions, and the cooperative and collaborative logics that characterize civic participation, at the centre of its investigation. As such, among the variety of blockchain applications that target social goals and, this contribution specifically addresses blockchain for local communities. These blockchains are designed to foster active citizen participation engagement in the social and economic dynamics of their territory (Domenicale and Viano, 2024). Using tokenization, these systems aim to enable value-based interactions and transactions that reflect the intentional and participatory nature of community involvement and encourage collaboration over competition. In blockchains for local communities, there is a tension between, on the one hand, the introduction of transformative systems that aim at addressing community needs and socio-economic sustainability, and, on the other hand, the maintenance of a link to the current market-based economic systems. Indeed, many of these tokenized systems and their tokenomics (i.e., the set of rules governing the issuance and use of tokens, and the incentive system) reflect orthodox economic thinking and market based logics. Recent research on token economies, on the size of economic incentives and on token functions (Pierluigi Freni and Enrico, 2022; Oliveira et al., 2018; Schwiderowski et al., 2023) has recognized their potential applications in sectors other than finance, such as healthcare, identity management, and decentralized energy systems, but they often overlook the role of tokens in purposely enabling forms of collaboration. The existing literature on tokenomics mostly considers financial incentives and purely economic exchange, but comprehensive tools for analyzing and designing tokenized system models for collaborative economies are currently lacking. Conversely, in these application fields, the governance and operational mechanisms of blockchain technologies should be reoriented to serve collaborative and socially oriented goals as reflected in community-base and local level dynamics, which often diverge from the profit-driven paradigms typical of mainstream cryptocurrencies and decentralized finance (DeFi). A more radical reassessment of the principles and mechanisms that drive the utilization of blockchain technology is needed for blockchains or local communities to generate societal value and facilitate the achievement of a triple-sustainability paradigm in the global economy, thus addressing sustainability goals such as SDGs 8, 10, 11, 12, 17. In order to reorient these mechanisms, a sound design of the tokenized systems that these mechanisms enable, and of their tokenomics, is needed (Domenicale and Viano, 2024). We propose participatory approaches to *co-design*, in order to make such design processes as grounded as possible in the needs of local communities.

With this paper, we aim at filling these multiple gaps with a methodological contribution consisting in *co-design* methods and tools focused on tokenized collaborative economies in local communities.

This work is part of a broad research that re-frames blockchain as a civic technology (Viano et al., 2023). This research project

advances the civic blockchain approach, where blockchain-based wallets and cryptographic tokens are expected to be accessible and flexible in order to enable people to actively and intentionally participate in social and collaborative economies at the local level. The research is based on an interdisciplinary empirical work through pilot projects that involve local actors such as local authorities and civil society organizations. The core experimentation of this research is the participatory design, technical development and iterative testing of a blockchain-based wallet app, named CommonsHood (Balbo et al., 2020). The CommonsHood wallet enables users to create their own tokens and the related exchange mechanisms. The application is iteratively co-designed to be adaptable to different exchange models. This is what makes this tool a promising tool for activating interdisciplinary research that rethinks tokenized economies towards the achievement of SDGs. Indeed, the creation of tokens that represent community-based assets and the customization of their exchange mechanisms in different socio-geographic contexts requires a sound knowledge (or design) of the same contexts and socio-economic systems.

The methodological contributions presented in this paper advance our research goal of understanding how tokenized mechanisms and blockchain-based wallets can be designed with communities to be context-adaptable and coherent with collaborative principles. While standard tokenomics can model social-good projects through utility functions and incentive mechanisms, its expert-driven design process often conflicts with solidarity economy principles. This work addresses this misalignment by repositioning communities from subjects of optimization to co-creators of tokenomics systems and propose a participatory co-design method expanding design beyond the efficiency-focused models that dominate standard cryptoeconomics.

Specifically, this paper address the following research questions:

1. What theoretical frameworks and economic paradigms are required to analyze tokenized systems when applied to the non-speculative, collaborative goals of local communities?
2. What design methodologies and tools can effectively support the participatory co-design of token economies that foster local collaboration?

In Section 2, we expose the core theoretical pillars on which our methodological proposal is grounded, which encompasses different disciplines. Section 3 describes our method for analysing and designing tokenized systems that enable collaborative economies in local communities, based on interdisciplinary and participatory research approaches. In Section 4 we demonstrate the application of this method in a pilot project. Section 5 concludes and summarizes the contribution of the proposed methodology.

2 Background

2.1 Tokenomics

Since the present research addresses blockchain-enabled tokenized economies, it is important to consider the tokenomics domain as a reference discipline to be investigated, in order to find principles and conceptual foundations to the design process. The

terms *cryptoeconomics* and *tokenomics* are often used interchangeably and without clear distinctions, contributing to conceptual ambiguity in the field (Kensuke, 2024). *Cryptoeconomics* emerged earlier in the literature and was initially defined by Vitalik Buterin as the design of systems with desired properties, using cryptography to verify past events and economic incentives to shape future behaviors (Buterin et al., 2014). Voshmgir and Zargham (2019) further describes it as “an emerging field of economic coordination games in cryptographically secured peer-to-peer networks,” emphasizing its interdisciplinary nature and links to system theory, political science, and network science. They also define a *cryptoeconomic network* as consisting of three interconnected networks: a computation and communication network, consisting of nodes that sustain the peer-to-peer protocol and validate transactions; a financial network, composed of blockchain addresses through which value is exchanged; an off-chain socioeconomic network, encompassing the individuals and organizations that control the tokens and operate the nodes.

These definitions highlight the multifaceted nature of the *cryptoeconomic systems*, which intersect different elements such as resource allocation, strategic decision-making and behavior of different actors, rules designed to achieve targeted outcomes. Based on this, it can be said that the interdisciplinarity that characterizes *cryptoeconomics* involves a wide variety of disciplines, ranging from Operations Research and Management Science, Industrial and Systems Engineering, AI, Optimization and Control Theory, Computer Science and Cryptography, Psychology and Decisions Science, Political Science and Governance, Philosophy, Law and Ethics, as well as Economics and Game Theory. All of the mentioned disciplines are bounded by the fundamental aim of allocating resources (Voshmgir and Zargham, 2019).

Tokenomics is considered an evolution of *cryptoeconomics*, defined as the study of how tokens are used within blockchain ecosystems (Kampakis, 2022) and this regards token issuance methods, consensus mechanisms, and the broader system of economic and game-theoretic incentives. Over time, *tokenomics* has expanded to include *cryptoeconomics* as a subset, and its foundations are rooted in neoclassical economics, particularly the dynamics between supply, demand, and utility (Kensuke, 2024). While these economic models are useful for designing blockchain-based monetary systems and digital assets, they largely reflect orthodox economic thinking. A central question in our research is what alternative paradigms might emerge when token design is guided by broader socio-economic theories, rather than solely by market-based logic. There is still room to call into question methods from various economic disciplines such as political economy or behavioral economics, but also digital geography and sociology.

Once clarified the interdisciplinary nature of the study of tokenized systems, they have to be understood in terms of their constituent elements. Still following Voshmgir and Zargham reasoning, tokenized system can be described as complex socioeconomic networks which are structured in three levels and has to be analyzed accordingly to these levels.

1. The first level is defined by individual autonomous actors and it is a micro-foundational level related to the agent behaviors.
2. The second level regards economic policies embedded in software, and it is a meso-institutional level concerning

policy setting and governance. At this level, decision-making processes and goal setting are at stake.

3. The third level is characterized by emerging properties that are the result of interaction between actors and established and implemented rules. Emerging properties provide feedback that informs the other two levels in terms of how the system is performing based on the defined properties.

Understanding the fundamental elements that constitute tokenized systems is extremely relevant when considering contexts other than the market economy. Each of these levels will involve different design requirements and mechanisms depending on the context and the objectives set by the community of actors involved.

Existing research on token economies has focused primarily on the size of economic incentives and the classification of token functions (Pierluigi Freni and Enrico, 2022; Oliveira et al., 2018; Schwiderowski et al., 2023). These fundamental studies have given rise to various taxonomies that propose the classification of tokens defined in terms of assets, payments, and utilities, and frameworks that include more nuanced structural and behavioral elements that take into account characteristics such as fungibility, ownership, and governance mechanisms. Although these works recognize the potential applications in sectors other than finance, such as healthcare, identity management, and decentralized energy systems, they largely overlook the role of tokens in purposely enabling forms of collaboration.

To overcome the idea that coordination in tokenized systems derives purely from the self-interest of individual actors, a scenario that is rarely found in its unspoiled form in reality, further investigation is needed. Certain research in this area has deepened the understanding of concepts such as indirect reciprocity (Nowak, 2006) and meta-incentives (Okada et al., 2015). These models indicate how incentive structures can be designed to reinforce cooperative norms and protect them from the intrusion of selfish behavior within *cryptoeconomic networks* (Voshmgir and Zargham, 2019). An emerging line of research in this direction is increasingly investigating the role of tokens in contexts that prioritize collective and social value creation. Recent studies have conceptualized tokens as tools for promoting community cooperation and governance (Choi and Ahn, 2013), mechanisms for democratizing access and improving transparency in cultural services (Rubino et al., 2024), frameworks for mitigating common pool resource dilemmas through self-regulation (Kraner et al., 2024), and incentive structures that shape information-sharing behavior by balancing intrinsic and extrinsic motivations (Ballandies, 2022).

Despite this, there are still gaps to be addressed. There are currently no comprehensive tools for analyzing and designing tokenized system models explicitly directed at collaborative economies in local communities. Most of the literature on *tokenomics* focuses on financial incentives and purely economic exchange. These gaps highlight the need to understand how to identify the principles and design the mechanisms related to collaborative dynamics in local community contexts in order to create systems that meet the requirements and objectives of these particular contexts.

2.2 Economic sociology and monetary theories

In order to move beyond market-based approaches, we draw on key contributions from economic sociology that enable us to understand tokenization not merely as a technical instrument for managing transactions, but as a process embedded in social contexts and shaped by historical dynamics, as money is. Tokens are more than digital representations of value; they act as monetary artefacts that shape social relationships, and serve as tools of governance. As Gómez and Dini (2016) explain, drawing on Ingham (2004b), theories on the nature of money can be divided into three major strands: the commodity theory, the credit theory, and the chartalist theory. The first strand, of Aristotelian origin, conceives of money as a commodity with intrinsic value, useful for simplifying barter, and still dominates mainstream economic thinking. The second strand highlights that economic relations, especially in pre-monetary societies, were based on credit and reciprocity networks rather than direct exchanges (Graeber, 2011). The third strand, often referred to as the state or tax-driven approach, conceives money as a unit of account instituted by public authority and rendered generally acceptable through the imposition of tax obligations denominated in that unit (Knapp, 1924; Ingham 2004a). Also significant is the institutionalist perspective, which understands money as a social relation of credit and debt—an origin that is often obscured once money takes on the apparently neutral form of a “thing.” To move beyond the binary between commodity and credit money, which has long characterised economic thought, our research draws on a broad interdisciplinary literature that includes anthropology (Graeber, 2011; Humphrey, 1985), orthodox economics (Post-Keynesian and circuitist theories: (Graziani, 1990; Keynes, 1930), heterodox economics (Aglietta and Orléan, 1990; 1998; Thérét, 2008), philosophy (Aristotle, 1984; Amato, 2010; Turri, 2008; Kurnitzky, 1974), sociology (Dodd, 2014; Ingham, 1996; Polanyi, 1944; Searle, 1995; 2005; Zelizer, 2001; Zelizer, 2008a; Zelizer, 2008b), and history. (Martin, 2015). This theoretical trajectory is further grounded in the work of Ricardo Orzi and the research group of the Universidad Nacional de Luján, who elaborate a framework called the “theory of the dematerialisation of money”. In this view, money is analysed in its essence as a social relationship and a complex network of social ties that contributes to the reproduction of the system of which it is part (Orzi, 2017). The authors referenced in this perspective include Aglietta and Orléan (1990), Aglietta and Orléan (1998), Aglietta and Orléan (2002); Simmel (1978); Martin (2015); Marx (1844); Amato (2010); Zelizer (1994). Starting from these wide-ranging reflections, we therefore conceptualise money as a historically situated artifact, in a recursive and processual relationship with the context in which it circulates. Following Servet et al. (2008), we acknowledge the anthropological universality of money as a social institution, which is present in most human societies, while emphasising the historical and cultural specificity of its forms. Such diversity does not contradict the idea of a universal monetary fact; rather, it affirms that money, as a social institution, assumes multiple historical and cultural configurations. In line with this perspective, we stress the historical and cultural specificities through which monetary systems are constructed, whose meanings, functions and uses, and architectures are shaped by distinct social and symbolic

configurations. Such an approach enables us to foreground the diversity of monetary configurations and to question the often presumed universality of specific modern monetary arrangements, historically associated with capitalist economies, as the sole legitimate or efficient models. This allow for the development of alternative conceptualisations informed by recent monetary experiments (Gómez and Dini, 2016), as well as to the critical contribution offered by the historicisation of the concepts of market and money (Polanyi, 1944; Toti, 2024a; Zelizer, 2001). Already in 1944, Polanyi invited us to understand money as embedded in social context, explicitly rejecting any conception of it as a neutral instrument isolated from the historical, symbolic, and institutional processes that determine its form and function within specific systems of coexistence. Building on this insight, Servet et al. (2008) extend the analysis to the level of monetary systems, arguing that every monetary system is grounded in specific relationships with oneself, with others, and with the world, acting as a carrier of cultural values and social norms, where the social uses of money contribute to structuring society as a whole. Granovetter (1990) initiated what is now known as the *new economic sociology*, proposing the concept of the embedded economy. He states that economic action is always in relationship with concrete social structures and interactions, which shape and constrain individual behavior, including monetary practices. This broader view of money and the economy—as inherently embedded in social structures—has been central to the development of economic sociology. However, modern economic thought has often marginalized the social, normative and institutional dimensions of money. This epistemic displacement can be attributed to the division of intellectual labour that took place at the beginning of the 20th century. At that time, the study of money was largely framed under the jurisdiction of economists, while sociologists and anthropologists focused on other aspects of social life. As Ingham (1996) observes, this division contributed to the consolidation of a monetary conception rooted in the assumptions of neoclassical economics, which then spread to other fields of knowledge. Viviana Zelizer’s work brings attention to the symbolic and relational dimensions of money, recovering a notion of commerce that goes beyond market primacy. She elaborates this through the concept of *circuits of commerce*, understood not as categories such as groups, networks, communities, or imperfect markets, but as a way to give voice to the lived experiences of monetary experimentation. As she clarifies, commerce certainly pertains to the sphere of exchange, but it is not reducible to monetary transactions alone—it also involves the creation of shared systems of meaning and action. Zelizer defines commerce « in an old sense of the word, where commerce meant conversation, interchange, intercourse, and mutual shaping. They range from the most intimate to quite impersonal social transactions » (Zelizer, 2001, p. 3). Zelizer (1994) argues that money is never separate from social life; rather, it is embedded in a web of moral values, institutional rules, and everyday interactions. Economic transactions are governed by complex structures and considerations that reflect the broader social context in which they occur. Crucially, it is not money itself that consolidates power relations, but the ways in which it is socially earmarked and used. In this perspective, the social dimension of money cannot be reduced to its instrumental functions or to its mere circulation within a given context. Rather, as

emphasised by Zelizer, monetary practices are embedded in socially differentiated forms of earmarking and use, through which money acquires specific meanings and relational orientations. At the same time, and beyond these situated uses, money also generates a form of sociality that is intrinsic to its design and architecture, as argued by [Doria and Fantacci \(2017\)](#). Through its issuance, circulation, functional configuration, and the meanings attributed to it, money both reflects and crystallises specific patterns of social relations and coordination, thereby recursively reinforcing particular models of social reproduction. Building on this perspective, [Orzi \(2017\)](#) revisits the concept of money as a social relation—already proposed by Ingham—to stress that money articulates and reinforces the global values of society, thus acting as a powerful mechanism of social shaping. This opens the possibility of considering the performative and normative effects of money—not merely its instrumental uses—as constitutive elements within a broader understanding of monetary systems. When money is conceived as a general-purpose medium, embedded within a given monetary system, this perspective also highlights both the theoretical and practical possibility of designing multi-monetary arrangements, in which different monetary tools are tailored to specific purposes rather than assumed to be universally applicable. This perspective makes it possible to distinguish between general-purpose money and purpose-specific monetary tools, opening analytical space for the design of multi-monetary systems in which different instruments are associated with specific uses, values, and forms of coordination. This is precisely the case of the tokenized system developed through the CommonsHood platform, in which different types of tokens, each with specific rules and functions, can coexist within the same circuit of commerce.

2.3 From CCCs to civic tokenization

The interdisciplinary reconceptualisation of money and the sociological insights on market and monetary practices, discussed in the previous sections, provide the foundations of our theoretical proposal: to consider the tokens generated within a civic blockchain as monetary forms. This issue cannot be addressed without considering the broader field of study on Complementary and Community Currencies (CCC), which offers valuable insights for empirically testing monetary theories through contemporary experimentation ([Gómez and Dini, 2016](#)) while also informing the development of context-sensitive taxonomies and evaluation models. The analytical and operational framework presented below is grounded in this research strand, responding to the need for multidimensional evaluation tools that are sensitive to the socio-economic and spatial context and to the social nature of the monetary instruments analysed. The theoretical foundations informing this conceptual orientation are: the framework proposed by [Gómez and Dini \(2016\)](#), the critical re-examination of taxonomies of CCC proposed by [Toti \(2024b\)](#), and the critical literature on evaluation tools for these circuits ([Doria and Fantacci, 2017](#); [Lucarelli and Gobbi, 2016](#)). The development of more sophisticated theoretical tools for the study of CCC has fostered the emergence of studies such as those conducted by the research group at the Universidad Nacional de Luján (2005–2017) and the contributions of [Bindewald et al. \(2013\)](#); [Bindewald and Place](#)

(2015), which emphasize the need for a multidimensional approach. This perspective makes it possible to grasp the richness and complexity of monetary forms by relating them to the specific contexts in which they circulate, while also accounting for their cultural, political, and value-oriented implications. [Toti \(2024b\)](#) offers a critical reading of CCC taxonomies by focusing on the indicators used in their construction, which reveal the implicit monetary theories underpinning them. Her work aims to identify the indicators that reflect the political nature of money, allowing it to be conceptualised as a political instrument. The analysis highlights the need to move beyond orthodox economic approaches by adopting a perspective that values the political dimension of money. This dimension is not limited to its issuance and management but includes the broader context in which it is designed—its governance models, ideological foundations, values, and organisational practices. The inclusion of political indicators within CCC taxonomies enables a shift away from purely economic analyses and opens the way toward understanding governance as a mechanism of socio-political transformation.

In order to fully grasp the structure of the analytical framework proposed in this paper, it is essential to consider these foundational contributions. Despite differences in context and scope, these studies make it possible to emphasize the relational and contextual dimensions of money. The emergence of more articulated evaluation tools—capable of incorporating social, political, cultural, ethical, and environmental indicators—constitutes a response to the need we encountered when approaching the sociological dimension of monetary ontology, namely, the need to move beyond the dichotomy between “money creates values” and “values create money” ([Evans, 2009](#)). Our proposal highlights the processual reciprocity between monetary circulation and the contexts in which it operates, and aims to define how to act coherently within this reciprocal relationship through co-design.

2.4 Embedded and collaborative digital platforms

In the sections above, conceptualizations coming from economic sociology and monetary theories have helped us to frame tokens as a form of money, which is socially and historically situated. Moreover, focusing on tokens and cryptographic wallets insofar as digital artifacts, we also deem necessary to make our approach to digital platforms explicit. To this aim, what follows build on geographical accounts on digital platforms, according to which digital tools both shape and are shaped by the socio-economic and spatial interactions they enable, in a process of co-constitution ([Ash et al., 2018](#)). In our research project, blockchain based wallets are intended differently from cryptographic wallets and exchanges aimed at speculative and delocalized trading of crypto-assets. Similar tools have been studied under the definitions of digital participatory platforms ([Falco and Kleinhans, 2018](#)) urban digital platforms ([Chiappini, 2020](#)) local non-corporate platforms ([Rose, 2021](#)) digital sharing platforms ([Santala and McGuirk, 2022](#)) or more generally forms of grassroots digital urbanism ([Vadiati, 2022](#)), that question mainstream digital platforms and the uneven power dynamics they produce. Geographers have studied how such platforms can

be embedded in specific urban communities, and how they are aimed at addressing societal needs. Building on this works, our experimental research aims at implementing context-based civic blockchains (Viano et al., 2023; Viano, 2024), leveraging on the blockchain's potential for innovating the way in which assets and values can be digitally represented and transferred. The civic blockchain approach is realized through the co-design and testing of a blockchain-based wallet app, named CommonsHood (Balbo et al., 2020), in scenarios such as urban commons (Boella et al., 2025), the reward of civic participation, and sharing economies such as library of things (Vanzo et al., 2024; Viano, 2024). 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: for instance, as regards modular functionalities, type and value of tokens, user roles. Through an intuitive graphical interface that requires no programming expertise, communities can deploy various token types representing coupons, community currencies, event tickets, digital collectibles, and resource-sharing rights. Beyond token issuance, CommonsHood offers functionalities such as crowdfunding campaigns, marketplace for the management of non-fungible assets, and exchanges for interacting with different tokens enabling the development of dynamic multi-token ecosystems aligned with collective goals. The platform also provides DAO-as-a-service, primarily used by local associations to support governance processes through role-based access control; these DAOs are integrated with FirstLife, a geo-referenced social network that facilitates interactions among residents, civic groups, and social-economy organizations. This integration makes it possible to align tokenized transactions with neighborhood-level priorities, enhancing transparency and trust through blockchain execution while supporting concrete initiatives such as local loyalty programs or community-based resource sharing. Technically, CommonsHood is an Ethereum-based decentralized application built on a consortium blockchain, which avoids energy-intensive mining and is compatible with the European Blockchain Services Infrastructure (EBSI). Since it relies on proof-of-stake consensus mechanisms—now standard across major smart-contract platforms—its energy consumption is significantly reduced compared to earlier proof-of-work systems. Currently classified in TRL 7, CommonsHood is already deployed in real-world environments.

3 Socially embedded tokenomics

3.1 Introduction to a multidimensional framework

Within the analysis of tokenized systems, the intent was to move beyond a purely instrumental or economic understanding of money and tokens, and to construct a more nuanced framework that gives voice to both the specific features of the digitally-enabled monetary tool and the contextual ecosystem in which it circulates. This approach is grounded in a recursive logic between systems of value, principles, and ideologies embedded in a specific culture of practice and, on one side, the architecture and use of money that emerge from it, and on the other side, the digital infrastructure that encodes such principles while also contributing to shaping them.

Such a perspective allows for the construction of an analytical and operational framework capable of capturing money (and the tools enabling its circulation, which in our case are digital) as a situated artefact: not only shaped by, but also actively shaping, the local dynamics of exchange, meaning, and identity. The sociological perspective underpinning our research offers a powerful lens through which to rethink both the concept of money/tokens and the notion of market. It enables us to consider (digitally-enabled) economic practices not as isolated, rational transactions, but as socially embedded and meaning-laden processes. The analytical framework that we developed offers an interdisciplinary tool for grounding both the analysis and the co-design of civic blockchain and tokenized systems. Our analytical and operational framework consists of six core dimensions:

- **General project description** - this dimension outlines the core aspects of the project, initiative or system under scrutiny, such as overall objectives and the addressed needs. This information are essential for mapping the relationship between a specific currency system and the sociopolitical landscape in which it operates
- **Geography** - this dimension investigates the spaces, scaled and spatialities in and through which actors and resources interact to create value that is grounded in a specific socio-spatial context.
- **Participation and Governance** - this dimension encompasses both the active participation of the community—emphasizing the role of token holders—and the structural governance model that defines how the initiative under consideration operates.
- **Digital Infrastructure** - this dimension explores how the project's goals and community values are embedded within the technology, specifically through the interplay between technical properties and flexible 'affordances'—the possibilities for action that arise from how users interpret and interact with the system.
- **Economic Structure and Integration**-this dimension is rooted in an interdisciplinary perspective drawing from economic sociology, analyzing exchanges, social relations and non-monetary value systems that coexist within the model.
- **Monetary Design, circulation rules, and their social effects**-this dimension examines the specific attributes of the tokens circulating within the community, assessing their design through a dual lens: on the one hand, the technical and institutional rules governing their issuance, and on the other hand, their broader capacity to generate tangible socio-economic outcomes.

Each dimension includes specific indicators, variables, and specifications that help gather data on how values are (expected to be) embedded into the architecture and circulation logic of the tokenized system.

The analytical and operational framework developed in this research serves multiple purposes across the various phases of project analysis and design. As an analytical tool, it enables the observation, comparison, and interpretation of tokenized systems in their situated multidimensionality—extending beyond the technical infrastructure to include social, ethical, economic, and territorial

dimensions. It supports empirical fieldwork by identifying key aspects to be investigated, while remaining open to the emergence of context-specific dynamics that may exceed any predefined categorization. At the same time, the framework contributes to the creation of new initiatives by informing the construction of an ideal-type co-design process, offering guidance on how to adapt it to specific contexts—that is, to processes that are sensitive to local needs, resources, and constraints. Furthermore, by fostering connections across dimensions and bridging disciplinary boundaries, the framework promotes transdisciplinary collaboration and integrative forms of knowledge production. It also functions as a boundary object—facilitating dialogue and cooperation among diverse actors, including local stakeholders, researchers, and developers—by providing a shared interpretative reference throughout the process.

3.2 Co-design process for designing tokenized collaborative economies

The multidimensional framework described in its core dimensions is designed to serve the dual function of an analysis tool and, in a different and revised version, a participatory co-design methodology. The six dimensions of the framework, and in particular the indicators constituting them, represent the information that has to be collected in order to design a collaborative economy implementing a tokenized system. Organizing this information in the form of a process, we derived four main co-design phases, which we subsequently specified in a step-by-step method for setting the ecosystem, the interaction among actors and the characteristic of the token in a collaborative community-based context.

The four phases of the co-design process, shown in [Figure 1](#), are ordered progressively, proceeding from a more qualitative informational level to the design of the token in its technical specifications. The second and third phases, specifically referred to as *co-design* in what follows, are intended to be conducted together with community members to ensure that the system is designed in accordance with the real needs and dynamics of the local context.

1. System Framing: in this phase we begin to investigate the main objective of the project, the needs it aims to meet, the values it intends to promote, and how the project's objectives relate to the values and behaviors the community wants to promote.
2. Co-design of the socio-economic system: this phase aims to understand and define the characteristics of the ecosystem being designed, including its scale, spaces, and the relationships between the various components of the system. More specifically, we investigate which actors are involved; whether the token economy will be an open or closed circuit and, if so, what conditions of access are envisaged; what resource flows are expected and what relationships exist between them; and what type of economic system we want to design, whether there is a relationship with external markets and what type of exchanges we want to support.
3. Co-design of the Tokenized Circuit of Commerce concerns the definition, together with community members, of what part of

the socio-economic system outlined should be tokenized and how. During this phase, the functions and types of tokens are detailed by designing the incentive system, the governance mechanisms, and the rules for token issuance and circulation. We also go into details about: which mechanisms can be designed on-chain and what other tools are needed to meet needs such as communication; what relationship the tokenized collaborative economy has with official markets, i.e., whether the token is convertible into fiat currency; whether certain elements cannot be tokenized without compromising their meaning.

4. Token Design and Technical Issues will be addressed during this last phase, with the involvement of field experts. These issues mainly concern the token economy modeling, with a view to ensuring its long-term sustainability, and legal issues related to compliance.

3.3 Participatory Co-Design method

The co-design methodology proposed here is the result of a pragmatic synthesis of both academic theory and industry-standard practices in token engineering. Rather than conducting an exhaustive literature review, this section delineates the specific frameworks we selected and adapted to construct our toolset. From the academic domain, we integrated the goal-setting models of [Kivilo et al. \(2024\)](#) and [Khamisa \(2021\)](#), alongside the conceptual work of [Voshmgir and Zargham \(2019\)](#) regarding blockchain-based value transfer. However, these technical foundations were explicitly reframed: we mapped their logic onto the specific constraints of collaborative economies, prioritizing community resilience over market efficiency. Complementing these theoretical pillars, we incorporated operational frameworks from industry literature. We drew significantly from the definition proposed by [Tan \(2020\)](#) of token economics, focused on resource allocation and incentives in Web3, and the interdisciplinary curriculum of the Token Engineering Academy. Furthermore, we adapted the systematic design processes of [BlackTokenomics \(2025\)](#) and [McConaghy \(2020\)](#) incentive machines,' translating their startup-centric methodologies into tools suitable for civic contexts. Our primary contribution lies in this translation: systematically reorienting design principles originally intended for competitive financial markets to serve the cooperative, place-based objectives of solidarity and sharing economies.

Each phase is structured through two complementary tables. The first table in each phase ([Tables 1–4](#)) maps co-design guiding questions to token economy theoretical concepts. The left column presents questions facilitators pose to participants during workshops, while the right column identifies corresponding concepts from collaborative economy and token engineering literature, ensuring the participatory process remains theoretically grounded.

The second table in each phase ([Tables 5, 6, 7–10](#)) specifies expected outputs and key performance indicators (KPIs) for measuring phase completion. The first and second columns list the outputs (e.g., reports, frameworks, specifications) and their expected contents, while the right column establishes measurable criteria for quality assessment. Moreover, completion criteria at the

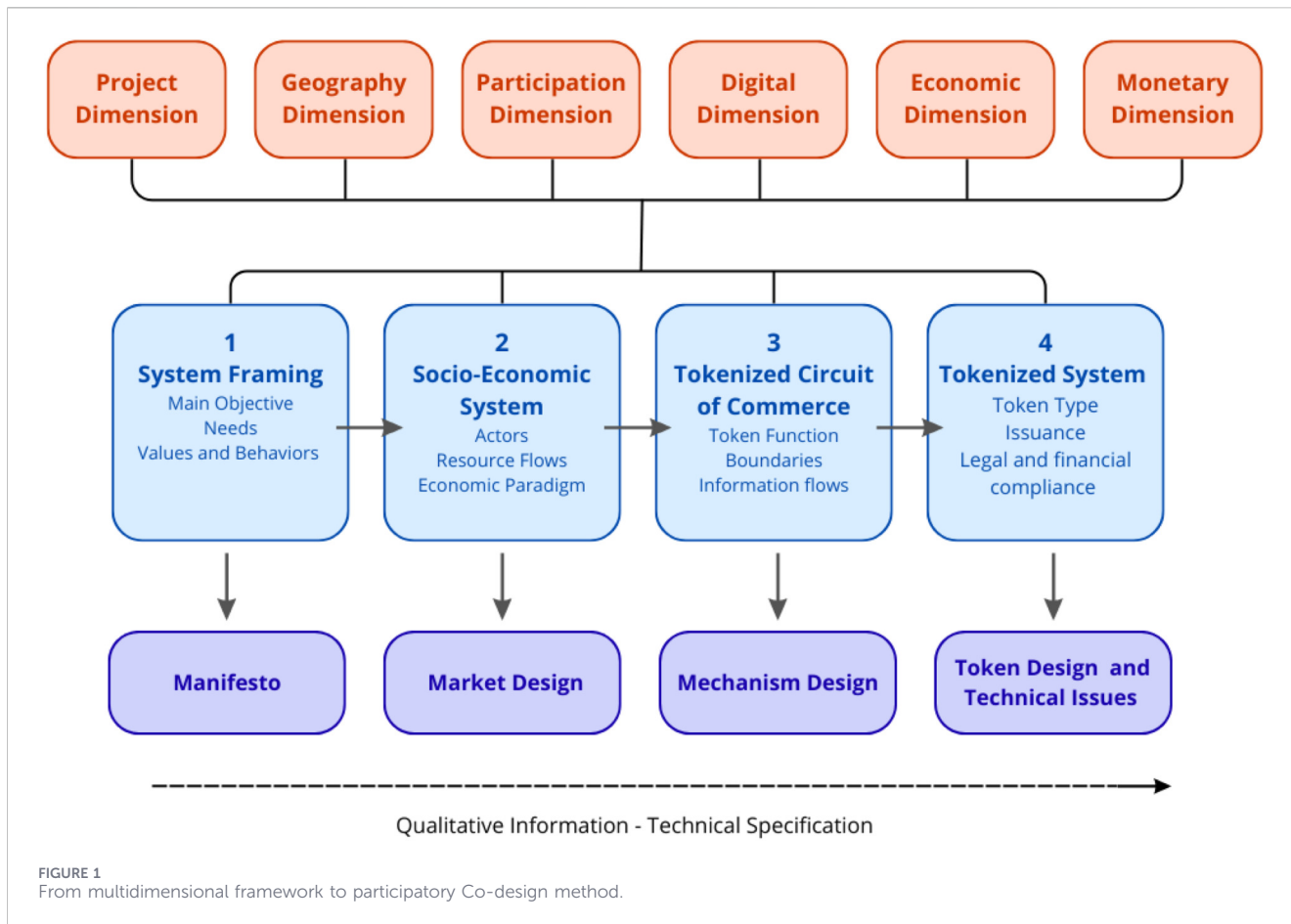


TABLE 1 First step: defining the manifesto as the foundation of the system.

System framing	
Main objective what are the main goals of the project? Are these goals aligned with the needs, ideas, and priorities that emerge during the co-design sessions?	Value Proposition
Problems/Needs addressed by the project what problems or needs does the project aim to address? How do the available resources (human, financial, infrastructural, etc.) relate to these needs?	
Actors motivations what are the shared territorial or community objectives in relation to the project goals? Which behaviors should be encouraged or valued? Where and how can incentives be introduced to support these behaviors? What forms of resistance might actors exhibit toward the adoption of the tokenized system?	Constraint
Values what core values does the project promote or aim to support? Are these values shared by the community and reflected in the co-design process?	Moral and Normative Framework

bottom of each table determine when sufficient progress has been achieved to advance to the next phase. While some metrics involve straightforward measurements, certain indicators require structured calculation methodologies that combine multiple data sources into quantitative indices. Detailed calculation methods are provided in [Supplementary Appendix 5](#).

3.3.1 System Framing

The first step can be defined as *System Framing*. This preliminary phase focuses primarily on needs, motivations for participation, possible resistances, and on understanding how

actors appropriate and give meaning to the overarching values of the project and to the economic model that is intended to be implemented.

Defining the Main Objective is fundamental as it subsequently determines all the mechanisms at play in terms of governance structure, policies, and incentives. In the context examined by this study, the definition of the main objective of the tokenized system is grounded in a collective construction of meaning centered on a core set of community-defined values. This element aligns with token design literature emphasizing that ecosystems require clearly defined overarching objectives (Tan, 2020; McConaghy, 2020). Such objectives constitute the system’s *value proposition* as

TABLE 2 Second step: mapping of socio-economic system design to market design elements.

Socio-economic system	Market design
Project opening and welcoming/access processes is the system open or closed? What are the access conditions for new participants? Are there any membership costs?	<i>Provide thickness</i>
Actors participation who are the participants in the system? What is the approximate number of participants, and what does this tell us about community diversity?	<i>Safe Participation and Sharing Information</i>
Spaces which physical or digital spaces are relevant? What areas are most important, and how are they used?	
Scale what is the geographical or social scale (e.g., neighborhood, city-wide, digital)? Are there any spatial or community boundaries?	<i>Overcome Congestion</i>
Relationship with official markets what is the relationship between the system and official markets or external actors (public institutions, companies, cultural orgs)? What remains outside the tokenized system? What are the boundaries of the tokenized ecosystem?	<i>Opportunities and behaviors outside the marketplace or token ecosystem</i>
Token function what kinds of exchanges occur (goods, services, time, knowledge)? What economic model fits (gift economy, market, mutual aid)? What behaviors does the system support or discourage? Does the system support reciprocity, redistribution, or market exchange? How are resource flows structured to promote integration?	<i>Economic Conception Integration Forms</i>

TABLE 3 Third step: mapping of tokenized circuit of commerce design to mechanism design elements.

Tokenized circuit of commerce	Mechanism design
Decision-making protocol and resolution mechanisms who is involved in the co-design process? Who defines the rules and monetary policies? Should there be voting or DAO-based governance? How are responsibilities and permissions distributed?	<i>Governance</i>
Incentive mechanisms what incentives would encourage to participate in this system long-term? How voting is done is the voting protocol? How is the allocation mechanism?	<i>Non-financial Incentives</i>
Ownership of the infrastructure who should manage and own the technological infrastructure (e.g., platform, servers)? Who is responsible for updates, support, and costs?	<i>Structure of the mechanism</i>
Digital/Physical relationship what resources, actions, or behaviors should be tokenized? Are there elements or activities that should remain outside the digital tool? What should not be tokenized or digitized?	
Actors requirements what kind of roles are present in the system? What type of wallet or access would you need? What actions should you be able to perform with tokens?	
Information flow model How should information about the project be communicated? What channels are most effective? Who should receive this information, and when?	<i>Community Information</i>
Resources should the token be convertible into euros or other fiat currencies? What assets does the token represent?	<i>Underlying Value</i>
Earmarking what kind of token is it (e.g., community token, reward token) used in the different flows? Which tokens support specific types of relations or good practices? What is the token's meaning and function within the system? (For each type of token) are other means used to support forms of economic integration beyond tokens?	<i>Token Type</i>

the core benefits and goals it aims to deliver (Barrera and Hurder, 2022).

At the same time, it is also important to understand the scope of the system understanding how actors and stakeholders relate to territorial goals, which behaviors are expected to be incentivized and with friction point may arise. This focus on Actors Motivations corresponds with what Tan (2020) defines as *Constraints*: the types of participants involved, the physical and digital spaces of operation, requisite professional competencies, governance models and their degree of decentralization, and the complexity of required smart contracts.

The Moral and Normative Framework represents a distinctive contribution emerging from the interdisciplinary approach adopted in this work, as it is typically absent from conventional token-economy design. It is crucial to understand the values and principles that operate as the normative foundation of the system—values that

guide its design and functioning while being actively supported and mediated through its tokenized architecture. In the context considered here, the construction of shared objectives and of the value proposition expressed in the manifesto results from a process of convergence that integrates the information previously gathered for each target group involved in the co-design process within a common moral and normative framework.

The completion of the operational tasks required from this phase lead to three expected outputs and the related measures.

The Needs and Objectives Analysis: catalogs identified community needs (target: > 85% validated), articulates main project objectives, and assesses alignment between objectives and both community needs and stated values (coherence index target: more than 70%). The Values Assessment Report: documents all core values identified during co-design sessions (minimum 3, optimal 5–7), measures consensus across stakeholder groups (target: >75%

TABLE 4 Fourth step: mapping of tokenized system of to token design elements.

Tokenized system	Token design and technical issues
Monetary architecture token standard, token behavior, token supply, inflationary, dis-inflationary or deflationary tokens, token circulation, any constraints if needed, exchange rate	<i>Token Policy</i>
Mechanism of tokens issuance how monetary incentives are issued and distributed? For each type of token, who is responsible for issuance, how many tokens are issued, and what degree of access do different actors have?	<i>Financial Incentives</i>
Value capture mechanisms what assets does the token represent? What are the endogenous factors impacting the value? Is the token backed by off-chain assets? What is the net present value?	<i>Valuation</i>
Platform usage costs and ongoing maintenance expenses	<i>Cost and Fees</i>
System’s legal status and fiscal obligation	<i>Juridical Compliance</i>
User identification and verification define user identification and verification procedures. Ensure compliance with anti-money laundering regulations	<i>Legal Compliance</i>

TABLE 5 Phase 1 outputs, content, and key performance indicators.

Output	Content	Key performance indicators
Phase 1: System framing - outputs and success criteria		
Needs and objectives analysis	<ul style="list-style-type: none"> • Main objectives clearly stated • Problems/needs catalog • Gap analysis (resources vs. needs) • Alignment assessment (objectives-community needs) 	<ul style="list-style-type: none"> • Number of needs/problems identified • % Of needs validated by community >85% • Coherence index (objectives-values) >70% • Resource-need gap documented
Values assessment report	<ul style="list-style-type: none"> • List of core values • Degree of value sharing 	<ul style="list-style-type: none"> • Number of core values • Degree of values sharing >75% consensus
Actor motivation map	<ul style="list-style-type: none"> • Target behaviors to incentivize • Friction points and resistance factors • Motivational drivers by stakeholder • Shared territorial/community objectives 	<ul style="list-style-type: none"> • Number of behaviors • Number of friction points mapped • % Actors expressing clear motivations >80%
Phase 1 completion criteria		
<ul style="list-style-type: none"> • Manifesto complete with all 3 components • Minimum 80% consensus on core values • Objectives-values coherence > 70% • All stakeholder groups consulted 		

TABLE 6 Phase 3 outputs, content, and key performance indicators (Part 1).

Output	Content	Key performance indicators
Phase 3: Co-design of tokenized circuit - outputs and success criteria (part 1)		
Governance architecture	<ul style="list-style-type: none"> • Decision-making protocols • Participant roles and permissions • DAO implementation (if applicable) • Dispute resolution mechanisms 	<ul style="list-style-type: none"> • All governance roles defined • Responsibility clarity >4.0/5 • Dispute mechanisms documented
Incentive design specification	<ul style="list-style-type: none"> • Non-financial incentives catalog • Financial incentives catalog • Barrier-removal strategies • Behavior reinforcement mechanisms 	<ul style="list-style-type: none"> • Extrinsic/intrinsic ratio 0.3–0.6 • >80% behaviors covered • Crowding-out risk: Low-Medium • All barriers addressed
Digital infrastructure management	<ul style="list-style-type: none"> • Ownership structure mMaintenance responsibilities • Cost estimates • Funding plan 	<ul style="list-style-type: none"> • Ownership clearly specified • Maintenance plan complete • 100% cost coverage
Digital-physical relationship spec	<ul style="list-style-type: none"> • Elements to tokenize • Elements excluded • Tokenization scope rationale • Value preservation strategies 	<ul style="list-style-type: none"> • % Tokenized: Intentional • All exclusions justified • Value preservation >4.0/5 • Decisions documented

TABLE 7 Phase 2 outputs, content, and key performance indicators.

Output	Content	Key performance indicators
Phase 2: Co-design of socio-economic system - outputs and success criteria		
Access and participation framework	<ul style="list-style-type: none"> • System openness (open/closed/hybrid) • Access criteria and conditions • Estimated participant numbers • Role definitions 	<ul style="list-style-type: none"> • System type specified • Diversity index >1.3 • Realistic estimates • ≥ 3 distinct roles
Spatial integration plan	<ul style="list-style-type: none"> • Physical spaces inventory • Digital spaces specification • Integration strategy • Geographic coverage 	<ul style="list-style-type: none"> • Spaces mapped • Integration ratio defined • Integration type justified • Coverage bounded
Scale and boundary definition	<ul style="list-style-type: none"> • Geographic scope • Social boundaries • Token utility assessment • Utility-coverage ratio 	<ul style="list-style-type: none"> • Scale clearly defined • Boundary clarity >80% • Utility score >3.5/5 • Ratio appropriate
External relations framework	<ul style="list-style-type: none"> • External actors inventory • Relationship specifications • Ecosystem boundaries • Interface mechanisms 	<ul style="list-style-type: none"> • Actors mapped • Boundaries clarity >3.5/5 • % out-of-scope documented • Interfaces specified
Token function specification	<ul style="list-style-type: none"> • Economic model selection • Integration forms • Types of exchanges • Behavioral expectations 	<ul style="list-style-type: none"> • Model specified • <i>geq2</i> exchange types • Coherence >70% • Behaviors documented
Phase 2 completion criteria		
<ul style="list-style-type: none"> • All 5 outputs complete and internally consistent • Community diversity index >1.3 • Physical-digital integration intentionally designed • Utility-coverage ratio meets minimum threshold for scale • Token function coherent with phase 1 values (>70%) • Ecosystem boundaries understood by >80% of participants • Community validation obtained 		

per value), and establishes value hierarchy. The Actor Motivation Map: identifies target behaviors to incentivize (minimum 5), documents friction points, and ensures that at least 80% of participating actors can clearly articulate their motivations.

The System Framing completion requires: (1) all three supporting outputs complete, (2) Token Economy Manifesto validated by at least 75% of co-design participants, (3) all specified KPI thresholds met, and (4) documented sign-off from community representatives. This validation ensures that subsequent design decisions are grounded in genuine community needs and shared values.

The output of this step can be defined as the Token Economy Manifesto. This document serves as the foundation of the token economy under consideration, ensuring that the development of subsequent mechanisms is aligned with social, economic, and ethical shared objectives.

3.3.2 Co-design of the socio-economic system

To develop a robust methodology that integrates token engineering with economic sociology, we must operationalize key concepts from both fields. The second step of our method—the *co-design of the socio-economic system*—corresponds to the first pillar of Tan’s token engineering framework: Market Design (Tan, 2020). In this context, however, we reconceptualize the ‘market’ not merely as a venue for transactions, but as a comprehensive environment where

actors operate and exchanges occur. It transcends the simple aggregation of token swaps to function as a broader socio-economic system. This definition encompasses elements beyond the immediate token ecosystem, accounting for external opportunities, behaviors, and social dynamics that interact with the system. Theoretically, this level corresponds to Voshmgir’s macro-observables, representing the global system states that constrain and guide the emergent behaviors of agents at lower levels (Voshmgir and Zargham, 2019).

With Project’s opening and welcoming/access processes, we define whether the system is open or closed and according to which criteria, as well as the conditions under which participants may join. This dimension corresponds to the notion of thickness (Tan, 2020) in market design: a system must attract a sufficiently large and diverse set of participants in order to reach an adequate level of adoption and ensure meaningful interaction within the tokenized environment.

Actors Participation and Spaces constitute another essential element to understand how many participants are expected to join the system, their characteristics and roles, as well as the spaces involved and use, in their physical or digital determination. This entails characterizing the participant, specifically their expected volume and roles, while simultaneously defining the operational context, whether physical, digital, or hybrid. This information is crucial for defining what Tan refers to as safe participation and information sharing, which emphasize the need to

TABLE 8 Phase 3 outputs, content, and key performance indicators (Part 2).

Output	Content	Key performance indicators
Phase 3: Co-design of tokenized circuit - outputs and success criteria (part 2)		
Actor requirements specification	<ul style="list-style-type: none"> • Technical role definitions • Wallet/interface requirements • Action permissions matrix a Accessibility accommodations 	<ul style="list-style-type: none"> • All roles specified • Permissions complete • Complexity appropriate • Support for all roles
Information flow architecture	<ul style="list-style-type: none"> • Communication channels • Stakeholder information needs • Update timing/frequency • Transparency mechanisms 	<ul style="list-style-type: none"> • >90% stakeholder coverage • Update schedule defined • Transparency baseline established • ≥ 2 channels per critical info
Resource backing framework	<ul style="list-style-type: none"> • Fiat convertibility decision • Asset representation • Relational backing description • Value definition 	<ul style="list-style-type: none"> • Convertibility clearly specified • Assets enumerated • Value clarity >4.0/5
Earmarking & token type specification	<ul style="list-style-type: none"> • Social meaning per token type • Technical type selection • Collective earmarking process • Individual practices supported 	<ul style="list-style-type: none"> • Token types: 1–3 • Social meaning clarity >4.0/5 • Technical-social coherence >75%
Phase 3 completion criteria		
<ul style="list-style-type: none"> • All 8 outputs complete and consistent • Governance structure clarity > 4.0/5 • Extrinsic/intrinsic ratio appropriate for context (0.3–0.6) • Infrastructure costs specified and funded (100%) • Technical-social coherence > 75% • Values coherence maintained from phase 1 (> 70%) • Technical feasibility confirmed • Multi-stakeholder approval obtained 		

TABLE 9 Phase 4 outputs, content, and key performance indicators.

Output	Content	Key performance indicators
Phase 4: Token design and technical issues - outputs and success criteria		
Monetary policy document	<ul style="list-style-type: none"> • Token standard selection • Token behavior (mint/burn/pause) • Supply model • Emission curves and schedules • Policy governance procedures 	<ul style="list-style-type: none"> • Standard explicitly chosen • Supply model defined • All constraints specified • Change process defined
Token issuance framework	<ul style="list-style-type: none"> • Issuance authorities per type • Initial distribution • Ongoing schedules • Verification procedures 	<ul style="list-style-type: none"> • All authorities defined • Distribution plan complete • Schedule explicit • Verification documented
Value capture & valuation model	<ul style="list-style-type: none"> • Value capture mechanisms • Off-chain backing specification • Valuation methodology • Endogenous value factors 	<ul style="list-style-type: none"> • ≥ 1 mechanism appropriate • Backing specified if applicable • Methodology documented • factors comprehensive

ensure that actors can participate safely while accessing the information required to navigate the system effectively. Ensuring safe participation also entails understanding the characteristics of the involved actors, promoting inclusivity across the spaces of interaction, and carefully considering the temporal dimension of transactions—particularly when offers should be made and how long transaction windows should remain open.

Scale is the next element to define, which involves gathering information about the geographical or social scope of the system, the spatial boundaries of the community, and the relationship

between the perceived utility of the token and the needs expressed by participants. This consideration resonates with a core principle of market design: the need to mitigate congestion. A well-designed system must allow transactions to occur with sufficient speed while ensuring that participants have adequate time to evaluate alternative options. When too many offers accumulate without the capacity for proper deliberation, congestion arises. Addressing this issue requires protocol mechanisms and practices that assist participants in making informed and timely choices.

TABLE 10 Phase 4 outputs, content, and key performance indicators.

Output	Content	Key performance indicators
Phase 4: Token design and technical issues - outputs and success criteria (part 2)		
Long-term sustainability analysis	<ul style="list-style-type: none"> Economic modeling Stress-test scenarios Multi-year projections (1/3/5 years) Risk assessment Scalability analysis 	<ul style="list-style-type: none"> Model complete and validated ≥ 3 stress scenarios ≥ 3 years projections Risks with mitigations Capacity limits documented
Phase 4 completion criteria		
<ul style="list-style-type: none"> All 6 outputs with implementation-ready precision Technical-social coherence maintained (>75%) Legal compliance confirmed (100%) Financial sustainability demonstrated (≥3 years) Independent technical review completed Community understanding verified Final approval from community assembly, technical team, and legal counsel 		

Relationship with official markets has to be understood in order to clarify the relationship between the system and official markets or external actors (public institutions, companies, cultural organizations) and what remains outside the tokenized system instead. This element aligns with Tan definition of opportunities and behaviors that exist outside the marketplace. While these elements function as exogenous variables—meaning they are not modeled directly by the token mechanism—they determine the opportunity costs for participants and are thus fundamental to the market design process.

Another element of this step that represents the integration of the interdisciplinary perspective is the articulation of the Token Function through the framework of economic sociology. This requires establishing two core dimensions: the economic conception (the paradigm governing the ecosystem, such as gift economies or mutual aid) and the form of integration (reciprocity, redistribution, or exchange). While existing literature defines tokens as units of value for self-governance (Mougayar, 2017) or coordination tools for network objectives (Pierluigi Freni et al., 2022) these definitions often prioritize market-like mechanics. Our approach extends these definitions by embedding the token within its social context. Here, the forms of integration determine the nature of exchanges—whether monetary or non-monetary. This nature is shaped not only by the types of transfers (the goods, services, or claims circulating within the network) but also by the media of exchange itself, emphasizing that the design of the token encodes specific social values and relational expectations.

The socio-economic system design phase produces the following five outputs. The Access and Participation Framework defines system openness (open/closed/hybrid), access criteria, estimated participant numbers, and role definitions, with success measured by community diversity index >1.3 and clear role specifications. The Spatial Integration Plan inventories physical and digital spaces, specifies the physical-digital integration strategy with an intentionally designed ratio appropriate to context, and defines geographic coverage boundaries. The Scale and Boundary Definition establishes geographic scope, assesses token utility (target: >3.5/5), calculates utility-coverage ratio, and ensures boundary clarity understood by >80% of participants. The External Relations Framework maps external actors, defines ecosystem boundaries (clarity target: >3.5/5), and specifies

interface mechanisms. The Token Function Specification selects the economic model (gift/market/mutual aid/hybrid), identifies integration forms, and ensures coherence with Phase 1 values (target: >70%). Phase 2 completion requires all five outputs documented, diversity and coherence thresholds met, and community validation obtained.

3.3.3 Co-design of the Tokenized Circuit of Commerce

The third step concerns what we refer to as the co-design of the tokenized system. It focuses on the rules that participants must define and follow when interacting with the system, aligning closely with what the literature typically describes as mechanism design (Mookherjee, 2008).

The first element to be defined within this step is the Decision-making Protocol and the System’s Resolution Mechanisms. This includes specifying how collective decisions are made, who participates in governance, whether the system incorporates a Decentralized Autonomous Organization (DAO), and how responsibilities, permissions, and oversight powers are allocated. It also requires clarifying who is involved in the co-design process itself, since these actors bear responsibility for establishing the normative and operational rules of the system. Within the token-engineering literature, this component corresponds to the governance dimension identified by Tan as a central part of the mechanism-design process. Governance design can vary significantly depending on the use case and the system’s objective function, leading to different degrees and configurations of decentralization. Moreover, governance is not limited to smart contracts: it may include dispute-resolution procedures, consensus protocols, and additional institutional or organizational layers that shape how the system operates in practice.

The design of Incentive Mechanisms builds directly on the initial analysis of participant motivations and friction points. At this stage, these insights are operationalized by distinguishing between incentives, which are intended to overcome specific barriers to participation, and rewards, which reinforce behaviors that the system aims to promote. This component of the process corresponds to the design of *non-financial incentives* within mechanism design, particularly the definition of voting protocols

for governance and the mechanisms governing the allocation of shared resources. In the context of collaborative local economies, financial utility alone is often insufficient to ensure sustained engagement. For this reason, the system must integrate meaningful non-monetary incentives (Domenicale et al., 2025), striking a careful balance between extrinsic rewards and the intrinsic motivations of community members in order to avoid undermining existing social values (McConaghy, 2020).

This step must also define the system's digital infrastructure, focusing on several additional elements. First, Ownership of the Infrastructure requires a clear delineation of responsibility for the technological stack. This includes identifying who holds management and sovereignty over the platform and servers, as well as who is accountable for maintenance, updates, and ongoing operational costs. Second, the Digital/Physical Relationship must be calibrated to determine the appropriate scope of tokenization. This involves assessing which resources, actions, or behaviors should be digitally represented and which should intentionally remain outside the tokenized system in order to preserve their intrinsic, non-transactional value. Finally, the system must specify its Actor Requirements in terms of, articulating how social roles translate into technical permissions. This requires specifying the types of wallets or access interfaces needed for different stakeholders and defining the precise set of actions—such as voting, minting, or transferring—that each role is authorized to perform. Taken together, these components correspond to what Tan identifies as the *Structure of the Mechanism*, that defines how participants transact with one another and how the ecosystem gathers and circulates information in a decentralized and fair manner. Through this structure, the system establishes the operational pathways that bridge off-chain social processes with on-chain execution, ensuring coherence between the technical infrastructure and the social dynamics it is meant to support.

A distinguishing feature of the *Structure of the Mechanism* within collaborative economies is the Information Flow Model. This component requires defining not only who receives information—differentiating among stakeholders such as developers, intermediaries, and end-users—but also when they receive it, ensuring transparency while avoiding information overload. Equally important is establishing how communication occurs, necessitating an integration of digital and physical channels capable of fostering trust among non-technical participants. In this respect, the role of information flow differs markedly from mainstream token engineering. It aligns with what Tan categorizes as *Community Information*, yet it diverges from the reliance on 'oracles' typical of conventional systems. Whereas standard architectures use automated oracles to import off-chain data, community-based token economies depend on socially mediated communication practices to validate and circulate knowledge.

It is essential to define the Resources backing the system, explicitly specifying the token's convertibility into fiat currency and the specific assets it represents. This step is crucial for understanding how the token's value is secured. However, in the context of local communities, value security is not merely financial; it is derived from ethical and relational dimensions that grant the system legitimacy and effectiveness. This dual approach aligns with

the concept of *Underlying Value* proposed by Pierluigi Freni and Enrico (2022) which analyzes the source of a token's inherent worth alongside the market dynamics that drive its fluctuations (appreciation or depreciation). By integrating the relational perspective into value definition, we expand the understanding of what 'backs' a community token beyond simple monetary reserves. The final component of this phase, the Definition of Token Type, is grounded in the sociological concept of Earmarking. Drawing on Zelizer, we analyze how tokens are collectively understood, designated, and used to support specific social relations or desirable practices. We propose that earmarking in tokenized systems manifests in two distinct configurations. First, it acts as a collective deliberative process: during co-design workshops, the meaning and function of tokens are negotiated through explicit relational work (Zelizer, 2001) between participants. Second, it operates as an individual practice during the system's live operation; here, users exercise agency to allocate tokens in ways that may reinterpret or extend the automated rules of the smart contracts. This sociological framing dictates the selection of the technical *Token Type*, ensuring the economic architecture aligns with these negotiated goals. The choice of type shapes the project's economy: Security Tokens constitute a claim to ownership or asset-backed stakes (e.g., equity in a DAO); Utility Tokens grant access to specific ecosystem services; Governance Tokens enable decision-making power (BlackTokenomics, 2025).

The mechanism design phase produces eight specialized outputs forming the comprehensive Mechanism Design Document. The Governance Architecture specifies decision-making protocols, roles, and permissions (clarity target: >4.0/5), with documented dispute resolution mechanisms. The Incentive Design Specification catalogs non-financial and financial incentives, ensuring an extrinsic/intrinsic motivation ratio appropriate to context (typically 0.3–0.6 for collaborative economies), covering >80% of target behaviors while maintaining low crowding-out risk. The Digital Infrastructure Management defines ownership, maintenance responsibilities, and operating costs with identified funding sources. The Digital-Physical Relationship Specification documents tokenization scope decisions with coherence to value preservation (target: >4.0/5). The Actor Requirements Specification translates social roles to technical permissions. The Information Flow Architecture integrates communication channels, ensuring >90% stakeholder coverage and establishing a baseline perceived transparency index. The Resource Backing Framework defines convertibility and underlying value, while the Earmarking and Token Type Specification ensures technical-social coherence >75% through documented collective deliberation. Phase 3 completion requires all eight outputs complete, coherence with Phase 1 values maintained (>70%), technical feasibility confirmed, and multi-stakeholder approval obtained.

3.3.4 Tokenized system

The final phase of the methodology addresses *Token Design*, which entails defining the intrinsic rules that govern the digital asset itself. This step corresponds to the third pillar of Tan's token engineering framework. The core element is establishing the Monetary Architecture, a process that translates the chosen economic paradigm into specific algorithmic behaviors. This

involves a suite of design choices: selecting the technical token standard, specifying issuance behaviors (e.g., expansionary minting or contractionary burning), and defining the supply model (e.g., disinflationary or deflationary curves). This set of parameters can be reconducted to the *Token Policy*, a concept adapted from traditional monetary economics. Crucially, as Tan (2020) articulates, Token Policy is distinct from Mechanism Design: whereas mechanism design governs the interactions and incentives of the system's participants, token policy specifically governs the management and supply of the tokens itself.

Another fundamental aspect is the value capture mechanism, which requires defining the endogenous factors that shape the token's value, determining whether it is backed by off-chain assets, and assessing its net present value. This component draws on the tokenomics design framework proposed by Kivilo et al. (2024), which identifies four primary mechanisms through which tokens may capture value: governance rights, where holding tokens grants participation in decision-making; asset representation, in which tokens are directly tied to the value of real-world assets; network value, derived from user trust, adoption, and overall ecosystem growth; and claims to earnings, whereby tokens entitle holders to a share of revenues generated within the system. This perspective aligns with broader *Valuation* principles in token design, which emphasize that token value should be anchored in internal ecosystem dynamics such as platform activity, user growth, and equilibrium between supply and demand. Existing valuation models for utility tokens, such as dynamic price equilibrium and dynamic adoption, further highlight how value emerges from the evolving interaction between token supply, user behavior, and system functionality (Tan, 2020).

In continuity with the definition of the token policy, it is necessary to specify the Mechanisms of Token Issuance, detailing how monetary incentives are created and distributed. This includes identifying the authority responsible for issuing each type of token, determining the quantity released into circulation, and defining the degree of access granted to different categories of actors. These design choices correspond to what the token engineering literature refers to as *Financial Incentives*, namely, the structured allocation of token-based rewards intended to encourage specific behaviors identified during the mechanism design process (Tan, 2020).

Finally, the design process must address the structure of costs and fees associated with participation in the system, specifying which transactions incur charges, who bears these costs, and how such expenses may affect user engagement, circulation, and overall system sustainability. Equally important is an assessment of legal and fiscal compliance, which requires clarifying the system's relationship to taxation, reporting obligations, and applicable regulatory frameworks. This includes defining appropriate procedures for user identification and verification, ensuring that the tokenized system remains compliant with relevant standards while maintaining accessibility for community members.

The technical specification phase produces six outputs forming the complete Technical Implementation Specification. The Monetary Policy Document specifies token standard, supply model, emission curves, and governance procedures for policy changes. The Token Issuance Framework defines issuance authorities, schedules, and verification procedures for each token type. The Value Capture and Valuation Model implements value

capture mechanisms (minimum 1, appropriate to context), specifies backing arrangements, and documents valuation methodology. The Cost and Fee Structure minimizes transaction fees for accessibility (typically <5% for community currencies) while ensuring 100% maintenance cost coverage. The Legal Compliance Framework achieves 100% regulatory compliance through complete cataloging of fiscal obligations, KYC/AML procedures if required, and data protection measures. The Long-term Sustainability Analysis includes economic modeling, minimum three stress-test scenarios, multi-year projections (minimum 3 years), and comprehensive risk assessment with mitigations. Phase 4 completion requires all six outputs with implementation-ready precision, maintained technical-social coherence (>75%), confirmed legal compliance, demonstrated financial sustainability, independent technical review, and final approval from community assembly, technical team, and legal counsel.

4 Case study

4.1 Local communities requirements

As the context of this research are collaborative economies involving local communities, it is worth noticing that the tokenized system functions as a social and technical infrastructure aimed at recognizing participant contributions within the community. Given that it could be useful to briefly specify how such tokenized systems could differ from the domain of DeFi. Even though these systems are digitally built on blockchain infrastructure, human roles remain crucial, especially in coordinating events and overseeing local activities. Defining distinct actors within a community is essential for designing effective tokens that fulfill their intended purposes. While maintaining decentralization as one of the core principles, certain managerial roles may still be necessary to coordinate resources, facilitate peer moderation, and ensure the maintenance of the digital infrastructure.

It therefore emerges that in these contexts there is a strong interconnection between on-chain and off-chain dynamics. It is important to integrate communication spaces within the digital systems, for example, through community forums or social platforms, which allow community members to discuss aspects of governance and decision-making processes. In this sense, the interoperability of the system also becomes relevant. This could include linking to municipal digital identity systems, integrating the cultural event calendars of local institutions, or enabling authentication through existing civic apps. As for scalability, tokenized systems oriented towards local communities do not require large-scale onboarding. It is important to prioritize reliability and inclusiveness rather than high-volume automation. Tokens can serve different purposes within a collaborative and community-oriented economy. They can represent tangible or intangible assets, designed to meet the circulation needs defined by values of the community or can function as non-monetary incentives aimed at recognizing and motivating civic engagement. In particular, with regard to non-monetary incentives, it can be seen how they can involve both extrinsic and intrinsic motivations of participants and can take the form of access to resources or services

offering tangible benefits, and gamification strategies that integrate the inherent enjoyment of an activity with external objectives such as the acquisition of collectibles or other forms of reward.

4.2 Food Reborn

To test this method, we applied it to Food Reborn¹, an ongoing project in the field of policies against food poverty and food waste in the city of Turin, Italy. The project aims at experimenting with a system where the recovery of surplus food generates environmental value (avoiding waste), economic value (providing beneficiaries with food aid), and social value at the same time. The latter consists in offering to beneficiaries socializing activities triggered by food consumption, rather than only providing them with stigmatizing food aids. A social currency is expected to make this value(s) emerge and circulate.

The co-design method presented in this paper has been used as part of a feasibility study which aimed at investigating how an existing initiative dealing with food surpluses could be redesigned as a social entrepreneurship project, economically sustainable and based on tokenization. More specifically, our method supported an initial phase of system design, in which the following actors participated: representatives of the social enterprise that initiated the project, social workers of local associations involved in food-related services, researchers who study the socio-political and spatial implications of the initiatives. In this initial phase, the perspective of the potential service beneficiaries have been taken into account through semi-structured interview. In the following paragraphs, we briefly report the information collected in each of the four phases of the method by following the contents listed in [Tables 1–4](#), and we present the resulting preliminary design of the Food Reborn social token.

4.2.1 System framing

4.2.1.1 Main objective and problems/needs addressed

The project aims to establish a social economy system that addresses food poverty in its social and psycho-emotional dimensions, in addition to material deprivation, while reducing food waste and loss in urban contexts (project documentation). Exploring the potentialities of cryptographic tokens for catching and multiplying the generated value, and for encouraging behaviors is an essential goal of the experimentation. Moreover, a digital platform is expected to support process management, monitoring and tokenization.

4.2.1.2 Actors Motivations

The initiator and key actors of the project at the present stage are a social enterprise, a local association and university scholars and action-researchers who share the vision of promoting food welfare

initiatives that go beyond traditional mono-dimensional and charity paradigms, in favor of people empowerment and of a multi-dimensional account of food poverty. Other actors (social restaurants, community centers) share this goal as part of their social mission. Based on what emerged from interviews with a sample of potential beneficiaries, the possibility of having access to food in socializing contexts is generally considered of interest. However, diverse needs also emerge, for instance as regards the actual way in which the food would be consumed: as ordinary customers of restaurants, during socializing activities, etc.

4.2.1.3 Values

Food poverty is addressed as a multidimensional phenomenon that includes not only material deprivation and limited access to food, but also immaterial aspects related to the loss of socially adequate food practices, which are central to wellbeing and quality of life.

4.2.2 Socio-economic system

4.2.2.1 Project opening and welcoming/access processes

At this stage, the system operates as a closed ecosystem with no membership costs. Participation as a beneficiary requires meeting specific eligibility criteria. Beneficiaries are primarily individuals involved in projects or activities implemented within the social sector.

Actors Participation.

- Collection Units are in charge of collecting, transporting, and deliver surplus food coming from local food markets.
- Beneficiaries are mainly individuals and families experiencing both food poverty and social exclusion (or only the former), identified by third sector services.
- Social Restaurants place orders of food surplus based on the list of available surpluses, transform unused food, and serve meals. They can receive food for free, and they comply with principles or mandates of social responsibility.
- Community Centers identify beneficiaries and define the rules for the (re)distribution of tokens as part of their mission to implement welfare policies.
- The Project Manager is the organization that coordinates and manages the entire system, and may help define the rules for the (re)distribution of tokens.

4.2.2.2 Places, spaces and scale

Two fundamental types of locations are involved: on the one hand, the CAAT, the general fruit and vegetable market which serves the entire city of Turin and which is the sole source of food for the initiative. On the other hand, the Social Restaurants which are places where food is transformed and accessed (the material dimension of food poverty) and places for socialization (the social dimension), albeit with different meanings. At present, in terms of geographical location, the Social Restaurants coincide with the Community Centers. The food collection and distribution system potentially affects the urban scale, with reference to the City of Turin (collection at CAAT, transport and distribution to various food outlets). However, the neighborhood scale is the most relevant in terms of beneficiary participation and access to food and socialization opportunities.

¹ The Food Reborn project is a joint project of the University of Turin (Department of Culture, Politics and Society, Department of Computer Science) and We.Co. Social Enterprise. It has been funded by the "Proof Of Value" Call of the University of Turin, and the European Digital Innovation Hub "PAI–Public Administration Intelligence".

4.2.2.3 Relationship with official markets

As currently figured out, the system does not require the conversion of tokens into fiat currency (Euro). However, such conversion may become necessary in specific circumstances—for instance, when certain services offered within the system require financial coverage. This coverage can be ensured through different mechanisms, corresponding to distinct models of economic and financial sustainability, e.g., through public funding, as in income support schemes such as shopping or social cards; through private donations or through revenue generated by the system's own commercial activities, such as subscriptions or sales. In a possible future extended model, local economic actors (e.g., neighborhood retailers) will be included in the system to expand the circuit within which tokens can be spent.

4.2.2.4 Token function

In the initial phase of the Food Reborn project, exchanges primarily involve food surpluses and meals prepared from recovered ingredients. In subsequent stages, these exchanges are expected to broaden to include additional goods and services produced within the local community. The system draws on principles from both the circular economy, emphasizing waste reduction and resource valorization, and the care economy, which highlights social participation, emotional wellbeing, and community cohesion. Within this framework, tokens function as mediators of value: they quantify the worth of recovered food, facilitate its redistribution in the form of meals for project beneficiaries, and thereby promote sustainable consumption, solidarity, and social inclusion, while discouraging waste and social isolation. Finally, with reference to the forms of economic integration defined by Polanyi, we can trace the interactions envisaged back to reciprocity (starting with the donation of food) and redistribution (the value generated by the recovered food is distributed, through tokens, to the beneficiaries).

4.2.3 Tokenized circuit of commerce

4.2.3.1 Decision making

The level of participation in the system's governance differs among actors. While transport units and social restaurants do not directly engage in decision-making, they play a crucial role in determining the quantity of community tokens issued, as this depends on their operational capacity and the average CAT price of recovered food. The managing entity, by contrast, holds the main decision-making authority, defining the project's objectives and strategies in a largely centralized governance model. Nonetheless, strategic partners such as the organizations that run the Collection Units and the Community Centers contribute to setting key guidelines and coordinating operations.

4.2.3.2 Incentives mechanisms

In an extended future model, additional non-financial incentives will be integrated into the system. Beneficiaries will be able to use community tokens not only to access meals but also a broader range of goods and services, either free of charge or at a reduced rate—such as fresh food for home preparation, discounted products from local retailers, and cultural or sporting activities offered at reduced prices. Providers of these goods and services will issue dedicated coupons, similar to those currently used for meal distribution. This mechanism expands the beneficiaries' possible choices and enhances the system's inclusiveness.

4.2.3.3 Structure of the mechanism

All the actors will hold a blockchain-based wallet for exchanging tokens, according to different roles: for instance, Community Centres and the Managers will be in charge of issuing and redistributing tokens, while the beneficiaries will be allowed to receive and transfer them. Tokens are expected to represent the value of the food while also, on one side, allowing to decouple the actions of collecting, transforming and consuming food, and on the other side serving as incentives to social encounter in socializing places. As part of the experimentation the project plans to adopt the CommonsHood application to implement the tokenized system. In a first experimental phase the cost of the digital platform will be managed by the University that developed the application. Subsequently, a financial sustainability plan will be implemented for the maintenance of the platform as a service.

4.2.3.4 Information flow model

With regard to information flows, digital mediation plays a crucial role. The platform is designed to facilitate and incentivize processes that address material poverty and promote physical and social encounters. It aims to enhance the visibility and accessibility of neighborhood spaces of social interaction, to encourage and streamline the efficient management of material food flows—thereby minimizing waste—and, secondarily, to improve logistical efficiency from an operational standpoint.

4.2.3.5 Resources

In the current implementation of the project, the value of the community token is underpinned by the economic value of the recovered food. In a future, extended model, the system aims to incorporate the value generated by local businesses and associations, which will be represented and circulated through dedicated tokens.

4.2.3.6 Earmarking

The boundaries of the system in its initial experimental phase involve interactions among wholesalers, food outlets, beneficiaries, and community venues. In a subsequent phase, the system is expected to expand to include additional economic actors—beyond food outlets—where tokens can be used (e.g., neighborhood retail stores) and where recovered food can be delivered (e.g., food processing companies). The fundamental transactions within this first phase are gifting (donation of unsold food) and access to services (free meals). The corresponding medium of exchange for these transactions has not yet been defined, representing one of the key areas of ongoing investigation in the development of the model.

4.2.4 Tokenized system

4.2.4.1 Monetary Architecture

The system will use ERC-20 fungible tokens to enable access to community services and resources. Specifically, *Coupons* represent specific benefits, such as discounts for local goods, free access to cultural or community events, or time-limited use of shared spaces. Once redeemed—particularly if returned to the issuer—coupons are considered consumed and cannot be reissued. The *community token* is an ERC-20 as well and functions as both a medium of exchange and a unit of account, acting as a monetary incentive and an enabler for

accessing services. Key design features include open transferability and a tokenomics model that is collectively determined by the community to align incentives and resource usage with local goals.

4.2.4.2 Mechanism of issuance of tokens

In this scenario, the wallet of the project manager creates and distributes tokens to beneficiaries, who are free to choose how to use it. Beneficiaries can view the businesses (restaurants, shops, etc.) where they can use their tokens to get coupons on the CommonsHood geolocated map. The *Exchange* feature shows the coupons that are available and exchangeable for currency. Once the exchange has been made, the coupon is transferred to the beneficiary, who can use it by going to the social restaurant and transferring it to its Wallet as proof of use. At this point, the social restaurant wallet burns the coupon received, completing the cycle and ensuring that the token cannot be reused.

4.2.4.3 Value capture mechanisms

The quantities of food delivered are recorded and converted into tokens, which are issued by the Community Center or Project Manager wallet. The equivalence criterion for determining the value of the food collected is as follows: $1 \text{ kg} * \text{average daily CAAT price} = \text{value in tokens}$. E.g., $100\text{kg} * 2.00 = 200 \text{ tokens}$.

At this stage of the research, certain technical and regulatory elements, including platform usage costs, legal status, and user identification mechanisms, have not yet been determined. These operational details will be specified during subsequent implementation phases.

Once all the necessary information has been collected, the tokenized system described and graphically represented below emerged.

In its simplest form, shown in [Figure 2](#) the tokenized system operates as a redistribution mechanism incorporating elements of exchange, where the token functions as both a unit of account and a medium of exchange for accessing services.

Recovered food is delivered to participating restaurants, and the quantities are recorded and converted into community tokens, issued by the Project Manager's wallet. The value of the collected food is calculated according to the following equivalence criterion mentioned in the token design step.

The Project Manager's wallet then redistributes tokens to beneficiaries' wallets, following redistribution criteria to be defined. The Social Restaurant issues coupons, representing the value of available meals. Beneficiaries use community tokens to obtain coupons, thereby reserving meals.

Meals can be consumed at designated community tables that foster social interaction, or alongside the general clientele. Once redeemed, coupons are burned, completing the transaction cycle.

Below are some possible extensions of the system, through which beneficiaries and other actors could use tokens for additional purposes.

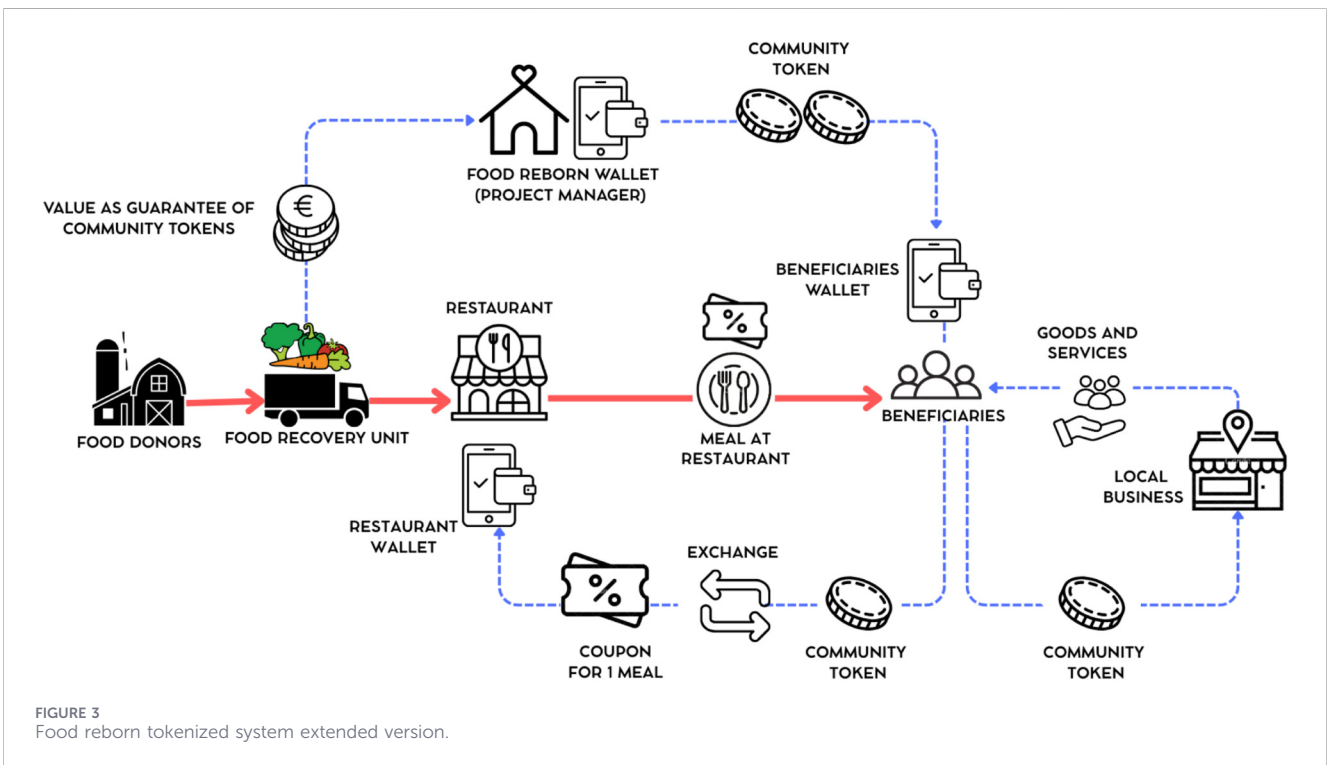
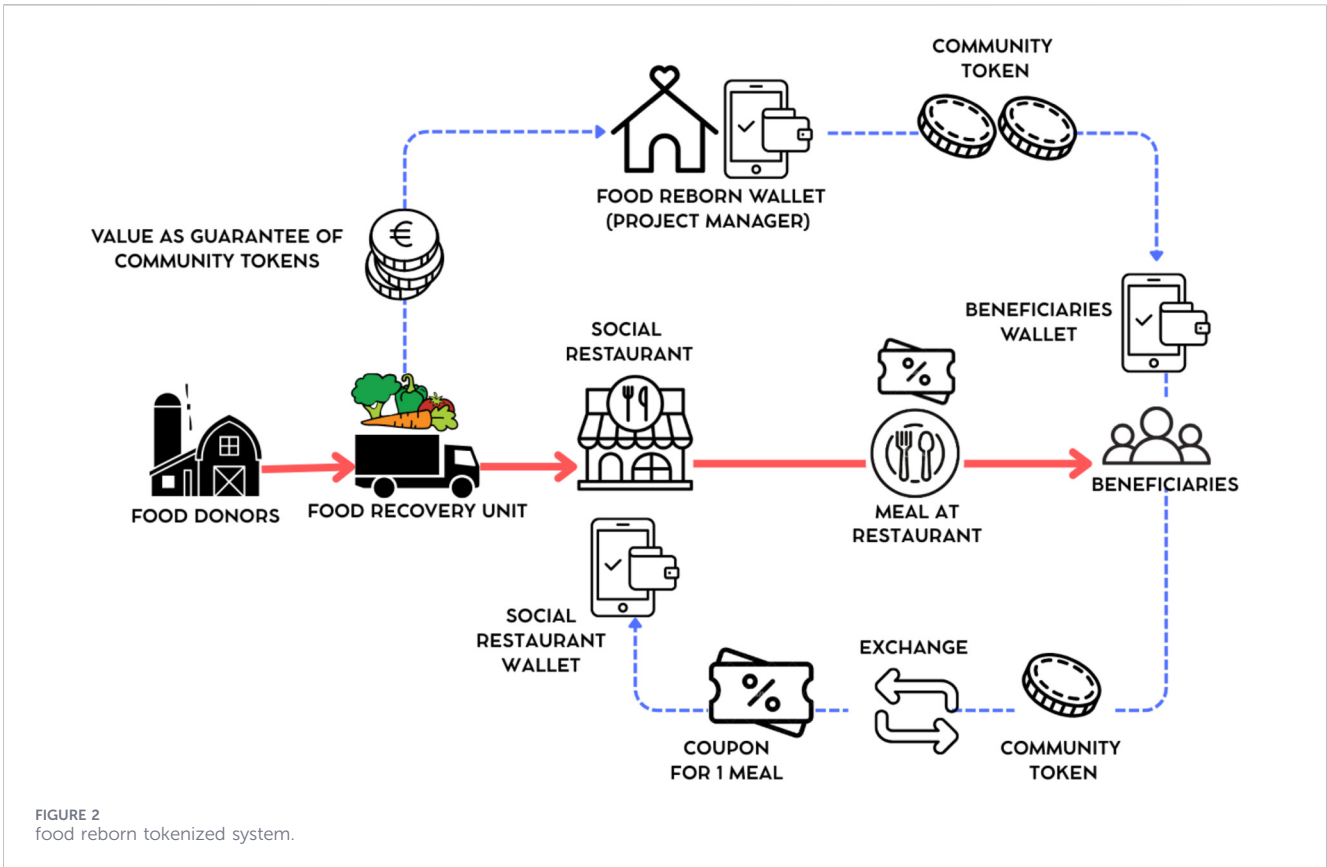
Beneficiaries may use community tokens not only to access meals but also to obtain other goods and services—either free of charge or at a reduced rate—such as fresh food for home preparation, discounted products from local retailers, or cultural and sporting activities offered at reduced prices. Providers of these goods or services would issue dedicated coupons, analogous to those used for meal distribution, thereby broadening the range of available options for beneficiaries.

Alternatively, community tokens and coupons could remain dedicated exclusively to the project's original purpose, namely, the provision of social meals. Access to other goods and services would then occur through other tokens representing incentive, distributed according to specific, *ad hoc* redistribution criteria distinct from those governing currency tokens. For instance, as shown in [Figure 3](#), incentive tokens could be earned through participation in activities of public or community interest.

Based on the outlined model, an initial analysis of the requirements for the CommonsHood wallet app was conducted. The following actors are expected to hold a wallet: the Project Manager (which issues token-currency), the community centers, the social restaurants (which issue token-coupons), and the beneficiaries. All wallet types potentially send and receive tokens, but different roles and privileges can be defined in terms of token transferability. The organizations' wallets and available coupons are visible on an integrated map. A dedicated functionality allows the exchange of community tokens for coupons. Regarding management and monitoring functions, additional functionalities are needed, which are not present in the CommonsHood platform but which should be integrated with it. Monitoring functions such as quantifying transformed surpluses and corresponding meals, and developing environmental and socioeconomic impact indicators, require direct integration with the blockchain infrastructure that manages token transactions.

4.3 Case discussion

This case study demonstrates how the method can support the elicitation of the core socio-spatial, governance, and economic aspects of a desired system, so that its value flows and the corresponding type and use tokens can be identified. This systematization of knowledge supported dialogue among the key actors involved in the feasibility study, including the authors of this paper, who acted as facilitators. Specifically, it supported the introduction of specialized concepts and logics related to tokenization to non-specialist actors. Within the Food Reborn project, the co-design process described in [Section 3.2](#) was applied in a simplified form, coherently with the preliminary nature of the project phase under consideration, namely, a feasibility study. Consequently, some of the co-design guiding questions could not yet be addressed in depth. Moreover, the detailed measurement of KPI is feasible when the method is applied to more advanced phases of project design than the current phase of Food Reborn. Conversely, highlighting the lack of available information on specific topics (e.g., legal aspects, digital platform maintenance plan) helped to systematically identify open issues to be addressed with adequate resources in subsequent project phases. This highlights, on the one hand, the flexibility of the co-design method which can be applied iteratively across different phases of project design and planning. On the other hand, it is worth noting that the full application of the four phases method is time demanding, and requires substantial work in terms of content elicitation and systematization by the process facilitators. With regard to the Food Reborn scenario, the following open issues have emerged. Future phases of system design should strengthen their participatory character, by more directly involving local actors who will actually be the wallet holders: particularly, beneficiary groups and the managers of the social restaurants and community centers. This is essential for a thorough identification of the types and uses of incentives and tokens, as well as of priorities in



terms of social goals that will guide the criteria for the (re)distribution of tokens to beneficiaries. A related aspects that requires further discussion concerns the degree of decentralization of governance

and territorial organization of the system. For instance, the circuit of commerce could be implemented either at the neighbourhood or at the city level, with different implications for the range of opportunities

available to beneficiaries in terms of token use. Finally, operational assumptions regarding the supporting digital infrastructure were formulated by planning, in the short term, to adopt and adapt the existing CommonsHood wallet (see 1) as part of new research projects. In the longer term, a sustainability plan for the maintenance of the digital platform by the Food Reborn community still needs to be defined.

5 Conclusion

The research presented in this article aimed at studying tokenized systems applied to participatory processes and social and collaborative economies at the local level, by identifying relevant theoretical framework and developing sound methodologies and tools for co-designing such tokenized systems. Economic sociology, monetary theories and their applications in the field of community and complementary currencies allow us to account for the socially-embedded and relational nature of money, and therefore of tokens. Similarly, geographical accounts of digital platforms as sociotechnical artifacts, that are co-constituted with society and space, allow us to account for the socially-embedded and political nature of digital tools and therefore of blockchain-based wallets. Based on this recursive logic between social values, money and digital tokens we presented a multi-dimensional analytical and operational framework that can be used both for analyzing existing initiatives of blockchain for local communities, and for designing new ones, by addressing their governance, geographical, digital, economic and monetary aspects. Based on this framework, we developed a co-design method that integrates existing approaches to tokens engineering with a sociological perspective. This method is aimed at guiding researchers through identifying the overall goals and values of a tokenized social economy and progressively defining its socioeconomic system, its tokenized system, and its actual tokens. We reported and discussed the application of this co-design method in the initial phase of a project that aims at introducing a social token in an experimental initiative around the contrast to food waste and food poverty. The originality of our contribution lies in bridging studies in the social sciences with consolidated works in the fields of tokenomics and token designing and engineering, thus widening the scope of the latter to local collaborative economies and civic technologies. Indeed, we claim that accounting for the contextual and relational nature of money and of digital platforms is necessary for tokenized systems to be socially and economically sustainable, and to generate social values.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary Material](#), further inquiries can be directed to the corresponding author.

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The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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