Tokenomics in Civic Blockchain: Implementing Community and SoulBound Tokens in a Game-Theoretical Framework for Collaborative Economies

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Abstract

This paper introduces a novel framework designed for the modelling and analysis of tokenomics within civic blockchain environments, aimed at enhancing collaborative economies. As digital platforms and blockchain technologies continue to disrupt traditional economic models, the need to understand and optimize the mechanisms of collaboration and value exchange within decentralized communities is becoming increasingly pressing. Our framework addresses this gap by integrating concepts from tokenomics, game theory, and community governance. Utilizing a game-theoretic approach, our framework establishes a solid foundation for understanding and guiding the complex interactions between participants, ensuring that the system remains balanced, sustainable, and aligned with the collective goals of the community. Central to our framework are two distinct types of tokens that govern the economic interactions within the community: a community token (CVT) and SoulBound tokens (SBT). CVT operates as a medium of exchange and a measure of value within the collaborative ecosystem, enabling and incentivizing participation and contribution. In contrast, SBT tokens serve a critical role in representing and verifying the membership and identity of participants within the community. These non-transferable tokens are pivotal in fostering a sense of belonging and trust among members, which are essential elements in the success of collaborative economies. By implementing this dual-token system, our framework provides a robust mechanism for governing decentralized local communities and facilitating collaborative economic activities.

Keywords

Blockchain, ERC20, ERC721, SoulBound Tokens, Local Communities

1. Introduction

Distributed ledger technologies (DLTs) have raised new questions about the relationship between the domains of computer science, games, and economics [1] in the study of interactions between participants in a network and the mutual benefits gained from such interactions. Of particular interest is the fact that DLTs have enabled processes of tokenization to emerge. Tokenization can be described as the conversion of value into a digital form or, more precisely, the establishment of a self-regulating (token) economic system governed by rules programmed by the token designer [2]. Tokenomics is a discipline that refers to the study and design of self-sustaining economic systems optimised through token incentives [3]. In this context, the tokens are intended to incentivise a particular behaviour within the network with the aim of aligning the interests of participants towards a common goal without involving intermediaries.

Another topic related to DLTs has emerged recently: the application of blockchain technology for social good. Of particular interest to our research is the category of civic blockchain. By civic blockchain, we mean a particular field of application of this technology, within the broader field of *blockchain for social good*, which is characterised by the co-production of public services to meet societal needs [4, 5]. More specifically, civic applications refer to the design and creation of systems that support processes

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of civic participation and alternative processes of value circulation within communities and local economies. Core elements of civic applications of blockchain are the co-design and accessibility of this technology at a local community level [6].

The intersection of blockchain technology with community engagement presents an innovative approach to fostering participation, decision-making, and trust within local ecosystems. This paper introduces the Community Value Token (CVT), an ERC20 token, tailored to enhance community engagement through a unique integration with SoulBound Tokens (SBTs).

2. Our contribution and motivation

The concept of civic blockchain is relatively recent, and, to the best of our knowledge, there is still no systematisation available of the literature relating to its applications. While use cases show how blockchain technology is also being used in the field of social good to implement community tokens, there are no unambiguous or systematised references related to models for the design and implementation of collaborative-economy-oriented tokenization processes in the context of local communities. Our research aims to investigate this gap and the contribution we intend to propose consists of three main elements.

The first element concerns the proposal of a framework that describes the context and objectives of the system we intend to take into analysis. In this regard, we decided to consider the collaborative economies as reference to describe the exchange system, (see Section 3), as it best represents the dynamics of resource sharing from the nonprofit and mutualistic perspective that we wish to consider. Indeed, the exchanges envisaged by this model cannot be attributed to market, profit or financial logic. Specifically, the types of exchange considered are: access to products or services without the need to own the underlying assets, reallocation of goods and exchange of intangible assets [7].

Within a local community, these processes may manifest as the management of shared spaces, redistribution of products from urban gardens, lending systems for everyday items (such as libraries of things), and skill exchanges.

In this context, the economic aspect of tokenization operates as a dynamic system that facilitates exchange and interaction among its members. Therefore, a token can be described as a community token, indicating a socio-economic unit of value used to facilitate interactions in terms of exchange and distribution of rewards as provided by the incentive system.

Indeed, this highlights the critical significance of modeling interactions among participants within the collaborative economy: the second aspect of this proposal focuses on exploring game theory as a tool for analyzing the strategic behaviors of the community members. Specifically, game theory is applied to the token economy rather than the blockchain infrastructure itself. While blockchain provides the foundational layer for secure and transparent transactions, the broader design considerations of tokenized systems extends beyond the blockchain technology itself: it involves the design of comprehensive frameworks that encompass tokenomics, governance structures and user incentives. This study aims to address a research gap by providing models that facilitate the design of tokenized systems tailored for collaborative economies within local community contexts.

The third central element of the research is the implementation, through the development of community tokens, incentive mechanisms and governance mechanisms. In this paper, we will address the preliminary phase of the implementation, starting with a detailed description of the Community Token and the SoulBound Token. The design choice to implement the community token brings us close to the concept of local currency, and some examples of using blockchain in this way can be found in projects such as Circles [8], Sarafu Network [9] and TrustLine [10]. While the integration of SoulBound Tokens is a strategic decision aimed at supporting the integrity and functionality of the community ecosystem.

This paper will first establish the framework within which our research will unfold. Subsequently, we will proceed to address the following research questions:

RQ1 Can game theory serve as a tool to support collaborative practices and shape the framework of a digital collaborative economy? This inquiry seeks to formalize strategic behaviors, considering the dynamics and community context in which they occur.

RQ2 Can community tokens be developed to foster participatory and collaborative dynamics? This research question delves into the mechanisms and attributes through which a token can act as a driver for non-profit and mutualistic principles, supporting collaborative economies and facilitating resource-sharing systems.

To illustrate the applicability of our proposed scenario, we introduce a use case that embodies all the outlined principles, demonstrating a collaborative sharing economy scenario driven by non-profit objectives.

3. Related Work

3.1. Collaborative economies

The field of collaborative economies encompasses a wide variety of different economic models and sectors and, for this reason, it is difficult to give an unique definition [11]. However, some elements can serve to categorise these platforms, such as whether they are for profit or non-profit, whether the interactions are business to consumer (b2c) or peer-to-peer (p2p), and whether the services offered can be regarded as professional or non-professional [11, 12]. The term collaborative economy is often associated with terms such as sharing economy, gig economy, platform economy, to name a few [13]. Part of this phenomenon has resulted in the commodification of social relations and the proliferation of extractive digital platforms [14]. We intend to distance ourselves from this type of outcome. Instead, for our research, we consider those models of collaborative economies that are oriented towards non-profit and peer-to-peer transactions. These models can be defined as new socioeconomic models [15]. They allow the redistribution of resources according to the logic of mutuality, which refers to the possibility of having access to resources without implying transfer of ownership [16, 17]. Blockchain technology can play a crucial role in these processes, accelerating the spread of collaborative practices [17]. In addition to offering the ability to implement automated and secure transactions, it has the potential to redefine exchange practices in a decentralised way [18].

3.2. Game Theory Applied to Blockchain Systems

Game theory has been and continues to be used to address different kinds of problems concerning blockchain. The general purpose of using game theory as an analytical tool is to analyze miners' behaviors to predict and evaluate their participation in maintaining of the system. The main areas of application identified in [19] and [20] are:

- security: selfish mining attacks and denial-of-service (DoS) attacks.
- mining management: individual mining (computational power allocation, fork chain selection and block size setting) and pool mining (pool selection and reward allocation).
- applications on top of the blockchain: cryptocurrency economic trading (for setting transaction transparency and determining the cryptocurrency value), and energy trading.

Liu et al. [19] also identify which game-theoretic approaches are most used to analyse interactions within the blockchain network. They include non-cooperative, extensive-form, Stackelberg and stochastic games.

3.3. Blockchain for Social Good

Blockchain for Social Good is a broad field. Here, we focus our attention on applications for social economies and civic participation [6], and we divide these into two categories: tools for community empowerment, and tools for social economies and financial inclusion.

The first category includes tools that allow members of a specific community to create from scratch what they need for a particular purpose, from tokens to a decentralised autonomous organisation (DAO) [21]. In this regard, we shall mention the *community toolkit platforms* of Waves [22], Coinsence [23] and CommonsHood [24], which offer innovative toolsets for the development and operation of Web 3.0 applications. Also of relevance are *platforms for creating community/complementary currencies* like Celo [25].

The second category consists of non-customisable ready-made tools for free use in a community. *Community and complementary currencies* include Sarafu [9], ImpactMarket [26], TrustLines [10], and Circles UBI [8]. In addition to constituting an exchange system, these projects enable the creation of microcredit systems to facilitate financial inclusion. Another set of applications are those that involve *purpose-driven tokens* with the purposes being, for instance, caring for the environment or the common good (Plastic Bank [27] and Empower [28]) and recognising civic participation (Colu [29]).

4. Description of the framework

In order to answer to the research questions, we establish a framework to better shape the setup we address. We move inside a local community that we consider like in Definition 4.1.

Definition 4.1. (Local Community) A *local community* is a finite set $\mathcal{L}_c = \{m_1, \ldots, m_N\}$ where N is its size and m_i for $i \in \{1, \ldots, N\}$ are its *members*, locally confined in a geographical bounded area of diameter Δ.

The local community is considered here as a closed self-sustained system, where members exchange goods or services and perform transactions that serve as the building blocks of a cohesive and collaborative community. Members can be people or associations (managed by groups of citizens according to governance rules).

4.1. The local community as a closed system

In the context of our analysis, the local community operates as a closed system, distinguished by its defined boundaries and specific criteria for participation and interaction within it. This system's closure is facilitated by the strategic issuance and management of Soul-Bound Tokens (SBTs), explained in details in Section 7.1, which serve as both a mechanism for membership verification and a means to cultivate and maintain the system's integrity.

The benefits of such a closed system are multifaceted. Primarily, it ensures a high degree of trust and security among participants, as the entry and participation within the community are regulated through the allocation of SBTs. This controlled environment allows for more targeted and efficient resource distribution, as well as the alignment of goals and values among members, thereby enhancing cooperative efforts and mutual support. Furthermore, the notion of closure in this context does not equate to exclusivity or lack of inclusiveness. Instead, it establishes a framework wherein inclusion is predicated on shared commitments and contributions to the community's objectives, rather than arbitrary or superficial criteria. This approach allows for a more purposeful and cohesive community fabric, where members are united by common purpose and collective action.

The use of SBTs is pivotal in fostering this closure, acting not just as a gatekeeper but also as a facilitator of engagement and participation within the community. A closed system, built on the strategic use of SBTs, promotes a secure, cooperative, and goal-oriented environment that values and rewards meaningful participation and contribution.

Another motivation to consider the local community as a closed system is that there are several services and activities that tend to function more effectively within closed communities compared to open ones, primarily due to the enhanced control, trust, and shared values that closed communities can offer. Closed communities can facilitate more efficient and equitable resource sharing (like tool libraries, car-sharing, or communal spaces) since there's a higher level of trust and accountability among members.

Initiatives that require collaboration and collective effort, such as community gardens, local energy projects, or cooperative businesses, can benefit from the closed community model. The alignment of interests and the ability to coordinate closely with a known group of participants can lead to more successful and sustainable outcomes. Also, some financial activities that rely on trust and mutual benefit, such as peer-to-peer lending, community-supported agriculture (CSAs) [30], or local currencies, often operate more successfully within the framework of a closed community. The shared commitment to the community's economic well-being can lead to more responsible and community-oriented financial behaviors.

Closed communities, by fostering a high level of trust, shared values, and mutual accountability, create an environment where these services and activities can flourish. This model leverages the strength of close-knit connections to enhance participation, efficiency, and outcomes in various endeavors.

4.2. The community *local starter*

In the structure of the local community under discussion, a pivotal role is played by what is referred to as a *local starter*. The local initiator of the community is typically an association formed by individuals who share common values and are united by a unique social objective, serving as the foundation for the community's establishment and growth. This entity acts as the cornerstone for the community's origin, embarking on a mission to fortify the local economy and improve the well-being of its members through innovative ideas or projects. The mechanism of action employed involves the minting and distribution of SBTs. As it will be explain later in Section 7.1 these tokens serve as a testament to membership and participation rights within the community. The starter association manages the distribution of SBT tokens to individual users and other associative bodies, effectively creating a network of stakeholders engaged in the community's development and well-being.

4.2.1. Benefits

Governance and autonomy. The fact that an entire local community can be initiated by a small association emphasizes self-organization, autonomy, and the power of collective action without centralized authority. A local starter enables the community to establish its own governance structures, rules, and objectives based on collective interests and values. This approach highlights the potential for self-organization, emphasizes the strength of collective action, and underscores the capacity of individuals to manage their affairs effectively without reliance on central authority. This means not only empowers communities but also contributes to the broader discourse on decentralization, autonomy, and the transformative potential of grassroots initiatives.

Resilience. Community-led initiatives can be more agile and adaptable to changing circumstances or needs. Without the bureaucratic constraints typical of standard institutions, communities can quickly pivot strategies, experiment with innovative solutions, and implement changes more efficiently. A local starter is inherently more aware of the specific needs, challenges, and aspirations of the community it serves. This focus leads to the development of tailored programs and initiatives that directly address the interests of community members, rather than the one-size-fits-all approaches often deployed by larger institutions.

Participation and sense of community. By organizing independently, community members can ensure direct representation in decision-making processes. This participatory model strengthens the sense of sharing within the community, as all members have the opportunity to voice their opinions, vote on initiatives, and contribute to governance. These strengthened relationships are the foundation for mutual support and collaboration [31].

Empowerment of community members. Organizing independently encourages the efficient sharing of resources and knowledge within the community. Members can pool assets, expertise, and labor to achieve common goals, leading to a more sustainable and self-sufficient community. The experience of self-organization enhances the capacities of community members. Skills in leadership, negotiation, project management, and democratic participation are developed and honed, equipping individuals for

active civic engagement and leadership roles. Freed from the constraints and risk-aversion typical of larger institutions, communities can become hotbeds of innovation

4.2.2. Potential drawbacks and solutions

However, it is crucial for the starter association to operate transparently and inclusively to avoid centralization of power and to mitigate potential issues like censorship. Implementing democratic processes, where possible, for decision-making and the distribution of SBTs can help in making the system more equitable and preventing misuse of power. Additionally, setting up checks and balances, such as oversight committees or the possibility for community review and appeals, can further ensure that the association's actions are in the best interest of the community as a whole.

In order to mitigate the problem of centralization of power within the community, it is possible to implement a system where SBT holders have the authority to distribute SBTs to new members. This approach encourages a more distributed governance model and has several advantages for fostering a participatory community structure. Moreover, when members have a say in who receives SBTs, they are likely to feel more invested in the community's growth and governance. This increased sense of ownership can lead to higher levels of engagement and participation in community activities and decision-making. In order for this solution to be effective in mitigating centralization and ensuring a healthy, thriving community, certain safeguards and guidelines should be established. These might include criteria or guidelines for new members, transparency in the distribution process, and mechanisms for dispute resolution or revocation of SBTs in cases of misconduct.

4.3. Why is blockchain useful in this context

Blockchain technology offers several unique advantages as it addresses limitations found in current currency systems and provides innovative solutions for secure, transparent, and decentralized transactions.

Blockchain eliminates the need for a central authority or intermediary. It allows for spontaneous activities to create and grow by themselves, always respecting the laws of the place, without the need for bureaucratic central approvals. Its nature also breaks down barriers to access for unbanked populations. Blockchain's transparency reduces the risk of censorship, fraud, and downtime ensuring trust among users.

Moreover, tokens on the blockchain can be programmed with smart contracts, which automatically execute transactions when predefined conditions are met. This allows for the creation of complex economic and governance systems within communities that can run by themselves.

Token technology also enables the creation of new economic models and community governance models together with incentive structures that reward contributors directly without intermediaries.

5. Game Theory as Enabler of Cooperation

As stated in Section 2, we regard game theory as an analytical tool to assess and facilitate interactions among members within the exchange system.

Game theory offers a collection of mathematical tools designed to examine how rational decision-makers interact. In the traditional framework of game theory each decision-maker chooses a strategy with the goal of maximizing their utility, taking into account the strategies chosen by others. Following the definition given by [19] some key terms are outlined below:

- Player: Refers to a decision-maker within the game. In our case, players are the members $\{m_i\}_{i=1}^{N}$ of the local community (See definition 4.1).
- Utility: A utility, whether it's expressed as a payoff, interest, or revenue, represents the expected outcomes for the player. If we name $\mathcal{O}$ the set of all possible outcomes of the game played, the utility is a function $\mathcal{U} : \mathcal{O} \longrightarrow \mathbb{R}$.

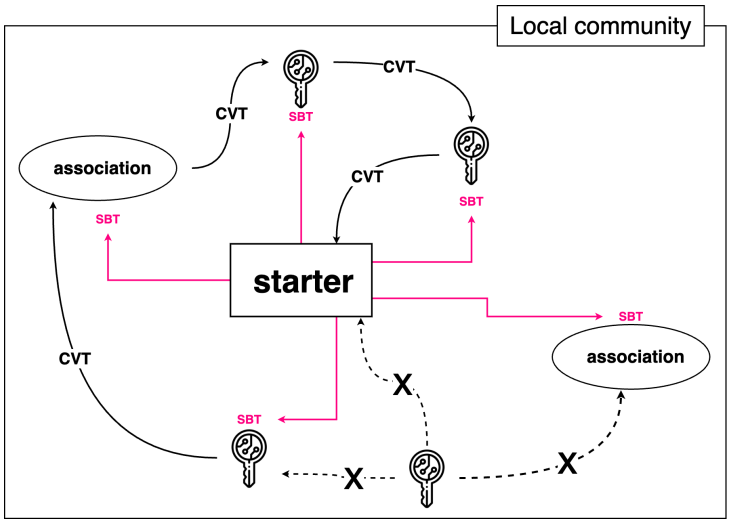

Figure 1: The figure depicts a local community that originates from a *starter association*, which serves as the foundational originator of the community. This association initiates the process by minting and distributing SBT tokens to other associations and individual users. Individual users are here represented as keys. Only those possessing SBTs are eligible to engage in exchanges involving the community token, CVT, amongst themselves. Consequently, users and associations without an SBT cannot participate in economic interactions within this framework

- Strategy: A player's strategy encompasses a range of actions, choices, or decisions that they can undertake to reach their outcome. Typically, a player's utility is influenced not only by their own strategy but also by the strategies adopted by other players. For this reason, the set of all the possible strategies is the product of all the players' ones, $\mathcal{S} = S_1 \times \cdots \times S_N$, and the stretegy function goes from them to the outcomes set: $f : \mathcal{S} \longrightarrow \mathcal{O}$
- Rationality: A player is deemed rational when their strategy is oriented towards self-interest, aiming to maximize their payoff.

In this interdisciplinary field, this version of non-cooperative game theory [32] stands out for its integration of traditional game theory with cognitive, economic, and social sciences, providing insight into real-world decision-making processes. [1] Given the local community context, we propose adopting the mentioned non-cooperative game theory as an analytical tool for designing the reward mechanism of a use case such the one described in the following section. This approach addresses the epistemic nature of coordination problems, considering players' knowledge about each other's states of mind crucial for effective coordination. Within a specific community, players interpret established norms and institutions collectively, fostering a shared understanding known as community-based salience [33][34]. This is driven by community-based reasoning, where players perceive themselves as part of the same community, anticipating uniform behavior patterns among members. This underscores the relevance of the community's value system, guiding individuals towards common expectations and facilitating tacit agreement among players [35]. In our research, we prioritize shared values over institutional affiliations, emphasizing collaboration and resource sharing within communities.

This perspective is useful for designing tokenomics to align strategic behaviors with community goals rather than self-interest. Unlike traditional game theory which equates payoffs with utility, our scenario draws a distinction between payoffs and utility functions as a result to the inclusion of human interactions in informal settings beyond mere rational strategies. This ensures that payoffs remain consistent across strategic behaviors, while utility functions are higher for individuals aligned with shared goals of mutualistic sharing and logic. The proposal suggests a theoretical framework to offer

[1] For a comprehensive and detailed exposition of the mentioned version of non-cooperative game theory, we refer to Larrouy, Lauren. *On coordination in non-cooperative game theory: Explaining how and why an equilibrium occurs and prevails.* Springer Nature, 2023. pp. 283-322.

guidance and analytical tools for designing a token economy tailored to the collaborative sharing model. As such, the focus is on analyzing and providing a preliminary description of the requirements necessary for system design, while the implementation of the system is planned as future work.

6. Use Case

A possible use case could be a collaborative sharing economy scenario, aimed at enabling resource sharing and based on nonprofit and mutualistic logics.

6.1. Exchanges

Specifically, the types of exchange considered [7] are: access to products or services without the need to own the underlying assets, reallocation of goods, and exchange of intangible assets. In a local community, these processes can take the form of: management of shared spaces and commons, redistribution of products from urban gardens, lending systems for everyday objects (libraries of things), and exchange of skills. Sharing can occur in two ways: simple borrowing or renting. In the simple borrowing scenario, users reserve and utilize objects or services without the need to lock tokens as collateral or make any pre-payment. Renting takes place when an object is borrowed and, for the duration of the borrowing period, a specified amount of tokens is locked to ensure a level of security for the renter. The tokens are then transferred to the lender as a rental fee.

6.2. Roles

In the case considered there are two kind of roles, that are both Players following the game-theory point of view of Section 5.

Organizations: namely local non-profit associations or social institutions, they are expected to lend but not borrow items or services. They have multiple financial roles. They can mint new CVTs to inject into the economy or burn existing CVTs to contract the monetary supply, thereby managing the community's liquidity and value stability. Otherwise, they can decide not to manage tokens and simply use the tokens in circulation at that moment. Additionally, they can hold a reserve of CVTs garnered through crowdfunding efforts, which can be used to finance community projects or to incentivise participation by distributing token rewards to community members.

Participants: upon joining the community, participants receive a SoulBound token granting them access to community participation and related activities. Within this framework, participants can make resources available, borrow or rent resources, and receive rewards corresponding to their actions. In our scenario, interactions between participants are governed by modified game theory rules, as explained in the next section. The modifications are related principally to the addition of other behaviors beyond those that are purely rational in order to better represent real-life community dynamics where people are more likely to reciprocate trust.

6.3. Strategic Behaviors

In our scenario, participant interactions are regulated by game theory principles, as discussed in Section 5. Behaviors shape the set of the possible strategies $\mathcal{S}$ members can undertake into the community. This perspective involves the addition of other behaviors beyond those that are purely rational in order to better represent real-life community dynamics where trust and reciprocity are prevalent. To operationalize this approach, we introduce behavioral groups, drawing inspiration from the framework developed by J. Poncela-Casasnovas et al. [1]. These groups include virtuous, rational, malicious, and random individuals. Virtuous individuals prioritize the welfare of others. Rational individuals follow classic game theory behavior, seeking the most advantageous outcomes, among all the possible ones

represented by the set $\mathcal{O}$, for themselves. Malicious individuals aim to disrupt the system, regardless of personal benefit. Random individuals act unpredictably, often changing their stance. The distinct outcomes associated with each behavioral group are caught through corresponding utility functions $\mathcal{U}$. In particular, when the output of the function $\mathcal{U}$ establishes that the exchange is worthwhile, the exchange occurs. This perspective influences the design of a token economy suitable for this type of context applications. Specifically, our approach assumes that the majority of participants belong to the virtuous group, shaping incentive mechanisms and rewards based on the utility function associated with virtuous behavior. These principles come under the concept of community-based reasoning. The community-based reasoning allows to frame the scope of interactions to the values and objectives shared by the community, limiting the games players engage in with each other and greatly facilitating coordination efforts.

6.4. Token

This scenario involves two tokens: the CVT and the SoulBound token. Further details regarding these tokens will be provided in 7.1. The system operates on an inflationary model and adopts a demand-driven issuance approach, providing flexibility to adjust to changes in demand and supply. The system is built on incentive mechanisms. These incentives are distributed via token exchanges serving as either rewards for positive behavior or a representation of value. All transactions in this system are conducted using the same CVT type, this is classified as a work token designed to reward users for particular actions or behaviors that support the system's goals.

7. Community Value Token (CVT)

This section delineates the conceptual underpinnings of the Community Value Token (CVT), the nature and utility of SoulBound Tokens (SBTs), and the rationale behind their integration to create a cohesive and secure community ecosystem. By intertwining the technical robustness of ERC20 tokens with the personalized, non-transferable nature of SBTs, we create a model that can be adapted for various community-driven initiatives seeking to benefit from blockchain's transparency and security.

At its core, the CVT is designed as a digital asset to facilitate and reward participation within a local community. Unlike traditional cryptocurrencies or tokens that focus on financial transactions, CVT's primary aim is to serve as a medium of engagement, empowerment, and recognition within a specific community setting. CVTs can be used to access community events, participate in decision-making processes, and receive incentives for contributions to the community. The versatility of the CVT stems from its ability to encapsulate both the tangible and intangible values that community members bring to the collective ecosystem.

7.1. SoulBound Tokens

In 2022 P. Ohlhaver, E. G. Weyl et al. define the concept of Decentralized Society whose principal element are SoulBound tokens (SBTs) [36]. SoulBound tokens represent a novel class of digital assets characterized by their non-transferability and their role as attestations of identity, affiliation, or accomplishment. SBTs are designed to be permanently associated with an individual's digital identity. In the context of the CVT ecosystem, SBTs are used to attest to an individual's membership in the local community. These tokens serve as digital credentials, verifying a member's eligibility to participate in community activities, access specific benefits, and engage in governance processes.

The integration of SoulBound tokens with the Community Value Token framework is a strategic decision aimed at enhancing the integrity, inclusivity, and functionality of community engagement. This integration addresses the following key objectives.

SBTs provide a secure and immutable method for verifying the identity and membership status of community members. This verification process is crucial for ensuring that only eligible members participate in certain community activities, thereby fostering a trust-based environment. By issuing an

SBT to members, we create a verifiable and tamper-proof record of their involvement and contributions. Since SBTs represent a permanent record of membership and contributions, they can encourage long-term engagement and investment in the community. Knowing that their efforts and achievements will be recognized indefinitely can motivate members to maintain an active, ongoing role in the community. The non-transferable nature of SBTs enhances the security and trustworthiness of transactions within the community.

SBTs can foster a stronger sense of belonging and community by visibly tying members' identities to their contributions and participation. This can encourage a more vibrant, active community ecosystem where members feel valued and integral to the community's success.

By using CVTs in tandem with SBTs, the system can effectively incentivize participation and contribution to the community. CVTs can be awarded for active involvement, and because SBTs attest to membership, the distribution of rewards can be targeted and meaningful, reinforcing positive behaviors and contributions.

The CVT and SBT framework facilitates a decentralized governance model, where community members holding specific SBTs are empowered to vote on community matters, propose initiatives, and participate in decision-making processes. This model promotes transparency, accountability, and collective decision-making, aligning with the principles of decentralization inherent to blockchain technology.

SBTs can also facilitate synergies with other communities and ecosystems. Members with SBTs could potentially access events, services, or benefits across different communities that recognize the value and significance of these tokens, fostering a broader network of collaboration and mutual support.

7.2. CVT

Our Community Value Token (CVT) is based on the popular ERC20 standard, with a significant modification: it incorporates checks for SBT ownership to control transactions. Before any CVT transfer, the contract verifies that both the sender and receiver possess a valid SBT, confirming their membership in the community. This mechanism aligns with our goal to strengthen community bonds and ensure that benefits circulate within a verified network of members.

7.3. The exchange of CVTs inside the community

The SBT tokens are instrumental in facilitating the exchange of CVT (Community Value Token), a specialized token designed to operate as the community's currency. This exchange mechanism is exclusive; only holders of SBT tokens are granted the privilege to trade CVTs, thereby ensuring a closed and secure economic environment that fosters mutual growth and support. The exclusivity of CVT transactions underscores a crucial principle within the community - economic interactions are reserved for those who contribute and share in the collective identity and aims of the community.

However, this system also delineates a clear boundary: individuals or associations outside the SBT framework find themselves unable to engage in the community's economic exchanges. This policy is not merely regulatory but serves a dual purpose of encouraging participation in the community's foundational activities and ensuring that the benefits of the community's economic system are preserved for its contributors. Importantly, the term 'individual users' within this community does not solely refer to distinct physical persons but encompasses the possibility for individuals to create and manage multiple identities. This flexibility allows for a dynamic and versatile participation landscape, where the multifaceted aspects of an individual's contributions and engagements can be recognized and rewarded in a nuanced manner.

Thus, the model presented not only fosters a sense of belonging and mutual support among its members but also erects a structured approach to community economic interaction. By requiring membership and participation through the acquisition of SBTs for economic engagement, the community effectively promotes a sustainable and self-reinforcing economic environment, aiming for long-term prosperity and cohesion.

This extended description provides a more comprehensive understanding of the mechanisms at play within the community, emphasizing the importance of the starter association, the role of SBT tokens in defining membership and participation, and the exclusive economic interactions enabled by such a system.

7.4. Actual implementation

This works focuses on the creation of two distinct types of tokens that can be deployed in any EVM compatible blockchain: the Community Value Token (CVT) and the SoulBound Token (SBT). This implementation underscores a pioneering approach towards embedding community engagement and exclusivity within digital assets through smart contract functionalities.

The CVT, derived from the ERC20 token standard, incorporates enhancements for permit capabilities. On the other side, the SoulBound Token, developed under the ERC721 standard for non-fungible tokens, is characterized by its non-transferable nature post-minting. The contract stipulates that SBTs cannot be transferred once issued, cementing them as a permanent, non-transferable attribute of the initial recipient's wallet.

We extended the ERC20 design to introduce a unique prerequisite for transfers: individuals must possess at least one SoulBound Token (SBT) to engage in CVT transactions. This condition enforces a layer of community membership verification, as SBTs act as a gatekeeper, ensuring that only verified members can transact with CVTs. Such a mechanism embeds a sense of community value and exclusivity by linking the transferability of CVTs to the ownership of SBTs, fostering a controlled ecosystem where token circulation is confined within a predefined community.

The use of the SoulBound emphasizes the token's role as a digital marker of community membership or achievement, unchangeable and locked to the owner. For this first stage of implementation, minting of SBTs is exclusively managed by the contract's owner, permitting a regulated distribution method that can align with specific membership criteria or qualifications, thus ensuring a controlled expansion of the community. For further improvements the minting process is meant to be managed by all the community members through a governance process.

Moreover, the SoulBound Token contract overrides the `_beforeTokenTransfer` method of the ERC721 standard to enforce its non-transferability, ensuring that any attempt to transfer an SBT, whether from or to any address post-minting, is categorically prohibited. This strict enforcement guarantees the token's permanence as a badge of identity or affiliation within the community it represents.

Inside the implementation of the SBT token, we have embedded the possibility of inserting a manifesto of the community, that can encapsulate the values that define and shape its essence.

The conjunction of CVT and SBT implementations builds a dual-token ecosystem that integrates transferability with non-transferability and open participation with exclusivity. By coupling the wide applicability and liquidity of ERC20 tokens with the fixed identity and membership representation of ERC721 tokens, this approach unveils a multifaceted application of blockchain technology that fosters a secure, community-centric economy.

The code that implements the two contracts is available on this GitHub page [37].

7.5. Interfacing with the community

CVTs and SBTs are issued by a primary association that spontaneously forms within the local community. This association is responsible for the initial distribution of SBTs to members, signifying their official inclusion in the community. The issuance process involves a careful selection procedure to ensure that new members align with the community's values and objectives, since once a member receives an SBT, they are considered eligible to participate in the community's decision-making processes, access specific benefits, and engage with the broader ecosystem of services and activities facilitated by the CVT.

In further stages of the implementation, every person owning an SBT has the right to participate in decisions regarding the community and the CVT system itself. This inclusive model empowers

members to have a say in critical aspects of community governance, including but not limited to, the acceptance of new members (counting other associations).

The decision regarding which members or associations to accept into the community is a collective one, made by existing SBT holders. Proposals for new members can be performed using their SBTs for voting. This mechanism ensures that the community grows in a manner that is consistent with its foundational values and objectives, fostering a cohesive and supportive environment.

8. Conclusion and future works

The objective of this proposal was to explore the utilization of blockchain and the token economy to bolster a collaborative economy within a local community. Various theoretical frameworks from diverse disciplines were considered to provide a comprehensive understanding of the requirements for designing and implementing a tokenized system tailored to collaborative and community-driven dynamics. The implementation of SBT allows supporting the game theory approach oriented to community-based reasoning, as it defines community membership and the sharing of the value horizon and rules of participation in the system, which are stated explicitly in the manifesto contained in the SBT and accepted by participants when they enter the community. In this way, it allows defining a set of strategic behaviors oriented to coordination and collaboration. This is relevant in order to proceed in the design of the tokenized system, both in terms of the development of incentive and governance mechanisms and the design of the creation and circulation of the tokens themselves in the exchange system.

Therefore future works involve the development of an incentive system, based on the utility functions identified through the proposed game theory approach and the implementation of a system of governance that allows all the participants to decide on the minting and distribution of SBTs. Since one of the aim of the present research is to develop increasingly accessible tools for empowerment and financial inclusion in local communities, the interface between community members and the CVT and SBT systems is designed to be user-friendly and accessible, ensuring that all members, regardless of their technical expertise, can engage with the system effectively. This interaction is facilitated through web interfaces and digital wallets, which serve as the primary channels for members to manage their tokens, participate in community decisions, and access community services.

The web interface acts as a gateway for community members to interact with the CVT and SBT ecosystem. Upon accessing the platform, users are prompted to connect their digital wallets, which are essential for storing their tokens securely. These wallets not only hold CVTs, which can be used for transactions within the community, but also store SBTs, which attest to their membership and eligibility to participate in community activities. Decision-making processes are conducted through the web interface, where SBT holders can vote on proposals, submit new initiatives, and engage in discussions about the community's future direction. The web interface ensures that these activities are conducted transparently, with the results being recorded on the blockchain for immutability and accountability.

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