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## EDITED BY

Qin Wang,  
Commonwealth Scientific and Industrial  
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## REVIEWED BY

John Anthony Rose,  
Ritsumeikan Asia Pacific University, Japan  
Raul Zambrano,  
Independent Researcher, New York,  
United States

## \*CORRESPONDENCE

Michael Lustenberger,  
✉ michael.lustenberger@zhaw.ch

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# DAO as digital governance tool for collaborative housing

Michael Lustenberger<sup>1\*</sup>, Sabrina Wollenschläger<sup>1</sup> and  
Lukas Küng<sup>1,2</sup>

<sup>1</sup>Institute for Organizational Viability, School of Management and Law, ZHAW Zurich University of Applied Sciences, Winterthur, Switzerland, <sup>2</sup>Institute for the Future, School of Business, University of Nicosia, Nicosia, Cyprus

This paper explores the promise of decentralized autonomous organizations (DAOs) as a digital governance tool for collaborative housing initiatives. Based on existing literature around the collaborative housing initiative no1s1, we explore the research question: How can DAOs help govern collaborative housing initiatives? To address this, we employ conceptual research methods, synthesizing theories from the field of collaborative housing and DAOs to propose a new framework for the governance of such initiatives. Our analysis identifies five key benefits of DAOs in collaborative housing governance: a transparent crypto-accounting system, scalable decision-making, global jurisdiction and rule enforcement, automated rights and incentives system, and flexible polycentric governance. These benefits align with Elinor Ostrom's "Governing the Commons" principles and highlight the potential of DAOs to enable scalability and autonomy in geographically dispersed communities. While theoretical, our study provides insights into the transformative potential of blockchain-based DAOs in collaborative housing governance, laying the groundwork for further research and real-world and empirical validation.

## KEYWORDS

collaborative housing, decentralized autonomous organization, blockchain, governance, commons, common-pool resource

## 1 Introduction

In 2018, the Swiss think tank "Dezentrum" introduced *no1s1* (no one's one) as a futuristic concept of a self-owned and self-managed house.<sup>1</sup> They declared it a "future experiment" (Zukunftsexperiment) to explore new approaches in dealing with collective goods made possible by technologies such as blockchain. While most empirical experiments explore causal connections in the context of social reality, future experiments ask about social possibilities. In this way, future experiments should not only think about the future but also consider the practical implications. Over the years, initial prototypes of no1s1 have been developed at ETH Zurich (Hunhevicz et al., 2021; Hunhevicz, 2022), focusing on the feasibility of the technical architecture of a blockchain-based autonomous space.

Since then, similar initiatives have been established to merge the concepts of collaborative housing (CH) and blockchain technology. Interesting examples are *CityDAO*, where a community collectively owns a piece of land in the United States and can vote on its use, and *DOMA*, a blockchain-based housing platform with an

1 <https://dezentrum.ch/case-studies/no1s1> [accessed 09.05.2024].

organizational structure jointly owned and run by its members (Crandall, 2023). Further similar projects include *Cabin*<sup>2</sup> and *Build*<sup>3</sup>, both of which seek to build a community that uses blockchain to manage living spaces such as land and/or houses. No1s1 is, therefore, no longer an isolated phenomenon but rather the expression of a new form of collaboration around communal owning and living based on blockchain technology—a technology with the promise of organizing collaboration in a new way that differs from traditional governance models (Davidson et al., 2018; Lumineau et al., 2021). However, most of these initiatives struggle to create a sustainable governance model (e.g., CityDAO), and many have already become inactive (e.g., DOMA).

In recent years, scholars have increasingly recognized that communal owning and living can effectively address the changing housing needs of society (Vestbro, 2010; Labit, 2015; Tummers, 2015; Czischke, 2018; Czischke et al., 2020; Lang et al., 2020). An aging population and the diversification of household compositions are cited as reasons for the growing demand for adaptable housing models, concepts, and infrastructures to accommodate different living situations. Even though conceptualization presents a challenge as there is no consistent terminology across housing sectors and academic disciplines, scholars commonly use *collaborative housing* (CH) as an umbrella term encompassing the broad range of housing forms, including cooperatives, co-housing communities, and community land trusts, all of which are characterized by their self-organizing features (Vestbro, 2010; Fromm, 2012; Czischke, 2018).

Literature and concepts relating to blockchain in collaborative housing are very scarce. One of the few with a specific focus on the impact of blockchain on the collaborative housing market, Nasarre-Aznar (2018) concludes in his aprioristic analysis that blockchain has the potential to facilitate access to housing by reducing costs, time, and the influence of intermediaries. However, the author falls short of explaining how collective action in collaborative housing activities such as shared financing, construction, housing, or ownership can be implemented and governed by a blockchain. Additionally, some studies analyze how blockchain could affect the traditional housing activities of financing (Mohamed, 2021; Proskurovska and Dörry, 2022; Utkarsh et al., 2022), construction (Wang et al., 2017; Hunhevicz and Hall, 2020; Li et al., 2021), and renting (Qi-Long et al., 2019; Wang et al., 2022). However, these studies cannot provide further insights into governance models and tools for collective action in collaborative housing initiatives. Furthermore, the literature has frequently underscored the need for applicable governance models and tools to support community housing projects and communities (Moore, 2011; Tummers, 2016; Fitzpatrick, 2018; Lang et al., 2020).

By conceptually considering the implications of applying a decentralized autonomous organization for governance to collaborative housing initiatives such as no1s1, we aim to answer the following research question:

RQ: How can decentralized autonomous organizations help govern collaborative housing initiatives?

To address this question, we outline the research design applied in this conceptual study in Section 2. Section 3 then develops the theoretical concepts around collaborative housing and DAOs individually, while Section 4 presents the synthesized theoretical concept of DAOs governing collaborative housing initiatives. Section 5 discusses and interprets the idea, after which Section 6 concludes by answering the research question and offering suggestions for further research.

## 2 Research design

The research design for this study refers to the conceptual methods put forward by Meredith (1993) and Jaakkola (2020). Both authors suggest that conceptual research methods can create valid theories by synthesizing previous research. Gilson and Goldberg (2015) further argue that rather than relying on empirical data, conceptual studies should seek to expand the scope of our thinking by integrating and linking existing theories in interesting new ways. This is supported by Weick's (1989) claim that conceptual research is mainly about designing, conducting, and interpreting *imaginary experiments*.

Meredith (1993) proposes seven different types of conceptual methods, mainly focusing on research output—i.e., models, frameworks, or theories—and less on the practical process of achieving these results. This may not be surprising since, as Fulmer (2012) explained (based on a review of award-winning articles from the Academy of Management), there is no one best way to structure a conceptual paper. Nevertheless, to establish a methodological structure for our research process, we will follow explanations by Meredith (1993) and Jaakkola (2020).

Attempting to synthesize various works on the same subject, we employ the three steps from inductive *philosophical conceptualization* by Meredith (1993): (i) summarizing common elements of different works, (ii) contrasting their differences, and (iii) expanding the current conceptual knowledge. In turn, we take up the suggestion from Jaakkola (2020), p. 21 regarding theory synthesis that “seeks to achieve conceptual integration across multiple theories or literature streams.” To better understand how DAOs can contribute to the governance of collaborative housing initiatives at a conceptual level, we synthesize the previously unconnected domains of DAOs and collaborative housing, presenting them as complementary research domains in a novel way.

In line with the terminology and methodological explanation by Jaakkola (2020), *our focal phenomenon is no1s1 – a collaborative housing DAO*. Jaakkola (2020) highlights that such a focal phenomenon is observable but not adequately addressed empirically in the existing literature. To address the observed shortcomings at the intersection of DAOs and collaborative housing, we will combine the two research domains and provide new insights into the focal phenomenon.

In developing our conceptual arguments, we specifically ensure that the line of argument is coherent and transparent to the reader. As shown in Figure 1 and in line with Meredith (1992) and Jaakkola (2020), we first summarize the literature regarding DAOs and

2 <https://cabin.city/> [accessed 15.03.2024].

3 <https://www.buildcities.network/> [accessed 15.03.2024].

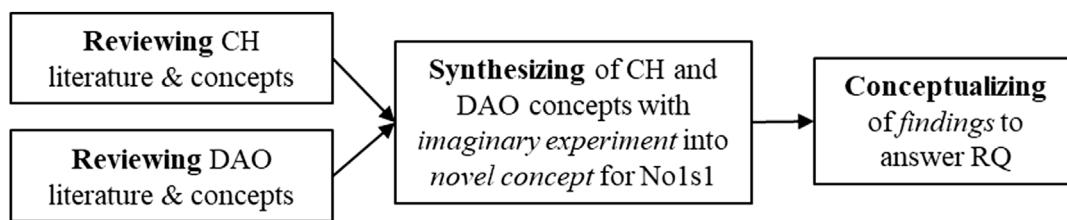


FIGURE 1  
Sequence of activities within the conceptual research design.

collaborative housing that can address some aspects of the *focal phenomenon of no1s1 – a collaborative housing DAO*. In the second step, we synthesize these previous concepts with the help of an *imaginary experiment* (Weick, 1989) into a novel concept for our focal phenomenon, no1s1. Finally, we conceptualize our findings from the imaginary experiment to provide an answer to our research question about how DAOs can help govern collaborative housing initiatives.

### 3 Review of theoretical concepts

#### 3.1 Governing commons as a model for the governance of collaborative housing

Collaborative housing (CH) initiatives aim to address systemic inequalities that lead to housing instability and exclusion by questioning the traditional view of housing as a commodity and advocating for its recognition as a basic human need (Tummers, 2016). An examination of CH literature reveals a diverse and multi-faceted field of housing research, as highlighted by Lang et al. (2020), who analyzed 190 studies published between 1990 and 2017. They found that distinctions between different CH models were more blurred and intertwined than previously thought, and specific contextual factors strongly influenced some significant overlaps and differences.

Researchers such as Durrett and McCamant (2011), Cooper (2000), and Williams (2005) focus on the architectural and design elements of community housing, while scholars such as Vestbro and Horelli (2012), Jarvis (2015), Brenton (2013), and Labit (2015) examine the social dimensions of CH. In addition, Bossuyt (2021) and Aalbers (2008) address the property rights and financialization of CH, illustrating the broad range of topics within CH research. While it is beyond the scope of this paper to explain each individual form of CH, it is valuable to provide a brief overview of the various models explored in research to demonstrate the broad spectrum of research underscoring the multi-faceted nature of CH.

In Fromm (1991), Lang et al. (2019), and Vestbro (2010), we find models such as co-housing, cooperatives, and self-build initiatives, which are characterized by promoting a balanced integration of private and communal living spaces to improve the quality of community life. In addition, Aernouts and Ryckewaert (2019) and Czischke et al. (2020) draw attention to the diversity in how affordability, collective decision-making, and community control

are addressed within co-housing and cooperative housing models. With a unique look at promoting affordable housing, community ownership, and collective control, Diacon et al. (2005) put forward the model of community land trusts (CLTs), while Balmer and Gerber (2018) highlight the role of housing cooperatives. In addition, Williams (2005) examines housing communities seeking to promote a communal lifestyle and interdependence between residents in terms of density, design, and location. Other scholars, such as Ferreri and Vidal (2022), explore theoretical frameworks tailored to specific CH concepts and develop a framework for public cooperatives. However, as noted by Czischke et al. (2020), challenges arise when trying to generalize these context-specific models owing to the different tenure, legal, and organizational characteristics of CH projects.

Ultimately, Lang et al. (2020) conclude that the literature about these models is scattered across various disciplines, resulting in a lack of a cohesive conceptual and methodological framework. This fragmentation contributes to a disjointed academic landscape surrounding collaborative housing. As a result, it is difficult to create a generally applicable theoretical framework because individual communities rely on individualized governance solutions based on their needs and circumstances.

One way of structuring the concepts of collaborative housing would be to place them in the broader context of known economic theories. A good example of such an attempt is Fitzpatrick (2018), who analyzed the concept of CH<sup>4</sup> from the perspective of the economic theories governing the commons put forward by Hardin (1968) and later especially by Ostrom (1990). The author notes that CH shares important similarities with common-pool resources (CPR), particularly the subtractability of the resource and the difficulty of excluding non-contributors, so it poses similar challenges to governance and collective action. However, as Ostrom and Hess (2007) point out, it is crucial to distinguish between common-pool resources and common property regimes, as the former refers to the economic characteristics of a resource—where use by one person reduces availability for others, and exclusion is problematic—while the latter describes a governance arrangement in which a defined group has collective control over a resource. Furthermore, common property should not be confused

4 Fitzpatrick (2018) uses the term “mutual housing” in his dissertation, but basically this has the same meaning as collaborative housing.

with open-access regimes, where no exclusion mechanisms exist, often leading to overuse and degradation.

In contrast, common property regimes involve structured governance by a defined community to regulate access and prevent resource depletion. In later research, [Ostrom \(2010\)](#) emphasizes how the successful governance of common-pool resources often involves active participation from local user communities. She found this localized approach could be effectively scaled by applying polycentric frameworks—systems with multiple independent decision-making centers rather than a single centralized authority. Building on Ostrom's eight design principles of stable CPR management<sup>5</sup> and her later polycentric concepts, [Fitzpatrick \(2018\)](#) proposes a theoretical framework based on a set of key principles for designing and crafting governance models for collaborative housing. With the help of this framework, he examines different CH initiatives to explore how the projects overcome challenges like finding land, financing the project, and developing unique internal management structures. However, the study does not explain how these proposed principles could be implemented nor how they can help design governance for collaborative housing initiatives to make management more stable and efficient.

## 3.2 DAO as a tool for governing the commons

The idea of DAOs was brought into public and academic discussions in 2013 by [Larimer \(2013\)](#) and [Buterin \(2013\)](#). Since then, several DAOs have emerged, and many scholars have tried to establish a standard definition. [Buterin \(2014\)](#), for example, calls DAOs “an entity that lives on the internet and exists autonomously, but also heavily relies on hiring individuals to perform certain tasks that the automation itself cannot do.” Ho, [Hassan and De Filippi \(2021\)](#), p.2) define DAO as “a blockchain-based system that enables people to coordinate and govern themselves mediated by a set of self-executing rules deployed on a public blockchain, and whose governance is decentralized (i.e., independent from central control).” [Spychiger et al. \(2025\)](#) further emphasize that DAOs typically manage some sort of asset that holds value to the community. While these while these assets are traditionally manifested as virtual cryptocurrency, more recently, DAOs have also been established to provide services (e.g., currency exchanges, project financing), curate collections (e.g., art collections based on NFTs), or own and manage physical assets (e.g., real estate).

Early research examined the impact of the influence of blockchain on economic theories, mainly by exploring whether DAOs could be an alternative governance institution to markets, hierarchies, and relational contracts in the sense of [Williamson's \(1985\)](#) new institutional economics (e.g., [Catalini and Gans, 2020](#);

[Davidson et al., 2016](#); [Lumineau et al., 2021](#)). [Davidson et al. \(2018\)](#), p. 654 describe a DAO as “a self-governing organisation with the coordination properties of a market, the governance properties of a commons and the constitutional, legal and monetary properties of a nation state.” [Catalini and Gans \(2020\)](#) and [Lumineau et al. \(2021\)](#) further argue that with blockchain technology, costs for transactions like searching, networking, monitoring, verification, and enforcement can be reduced.

Despite their transformative potential, DAOs face significant governance challenges ([Lustenberger et al., 2024a](#)), whereas centralization remains a critical issue, as decision-making control is often concentrated among a few influential actors centralization remains a critical issue because decision-making and control are often concentrated among a few players ([Axelsen et al., 2022](#)). At the same time, voting power is disproportionately weighted in favor of wealthier participants, leading to a system that more closely resembles a plutocracy rather than a democracy ([Feichtinger et al., 2023](#)). Low participation rates further exacerbate these issues, with only a tiny fraction of token holders actively engaging in decision-making processes ([Rikken et al., 2023](#)). Additionally, DAOs are vulnerable to governance attacks, as demonstrated by incidents such as the Beanstalk and Tornado Cash breaches ([Spychiger et al., 2025](#)). To overcome these obstacles, DAOs require more sophisticated designs that balance decentralization, efficiency, and security while fostering mechanisms that encourage active participation and equitable decision-making ([Lustenberger et al., 2024b](#)). In spite of these challenges, DAO governance represents a paradigm shift in organizational structures, offering a new governance model independent of central control and potential benefits to digital self-organization ([Bellavitis et al., 2023](#)). For this reason, a growing body of literature has emerged analyzing whether blockchain-enabled, self-organized structures have the potential to support the management of CPRs.

An initial attempt to explore how DAOs could support the principles designed by Ostrom dates to [Calcaterra \(2018\)](#), who outlined the first design principles for a blockchain-enabled governance system for CPRs. In a second attempt to explore the possibilities of using blockchain technology for the governance of CPRs, [Cila et al. \(2020\)](#) critically explore the design challenges and limitations of the technology. Here, the authors argue that while blockchain technology has the potential to enhance CPR governance by providing transparency, the open and immutable data records also raise concerns regarding privacy and the potential for over-reliance on quantified values. In this sense, [Cila et al. \(2020\)](#) recognize the possibilities provided by blockchain-based systems to empower communities to manage CPRs. However, they are wary of uncritically designing technological solutions with far-reaching social consequences.

At the same time, [Poux et al. \(2020\)](#) published a conceptual paper analyzing blockchain technology as support for the governance of CPRs. In it, they especially emphasize the aspect of community regulation through blockchain, which follows a novel approach involving proactive automation and retrospective verification rather than the conventional methods of monitoring and sanctioning. Without empirical data, they conclude that further research is needed to define the most promising use cases and implement solution strategies. In this sense, [Rozas et al. \(2021a\)](#); [Rozas et al. \(2021b\)](#) explore the potential of blockchain technology

<sup>5</sup> The eight principles ([Ostrom, 1990](#)) are: clearly defined boundaries, congruence between appropriation and provision rules and local conditions, collective-choice arrangements, monitoring, graduated sanctions, conflict-resolution mechanisms, minimal recognition of rights to organize, and nested enterprises.



as an administration layer for CPRs. Indeed, their work sheds light on the complex and multi-faceted relationship between blockchain and CPR governance and has been highly influential in the remaining discussion involving blockchain and commons. Their study establishes six specific affordances and aims to provide a foundation for developing blockchain-based tools that align with the CPR management principles. Nevertheless, exactly how these six affordances – (i) tokenization, (ii) self-enforcement and formalization of rules, (iii) autonomous automatization, (iv) decentralization of power over the infrastructure, (v) increasing transparency, and (vi) codification of trust—can be implemented remains unclear and unanswered.

Hunhevicz et al. (2022) offer a systematic starting point for the practical scenario of how the blockchain can support governance, in their study involving a construction project involving multiple parties. Here, they synthesize the literature on blockchain as an institutional innovation (Davidson et al., 2018) with a theoretical understanding of integrated project delivery (IPD) and the collective action theory (Ostrom, 1990) with respect to the six affordances in designing blockchain governance (Rozas et al., 2021a). As such, their paper suggests new construction project delivery models and provides a comprehensive understanding of the possibilities for blockchain, specifically in the application in IPD and other future forms of project delivery, as well as the challenges of governance design in the construction industry.

Drawing on Rozas et al. (2021a) and adding an extensive literature review, Van Vulpen and Jansen (2023) seek to close the research gap by describing a *common DAO* and its use in a conceptual playground scenario. The authors argue that there is no clear understanding of how a DAO for CPR governance should be designed. Hence, they create a conceptual prototype of a DAO governing a simple CPR and provide several requirements concerning governance areas that a DAO needs to fulfill, to enable collective action and unite a community in a shared goal. Although Van Vulpen and Jansen (2023) provide an extensive governance structure for their *common DAO*, they avoid defining what kind of resources and communities can benefit from the blockchain-based governance using a DAO and leave their framework's applicability open. Furthermore, scaling a *common DAO* with decentralized decision-making up to a global digital organization appears unlikely.

Building on the principles of polycentric governance and the dynamic interaction between local and global opinion formation and decision-making (Ostrom, 2010), the creators of DAOstack developed a scalable voting mechanism for DAOs called *holographic consensus*. This system allows decisions to be made locally with limited participation as long as the decisions align with the organization's global viewpoint (Field, 2018; Field and Weller, 2019). This approach supports scalability in decentralized governance systems, enabling decisions to be made efficiently even as the number of participants grows. Additionally, it enables the formation of local sub-DAOs, allowing individual communities to make decisions that affect them directly while still adhering to the global consensus. This structure enhances decision-making scalability by enabling decentralized governance across both local and global levels. Moreover, implementing Layer-2 solutions and off-chain voting mechanisms can optimize scalability by reducing on-chain transaction costs and improving transaction speed (Zhao et al., 2022). In summary, this rich

academic discussion highlights the possibility of a DAO that offers new ways to create governance structures, including global CPRs. However, where and how these types of blockchain-based governance structures can be utilized is still an open question requiring further investigation (Tan et al., 2023).

## 4 Synthesizing CH and DAO concepts: a novel governance concept for No1s1

Our collaborative housing DAO, no1s1, was initially motivated by the technological possibilities of blockchain and established around the idea of a blockchain-powered, self-managed house, autonomously determining its usage via smart contracts. Unlike other DAOs, which are mainly built for decentralized finance experiments managing digital assets, no1s1 emphasizes the physical space, making it the focal point of participation and involvement. Building on the characteristics of a DAO, no1s1 can therefore establish and sustain an alternative model for self-organized living spaces.

While the real-world no1s1 initiative currently functions as a small-scale experimental space rather than a fully-fledged housing model (Spychiger et al., 2024), this conceptual research expands its scope to a decentralized collaborative housing DAO managing multiple housing units across different locations. This imaginary experiment assumes that no1s1 evolves into a global network of DAO-governed houses collectively maintained by its members. In doing so, we consider the governance challenges that arise when managing not just a single experimental space but an interconnected system of housing units, each requiring a range of services such as maintenance, security, and resource management.

To guide our imaginary experiment, we synthesized different concepts from the CH and DAO literature to develop a novel governance concept for no1s1 as follows. First, we adapted the key principles from Fitzpatrick's (2018) framework, integrating insights from the DAO literature to establish a robust and efficient governance structure for collaborative housing. By applying recognized DAO concepts to the initial design principles of collaborative housing, we derived eight key design principles for governing a collaborative housing DAO, as illustrated in Figure 2.

Second, we applied these eight key concepts to our imaginary experiment of no1s1 as a globally coordinated and operated collaborative housing initiative organized as a DAO. The no1s1 community collectively owns and manages a network of houses around the globe, prioritizing the generation of shared benefits and reinvesting any profits back into no1s1's houses. At its inception, people across the world donated the first few houses to the DAO, thereby granting them membership in the DAO community. Thereafter, members were encouraged to use and contribute to the upkeep of the houses through a blockchain-based incentive system. They had a voice in the future of the DAO and the houses but were also held accountable for their actions within the community.

In summary, no1s1 relies on a combination of pre-programmed rules and blockchain-based community voting to govern itself, and ultimately, the viability of no1s1 depends on the continued member participation and use of the houses.

CH Principle	Description
Defined Boundaries & Responsibilities	The community is clear about who has the right to live in and use the living space and who is responsible for its upkeep.
Proportional Costs	The costs of using and maintaining the living space are proportionally shared according to the benefits that the user derive from it.
Inclusive & Adaptive Decision Making	Everyone impacted by a decision has a voice in the process and rules can adapt to needs of the community.
Shared Knowledge & Responsibility	Members share skills and information to improve living conditions and monitor compliance with housing use rules.
Gradual Accountability	Anyone who violates the rules must expect consequences that are imposed by the community and that are gradual to the seriousness of their actions.
Community Conflict Resolution	Members should have access to affordable and easy-to-use conflict resolution processes.
Autonomous Governance	Local authorities recognize the self-governance of the collective housing community.
Global Coordination	Local collective housing groups, part of larger communities, follow subsidiarity governance, delegating authority to the lowest possible level.

FIGURE 2  
Eight key design principles for governing a collaborative housing DAO based on Fitzpatrick (2018).

Figure 3 below presents the application of the CPR-management design principles for the governance of a collaborative housing DAO from Figure 2 to our imaginary no1s1 experiment. Here, we describe each principle in more detail.

## 4.1 Defined boundaries and responsibilities

During the initiation of no1s1, members must implement a system that merges traditional social norms with blockchain technology to manage their collaborative housing initiative. Accordingly, the community establishes a social contract that describes the criteria that must be met to join (or leave) the DAO and defines the rights and obligations of members (Van Vulpen and Jansen, 2023). To implement this social contract in the blockchain-based governance system, no1s1 utilizes a token-based access and incentive system (Rozas et al., 2021a). This restricts access to any DAO activity to authorized individuals who hold a specific token in their crypto wallet. Members must comply with predefined criteria to gain these governance tokens, such as “donating” a house to no1s1. Over time, further specific tokens can be introduced to the token model and issued by no1s1 for

renting and using the houses, performing maintenance duties, or supporting the decision-making and conflict-resolution process to incentivize (new) members to participate, interact, and use the DAO and its houses. Smart contracts on the blockchain can automatically distribute and verify these tokens, granting access to approved token holders and unlock specific benefits connected to no1s1 (Hunhevicz et al., 2022). Hence, utilizing tokens at different levels, which describes the entry model of no1s1 and is linked to the requirements of the house usage and the voting, establishes the basis for an effective incentive system.

## 4.2 Proportional costs

The No1s1's economic models revolves around affordable housing within a globally distributed network of properties. To ensure fairness, all costs related to this network must be proportional and linked to the usage benefits (Fitzpatrick, 2018). A DAO can best achieve this by introducing a “utility” token to use the house (Hunhevicz et al., 2022). Hence, to rent any of the houses, community members need to buy utility tokens from no1s1, whereby the revenue directly flows into the no1s1 treasury, a

CH Principle	Implementation by No1s1
Defined Boundaries & Responsibilities	Tokens grant access to No1s1, while also being able to incentivize members to partake in the duties, ensuring No1s1s' viability.
Proportional Costs	Community members of No1s1 purchase tokens for rent, with revenue flowing directly into a treasury for maintenance activities, while dynamically adjusting costs to demand and supply.
Inclusive & Adaptive Decision Making	No1s1 fosters active participation in decision-making by forming sub-DAOs around houses and local communities, allowing members to adapt rules to fit needs and housing conditions.
Shared Knowledge & Responsibility	A communication platform serving as a central hub for community management, enabling members to address problems, suggest ideas, discuss rules, and share information, is essential to No1s1.
Gradual Accountability	Addressing accountability challenges in DAOs, No1s1 implements a proof of identity tied to physical houses, coupled with gradual sanctions for rule violations programmed into smart contracts.
Community Conflict Resolution	No1s1 implements a community court system with communication channels for problem reporting, and elected members determining penalties based on accountability and executed via smart contracts.
Autonomous Governance	No1s1's self-management reflects their desire for control over their shared living environment, though serious conflicts will require recognition and support from authorities for long-term success.
Global Coordination	No1s1 facilitates efficient decision-making by combining local control with global coordination, empowering local groups while leveraging collective opinions for the shared governance.

FIGURE 3  
Eight key design principles for governing a collective housing DAO as implemented in no1s1.

community-controlled “bank account” dedicated to the maintenance and upkeep of all the houses. A fund could also be kept for each house separately, ensuring each house is an independent sub-DAO of the global no1s1 community. Depending on the maintenance costs and demand for a specific house, the rental cost (and, therefore, the number of utility tokens) for a given period can be dynamic and vary from house to house. In this way, the DAO automatically links the rental cost of a property to both maintenance costs and its perceived value by users.

### 4.3 Inclusive and adaptive decision-making

A fundamental commitment to inclusive decision-making characterizes the operational framework of no1s1. However, this does not mean everyone has the same voting rights (Spychiger et al., 2025). Depending on the roles and responsibilities the different tokens represent, no1s1 members can participate in decision-making processes at various levels. For example, members who have donated a house to no1s1 in exchange for “governance tokens”

have other decision rights than members renting, utilizing, or maintaining the houses and the DAO. Governance tokens are exclusively earned through house donations and cannot be bought on the market, mitigating the risk of hostile takeovers commonly observed in token-based DAOs. Over time, governance participation can also be earned through reputation, ensuring that decision-making authority is based on community contributions rather than financial muscle. Governance tokens remain non-transferable and can only be obtained through beneficial community actions such as donations or active participation, thus preventing a concentration of power based on wealth and ensuring a more equitable governance structure. The key here is that all DAO members affected by a decision can actively participate in the decision-making process (Ostrom, 1990). In this sense, forming sub-DAOs around each house, based on local communities would be beneficial. Beyond this inclusive structure, members can also adapt the rules and role of the group to the evolving needs of the community as well as to the environment and conditions of the housing and other shared resources. The decentralized architecture of blockchain technology facilitates

such adaptable, self-managed, and community-driven decision-making (Spychiger et al., 2025).

## 4.4 Shared knowledge and responsibility

Within no1s1, there is a need for some form of communication platform that acts as a central hub for all aspects of community management (Beck et al., 2018). DAO members can address problems, make suggestions, discuss rules, share information, and even resolve conflicts, thereby promoting transparency and shared knowledge within the community. To encourage active participation, no1s1 offers rewards in the form of tokens for valuable contributions such as sharing knowledge, monitoring the rules, supporting the development of proposals, and participating in decisions (Zhao et al., 2022). Communication is facilitated globally and locally, with separate channels for discussion and potential decision-making based on holographic consensus, allowing members to focus on specific local topics (Field, 2018). The platform forgoes a reputation system to prevent centralization and ensure equal participation. However, as outlined in the previous section, a reputation-based voting system could be introduced to ensure that decision-making power is based on active participation rather than financial wealth, fostering a more equitable governance structure and avoiding the centralization of power. Additionally, to incentivize greater responsibility within the community, increased voting rights for active members might be considered beneficial, possibly alongside delegated roles with specific responsibilities based on trust or reputation within the community.

## 4.5 Gradual accountability

Accountability in no1s1 can be challenging due to the anonymity and distributed nature of DAOs. Nevertheless, the physical part of no1s1, in the form of real estate, also provides the possibility to implement a variation of “proof-of-personhood” as in the case of specific cryptocurrencies (Borge et al., 2017). This requires members to obtain verified proof of identity before being granted access to the DAO. This mechanism of proof-of-personhood might also be limited to local sub-DAOs, enabling the no1s1 community to use its blockchain-based infrastructure to resolve anonymity issues. Additionally, graduated sanctions for rule violations—from warnings, access restrictions, and withdrawal of tokens to complete exclusion from the DAO—can be programmed into smart contracts, allowing for automated enforcement (Rozas et al., 2021b). This creates a transparent, tamper-proof, graduated accountability system with sanctions appropriate to the offense.

## 4.6 Community conflict resolution

A key element of no1s1 is a transparent monitoring and sanction system that allows conflicts to be resolved rapidly. Therefore, a form of community court system with clear communication channels for members to report problems would be required. Monitoring could be carried out with the help of sensor technology and through the

active involvement of members using digital tools such as mobile apps. At the local sub-DAO level, with just a few members, each person could be part of the conflict resolution court. In contrast, at the global level, the no1s1 community would have to delegate conflict resolution to specially elected members. This conflict resolution court would determine penalties (fines, penalties, exclusion, etc.) based on progressive accountability and trigger execution via smart contracts. However, it is still the community that continuously develops the rules and defines the accountability measures.

## 4.7 Autonomous governance

The emphasis on autonomous governance and self-management through technological capabilities reflects the no1s1 community's desire for self-determination and control over shared living space. The legal status of DAOs is currently unclear, which has even led to blockchain-based systems being labeled “alegal” because they operate outside the law so are neither legal nor illegal (De Filippi et al., 2022). Even if DAOs can develop their own “alegal” framework based on smart contracts and without local regulations, no1s1 would still need access to the local legal system in case of serious conflicts within its community. Therefore, recognition and support of the no1s1 autonomous governance model by local authorities and government agencies is undoubtedly a key factor in successful operation and long-term viability.

## 4.8 Global coordination

A network of collectively managed houses worldwide can only function with local control and global coordination. In the case of no1s1, each sub-DAO could manage its own property (or geographically neighboring properties) through elected representatives within the subgroups. This keeps decision-making efficient and avoids information overload, as all members only need to be involved in key decisions (Zhao et al., 2022). These sub-DAO representatives could then be entitled to vote on specific issues in a global no1s1 governing body. Alternatively, all members of no1s1 could elect a separate body to deal with overarching global problems. In this way, blockchain technology can efficiently implement and facilitate these elections and voting processes. This bottom-up approach empowers local groups while enabling them to leverage the collective knowledge and resources of the network through elected representatives and shared governance structures.

# 5 Conceptualization of DAO as a governance tool

In this paper, we have developed a globally run collaborative housing initiative based on the new concept of decentralized autonomous organizations for governing CPRs (Cila et al., 2020; Rozas et al., 2021a; 2021b; Van Vulpen and Jansen, 2023). In the previous section, we outlined how DAOs could serve as digital governance tools for global collaborative housing initiatives and how



CH Principle	Key benefits of DAOs for collaborative housing				
	Transparent Crypto-Accounting System	Scalable Decision-Making Mechanism	Global Jurisdiction & Rule Enforcement Mechanism	Automated Rights & Incentives System	Flexible Polycentric Governance System
Defined Boundaries & Responsibilities				X	(X)
Proportional costs	X				
Inclusive & Adaptive Decision-Making		X			X
Shared Knowledge & responsibility	X	X			
Gradual accountability			X		
Community conflict resolution			X		
Autonomous governance	X		X	X	
Global coordination	X	X	X	(X)	X

FIGURE 4  
Key benefits of DAOs for governing collaborative housing.

DAOs enable the implementation of the developed eight key design principles for the creation of stable and efficient collaborative housing governance in line with the concepts of [Ostrom \(1990\)](#); [Ostrom \(2010\)](#) and [Fitzpatrick \(2018\)](#). As [Figure 4](#) shows, we can now conceptualize our findings by identifying five specific benefits of DAOs for governing CH initiatives, namely: (i) a transparent crypto-accounting system, (ii) a scalable decision-making mechanism, (iii) a global jurisdiction and rule enforcement mechanism, (iv) an automated rights and incentive system, and (v) a flexible polycentric governance system. All five are explained in greater detail below.

First, we observe that blockchain-based DAOs facilitate a collectively and globally managed accounting system for the financial and economic needs of the CH initiative. A standard, global, and *transparent crypto-accounting system* such as this helps the community follow the key principles of proportional costs, shared knowledge and responsibility, autonomous governance, and *global coordination*. A shared global accounting system helps distribute the costs of using and maintaining the houses in a transparent and fair way, including shared responsibility for financial and economic decisions within the community ([Beck et al., 2018](#)). Furthermore, the independent global accounting system should be seen as a key feature to provide the community with autonomy for its self-governance; only communities with an independent, censor-resistant, adaptable, tamper-proofed, and transparent financial system can ultimately be defined as autonomous ([Wright, 2021](#)). Additionally, the global independent accounting system helps coordinate and allocate funds according to the local and global needs of the communities.

Second, DAOs enable flexible, transparent decision-making mechanisms that can be adapted and scaled to globally distributed collaborative communities ([Zhao et al., 2022](#)). The transparent and *scalable decision-making mechanism* of no1s1 is characterized by the key design principle of *inclusive and adaptive decision-making*, *shared knowledge and responsibility*, and *global coordination*, whereby voting rights are differentiated according to the roles and responsibilities of each member and local communities represented by different tokens (e.g., governance tokens, utility tokens, etc.). It is crucial that sub-DAOs are organized around local communities so that all affected local members can actively participate within their sub-community, be jointly responsible, and be empowered to adapt the rules to their changing needs. In addition, DAOs need to include knowledge-sharing mechanisms, such as communication platforms for opinion formation and information sharing ([Spychiger et al., 2025](#)).

Third, a key advantage of DAOs for governing CH initiatives is their ability to create a *global jurisdiction and rule enforcement mechanism*. In this way, DAOs can help implement key design principles like *gradual accountability*, *community conflict resolution*, *autonomous governance*, and *global coordination*. The key here is undoubtedly the ability to install autonomous governance that not only helps a global community define its own rules, measurements, and conflict resolution procedures ([Rozas et al., 2021a](#)) but also provides the ability to enforce any decision directly by actively revoking, confiscating, or distributing access, governance, and/or utility tokens from/to a specific community member ([Hunhevicz et al., 2022](#)). Furthermore, by allowing local communities to organize local governance within a sub-DAO, it should be possible to follow the principles of subsidiarity governance

(Fitzpatrick, 2018) and provide local communities with the tools and power to decide quickly and efficiently on regional issues.

*Fourth*, one of the key features of DAOs—and blockchain—is the possibility to create trust and transparency within a global community of people who do not know each other and do not necessarily trust each other (Rozas et al., 2021b). This is mainly possible through a token-based *automated rights and incentives system* clearly defining the community's boundaries and each member's rights and responsibilities (Hunhevicz et al., 2022). In this way, DAOs can help implement the key design principle of *defined boundaries and responsibilities* for collective housing initiatives. Smart contracts can automate the rights to grant and revoke incentives, offering greater control and flexibility than traditional methods (Van Vulpen and Jansen, 2023). Additionally, a DAO can provide specific incentives to reward valuable activities through token rewards, in which the blockchain provides an immutable record of any activity and decisions, promoting global transparency within the community (Cila et al., 2020). As a result of DAO-based transparency, CH initiatives would benefit from increased trust not only by their members but also by local authorities, which again would help achieve an autonomous governance recognized by local authorities.

*Fifth*, with sub-DAOs, CH initiatives can implement a *flexible polycentric governance system* still based on the key design principles but complying with the concept of *global coordination*. Here, local groups are part of a larger community, following their overarching rules, strategy, and vision. This polycentric governance system would allow CH initiatives to scale—not only in community size from small to large but also geographically from local to global. In this way, DAOs enable the implementation of scalable governance mechanisms, such as decision-making that ensures local decisions still reflect the global opinion of the DAO community (Field, 2018; Field and Weller, 2019).

To conclude our conceptualization section, we assert that our study contributes theoretically and practically to the discourse on collaborative governance and offers insights into how DAOs and blockchain technology can potentially transform CH initiatives by promoting autonomy, transparency, and coordination on a global scale. Hence, we propose a theoretical framework for globally operating CH initiatives based on the principles of autonomous governance, shared responsibility, and global coordination, extending existing theories of collaborative governance to the context of DAOs. In practice, we further propose that DAOs could facilitate transparent and flexible decision-making mechanisms, create token-based jurisdictions for rule enforcement, and establish polycentric governance systems that promote scalability and the alignment of local decision-making with global community values. This would create a scalable and trustworthy system for geographically dispersed CH communities.

## 6 Conclusion

Drawing on the work of various scholars and the experimental development of a collaborative housing DAO, this paper presents an

innovative approach to CH governance using decentralized autonomous organizations (DAOs) as it seeks to establish how DAOs could help govern CH initiatives. In doing so, we outline how DAOs could become a valuable digital governance tool that helps CH initiatives apply Ostrom (1990); Ostrom (2010) governance principles. This allows us to identify the following five key benefits of DAOs in the governance of collective housing initiatives:

*First*, DAOs enable a transparent and globally accessible accounting system that ensures fair cost allocation and shared responsibility. *Second*, DAOs enable flexible decision-making with voting rights based on members' roles and local needs. Sub-DAOs empower local communities to modify rules and promote active participation. *Third*, DAOs can create a token-based system to enforce the rules and resolve conflicts, allowing communities to define their own governance structure with the help of a token mechanism. *Fourth*, DAOs promote trust and transparency within a global community by clearly defining the rights and obligations of its members. Here, smart contracts automate processes and provide an immutable record of activities. *Finally*, DAOs facilitate the implementation of a polycentric governance system with sub-DAOs for local communities, allowing CH initiatives to be scaled globally while maintaining local autonomy.

From a theoretical perspective, it also seems relevant to identify (i) the tokenization of rights and incentives and (ii) the institutionalization of trust based on a transparent and automated code system as key features of DAOs since this could have implications for ongoing research on trust and governance in traditional organizations. However, it is essential to recognize that blockchain—and therefore DAOs—are a new technological innovation, and their transferability to CH is still largely theoretical. Further research would require real-life applications to assess their potential benefits. For example, a subsequent research project could evaluate certain aspects of DAOs as a technical tool (e.g., decision-making) for a specific governance process in CH initiatives. It could also apply the governance framework to a community that wants to adapt blockchain technology for scaling globally. In addition, such research could extend governance for CH communities by adding smart features to homes and involving the Internet of Things. Integrating the latest intelligence into the governance process would lead to new requirements for the governance system and an adaptation of the proposed governance principles.

## 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.

## Author contributions

ML: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Validation, Writing—original draft, Writing—review and editing. SW: Conceptualization,

Investigation, Validation, Visualization, Writing—original draft, Writing—review and editing. LK: Conceptualization, Investigation, Validation, Writing—original draft, Writing—review and editing.

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## Conflict of interest

The authors declare that the research 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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