From Knowledge to Action: Understanding Coordination Practices in Community-Led Urban Sustainability Projects

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Abstract: This study explores how community-based initiatives coordinate knowledge and collective action in urban agriculture and organic waste management in Bogotá, Colombia. Grounded in coordination theory and following a design science research approach, the study examines how interdependencies between tasks and knowledge sources are addressed in grassroots sustainability projects. The discussion is supported by a case study in a community-driven urban agriculture and organic waste recovery setting. We identify four core community needs through qualitative methods: resource management, knowledge management, collaboration, and organization. The findings show that coordination mechanisms are shaped by sociotechnical variables such as the nature and origin of knowledge, its degree of codification, organizational learning trajectories, and the availability of technological infrastructures. These factors configure dynamic conditions that affect both the technical feasibility and social legitimacy of coordination practices. The study highlights coordination as a situated and adaptive process, offering an analytical framework to understand knowledge flows in community-led innovation.

1 INTRODUCTION

In community-driven sustainability initiatives, particularly those related to urban agriculture and organic waste management, coordination among diverse actors is both essential and inherently complex. In cities like Bogotá D.C., where public institutions, academic sectors, and grassroots organizations interact across fragmented governance systems, aligning actions and knowledge flows becomes a central challenge. This complexity affects operational efficiency and long-term sustainability, as well as the social appropriation of knowledge at the community level. Knowledge sharing, information circulation, and collaborative decision-making are fundamental to the effectiveness of these initiatives. However, poorly managed interdependencies among tasks—such as compost production, resource allocation, and cultivation planning—often result in inefficiencies, duplicated efforts, and fragile networks. Previous studies have shown that weak coordination among stakeholders impedes waste recovery strategies and limits the reach and continuity of urban agriculture projects (Obule-Abila, 2020; Calderón and Rutkowski, 2020). Various studies highlight that coordination failures represent one of the main obstacles to sustainable development in urban contexts. Among these challenges are the lack of collaboration between institutions to achieve the Sustainable Development Goals Fu et al. (2020), ineffective communication between stakeholders involved in waste management Soltani et al. (2015), and the persistent disconnection between public, private, and civil society sectors, which hinders the achievement of positive environmental and social outcomes (Batista et al., 2021). Understanding and addressing these limitations is crucial for advancing towards more integrated and effective urban sustainability models. In addition, low levels of awareness and weak stakeholder engagement in waste classification processes further hinder integrated solutions (Obule-Abila, 2020).

To address this challenge, this study draws upon Coordination Theory Malone and Crowston (1990), which defines coordination as the management of interdependencies between activities. Coordination mechanisms—such as standards, mediation, and mutual adjustment—are defined as methods or tools

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used to manage interdependencies performed by different actors within a system (Malone and Crowston, 1990). These mechanisms are shaped by the sociomaterial practices in contextual dimensions, meaning they need to adapt to the social and technological context in which they are applied (Nova, 2019). This paper contributes to that perspective by examining community-driven knowledge management in the context of peri-urban agriculture. The empirical basis of this study is the Terraza Verde Colombia project, launched in 2021 across three peri-urban communities in Bogotá: La Flora and Alfonso López (Usme), and Palermo Sur (Rafael Uribe Uribe). These communities engage in organic waste transformation and food production through participatory processes that combine traditional practices, local governance, and the use of digital tools. The study aims to analyze how coordination unfolds in these settings and how actors navigate the interplay between formal structures and adaptive, community-led mechanisms. Accordingly, this paper is guided by the following research question: *What sociotechnical and contextual factors shape the selection and enactment of coordination mechanisms for managing knowledge-intensive interdependencies in community-based urban agriculture and waste management projects?*

To explore this question, the study adopts a Design Science Research (DSR) approach, incorporating participatory workshops, expert focus groups, and field observations. The objective is not only to map the relationships between coordination mechanisms and the interdependencies they address, but also to understand how communities decide which mechanisms to apply in each context. This includes examining the frequency of use and the practical criteria that guide their selection—such as accessibility, cultural alignment, technological familiarity, or trust. These choices are often shaped by localized knowledge, the nature of the information being exchanged, and the dynamic conditions under which community actors operate. By analyzing these situated decisions, the study reveals how coordination unfolds as a flexible and adaptive process within knowledge-intensive environments. The rest of the paper is structured as follows: Section 2 reviews related research on coordination and knowledge exchange. Section 3 outlines the research methodology. Section 4 presents empirical findings. Section 5 discusses their implications, and Section 6 offers conclusions and directions for future work.

2 RELATED RESEARCH

Coordination Theory (CT), proposed by Malone and Crowston (1990), examines how tasks and activities are efficiently managed among individuals, organizations, or systems to achieve common goals (Gonzalez, 2010). Coordination becomes essential when interdependencies arise between activities, as managing these relationships ensures effective functioning. Malone et al., (1999) and Herman and Malone (2003) reinforce this idea, emphasizing that every interdependence presents an opportunity—or necessity—for management. Thus, CT focuses on interactions among actors, the processes (knowledge sharing), resources (information), and decisions (actions) that align their efforts. In knowledge exchange, coordination refers to the mechanisms facilitating collaboration and efficient interaction among stakeholders (Nova, 2019). A well-structured coordination process strengthens adaptability in complex environments, fosters cooperation, and enhances communication across diverse sectors. The challenge lies in managing dynamic interdependencies, which evolve over time and require adaptable coordination strategies (Faraj and Xiao, 2006). Effective coordination not only optimizes resource utilization but also mitigates inefficiencies arising from fragmented efforts.

In Figure 1, the left section highlights the three types of interdependencies between activities, which create needs for knowledge sharing as well as coordination. The right section presents the three types of coordination mechanisms that manage these needs, increasing the capacities for knowledge sharing among various actors. According to Figure 1, flow interdependence (F1) occurs when an activity generates a resource that is utilized by another. Meanwhile, adjustment interdependence (A2) arises when multiple activities create the same resource. Lastly, resource-sharing interdependence (C3) refers to a scenario where multiple activities depend on a common resource for their management.

In parallel, norm-based mechanisms (M1) refer to formalized guidelines, action strategies, and predefined objectives in which verbal interaction or direct communication among agents is not required for coordination (March and Simón, 1958; Galbraith, 1974). On the other hand, mediation-based coordination (M2) involves the intervention of an intermediary to facilitate the process between the involved parties (Gonzalez, 2010). Finally, mutual adjustment mechanisms (M3) rely on direct exchange among participants, where adjustments and corrections are managed internally without the

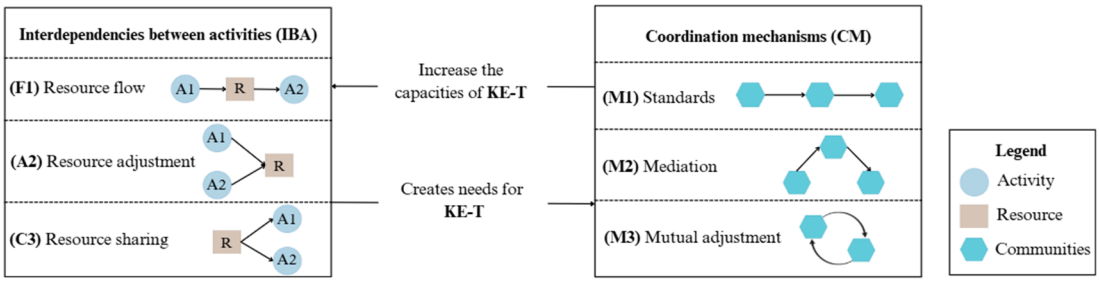

Figure 1: Coordination framework for knowledge exchange and transfer. Based on Gonzalez (2010).

intervention of an external agent (González, 2010). Coordination theory in knowledge management practices has been applied in diverse domains.

For example, Nova and González (2016) examined knowledge transfer in inter-organizational projects, identifying coordination gaps caused by technological mismatches and the misalignment of stakeholders' expectations. Yu and Zhou (2017) explored the role of coordination in cooperative agricultural practices. Additionally, Brennecke et al. (2024) analyzed informal coordination in knowledge-intensive work. These studies highlight that coordination relies on both formal structures and informal interactions.

Coordination mechanisms are effective in promoting knowledge exchange, collaboration, problem-solving, and innovation (Ahmad, 2018). The ability to share information and experiences fosters trust, facilitates the resolution of shared challenges, and enables solutions tailored to local needs (Keller et al., 2013). However, weak regulatory structures and insufficient governmental incentives limit the development of robust knowledge-sharing platforms. Strengthening legal frameworks and providing financial support for collaborative initiatives could enhance knowledge flow and reinforce urban sustainability efforts Given these challenges, coordination remains the cornerstone of effective waste management and urban agriculture, ensuring that knowledge exchange and resource utilization contribute to long-term sustainability. Coordination mechanisms are crucial in agriculture for organizing collective efforts and optimizing resources. Examples like China's "Enterprise plus Farmers" model Yu and Zhou (2017) and cooperative pest management (Stallman and James, 2015) demonstrate how collaboration enhances efficiency and profitability. In knowledge-intensive environments, formal hierarchies combine with informal networks to improve adaptive problem-solving (Brennecke et al., 2024).Furthermore, studies show knowledge coordination across diverse practices, even in public organizations, relies on collaborative infrastructures and shared spaces (Davies et al., 2015). Theoretically, effective coordination also necessitates understanding the social dynamics within communities of practice, where shared meanings and experiences are vital for overcoming organizational barriers and fostering collective action (Brown and Duguid, 2014). Effective coordination and information flow are crucial for urban agriculture and integrated organic solid waste management. Currently, a lack of timely exchange and collaboration among public entities, community organizations, and private companies hinders waste separation and sustainable initiatives (Dotoli and Epicoco, 2019).

This inefficiency, a persistent challenge in waste management, obstructs transitions to circular economy models and limits urban resilience. The absence of mechanisms linking waste generators, operators, and authorities prevents integrated strategies (Obule-Abila, 2020), compromising information flow and joint decision-making. Inter-institutional coordination, therefore, is essential for facilitating knowledge exchange, collaborative actions, and social transformation (Fu et al., 2020). The literature underscores the importance of knowledge coordination from a practical and social standpoint. Brown and Duguid (2014) argue organizations must coordinate not just formal units but also communities of practice to overcome epistemic barriers and foster knowledge flow. This requires recognizing the centrality of shared practice and collective learning. Sudirah (2022) study in Indonesia exemplifies this, showing how coordination among community, district, and irrigation actors was key to addressing water and crop challenges, boosting both technical efficiency and local social networks. Conversely, deficient coordination significantly limits sustainable urban agriculture projects (Kanosvamhira, 2019).

Therefore, the lack of collaboration among public institutions, social organizations, and communities restricts their scalability. Establishing spaces for dialogue and aligning objectives among actors is key

to promoting sustainable initiatives that emerge from the communities themselves (Méndez-Fajardo and Gonzalez, 2014). More structured coordination not only facilitates the integration of various actors but also enables the optimization of resources and the sharing of valuable learnings among them.

To understand the dynamics of coordination in community urban agriculture and waste management, this study draws on existing research by framing the issue within a context of community needs that guide coordination processes (Gonzalez, 2010; Nova, 2019). Previous studies have shown how formal and informal coordination mechanisms operate in various settings, highlighting the balance between structures and relationships. Expanding on this perspective, the present study introduces a framework of four interrelated community needs that shape coordination and knowledge management processes. These are: Resource Management, focused on the access to and organization of shared inputs; Knowledge Management, related to the circulation and appropriation of technical and community-based knowledge; Collaboration Management, aimed at facilitating joint actions among various actors; and Organizational Management, related to leadership, decision-making, and conflict resolution. These categories allow for an examination of how specific coordination mechanisms interact within community practices, offering a more nuanced view of their interdependencies. Building on the existing body of research, this study seeks to explore the practical application of coordination mechanisms for knowledge exchange in community sustainability projects.

3 RESEARCH METHOD

This research adopts the Design Science Research (DSR) approach proposed by Hevner et al. (2004) to analyze coordination and information exchange in urban agriculture and waste management projects. DSR is a research methodology centered on the development and evaluation of practical solutions that address specific domain challenges, combining theoretical knowledge with empirical application. The study follows the three iterative cycles proposed by Hevner (2007): the relevance cycle, the rigor cycle, and the design cycle. The study begins by identifying the limitations in knowledge exchange and coordination in urban agriculture initiatives, particularly in the Terraza Verde project. Stakeholders, including community members and experts, contribute insights regarding the challenges in organizing, sharing, and utilizing knowledge related to waste management and urban farming. The research integrates theoretical foundations from coordination theory Malone and Crowston (1990) and knowledge management to systematically examine coordination mechanisms in this context.

3.1 Case Study Selection

The study employs a case study approach to explore collaborative knowledge-sharing practices and coordination mechanisms within peri-urban agriculture communities in Bogotá, Colombia. The selected case study focuses on three communities participating in the Terraza Verde project: UPZ La Flora, Alfonso López (Usme), and Palermo Sur (Rafael Uribe Uribe). These communities are situated at the urban-rural interface, where socio-economic and environmental dynamics converge, influencing resource management and agricultural activities.

The case study follows Yin (2009) methodological framework, which is suitable for addressing "how" and "why" questions within contemporary social contexts. Field observations and direct engagement with local stakeholders were essential to understanding the interactions shaping agricultural knowledge exchange. Through in-depth interaction with community members, trust-building facilitated open exchanges of experiences and local knowledge. This ethnographic engagement allowed for an integrative analysis of social cohesion, adaptive capacity, and sustainability practices within the communities. The presence of formal and informal networks for knowledge dissemination was observed, highlighting the role of community-driven training initiatives supported by public and private institutions. The case study provides a practical perspective on knowledge coordination in urban agriculture, examining the influence of institutional collaborations, grassroots initiatives, and digital tools for information exchange. It also offers insights into coordination mechanisms tailored to the sociomaterial conditions of peri-urban farming ecosystems.

3.2 Data Collection

To deepen the understanding of knowledge exchange mechanisms in these communities, a mixed-method approach was employed, combining qualitative and quantitative techniques. The case study selection informed the data collection process, ensuring that the identified challenges and knowledge-sharing practices were adequately explored. Data were

collected through participatory workshops with community members engaged in the Terraza Verde possible solutions to improve information flow and stakeholder collaboration. A focus group involving experts in urban agriculture, waste management, and information systems was also organized to validate the findings and refine the analysis.

Figure 2: Sharing knowledge by community leaders.

Direct observations were conducted in the three selected communities to document knowledge-sharing practices, coordination mechanisms, and stakeholder interactions. Reports, policy documents, and previous studies related to urban agriculture and waste management in Bogotá were analyzed to contextualize the findings and validate the research framework. The research data supporting this study is available at [https://osf.io/a9hy6/files/osfstorage].

3.3 Data Analysis

The collected data were analyzed using a combination of qualitative coding and network analysis to identify patterns in knowledge exchange and coordination. Thematic analysis was conducted by transcribing and analyzing data from workshops and focus groups, identifying recurring themes related to coordination challenges, knowledge transfer barriers, and community-driven solutions. Findings were validated by cross-referencing data from multiple sources, including interviews, observations, and document analysis, to ensure consistency and reliability.

4 FINDINGS

As a result of these workshops, four community needs were supported: Resource Management, Knowledge Management, Collaboration Management, and Organizational Management. Based on these needs, eleven interdependencies between activities were identified and categorized as follows: two related to flow (F1), three to adjustment (A2), and six to resource exchange (C3). Additionally, the relationships between the interdependencies and the coordination mechanisms within each community need were established. Table 1 shows how coordination mechanisms are linked to each community's need and their corresponding interdependencies. The purpose of this case study was twofold: first, to identify the coordination mechanisms used to manage each interdependency. Second, to determine the extent to which a particular mechanism is selected within the overall set and the criteria that guide that selection. The correlation between coordination mechanisms and interdependencies is presented in Table 1, which includes a ranking of the use of the mechanism with respect to the interdependency and the community need to which it is applied. This information made it possible to identify coordination patterns linked to each type of interdependency and community need, facilitating the analysis of the mechanisms used and the criteria guiding their selection.

4.1 Community Need 1: Resource Management

This need revealed two resource-sharing interdependencies (C3) critical to the operation of the community garden. The first (c3a) involves collective participation in and exchange of materials and labor required for various stages of the garden's development: from its initial design and formalization to compost and food production. Coordination practices identified in this context include collective work sessions rooted in traditional practices (Communities of communitarian experts), which are oriented toward solidarity and community self-management, and align local labor efforts with shared goals and territorial realities. Additionally, expert communities facilitate the exchange of technical knowledge and the joint construction of solutions between institutional and community actors. Day-to-day coordination is maintained through diverse communication strategies, such as WhatsApp groups, phone calls, video conferencing, face-to-face gatherings, and public announcements made through local institutions like the parish. These practices enabled real-time interaction despite geographic

dispersion and asynchronous availability. The second interdependency (c3b) refers to the distribution of agricultural tools and products—such as seeds, fertilizers, and work implements—by the Botanical Garden, the UAESP, and the Pontificia Universidad Javeriana. Coordination in this domain is achieved through both formal and informal instances of interaction, including scheduled coordination meetings, and through the roles assumed by institutional and community leaders who guide resource allocation. Communication between actors is further reinforced through locally adapted methods such as community notice boards, interpersonal exchanges, and direct participation in community events, ensuring that information reached all stakeholders involved in the distribution process.

Finally, a fit interdependency (A2) was identified in relation to the collection and contribution of organic material for composting by the community (a2a). This involves the aggregation of household and local organic waste for transformation through composting and vermiculture techniques. To manage this process, the community follows established composting protocols and guidelines co-developed with institutional actors. Coordination efforts were supported by the planned use of the CERES (a mobile application for agriculture management), periodic follow-ups by coordination committees, and the participation of community leaders responsible for overseeing adherence to procedures. These activities are reinforced by informal but effective practices such as house-to-house communication, in-person discussions during community events, and institutional training sessions. To enhance local capabilities in organic waste management, additional educational initiatives and personal development workshops are envisioned for future implementation.

4.2 Community Need 2: Knowledge Management

Two resource-sharing interdependencies (C3) are identified in relation to the community's acquisition of knowledge on waste separation and crop cultivation (c3c). Coordination practices include printed materials such as booklets, guides, and training programs that structure and reinforce community learning. These tools support knowledge circulation, encourage the involvement of new participants, and help consolidate a shared foundation that sustains long-term community action in waste management and agriculture.

Complementary practices involve digital tools, such as the moderate use of websites by gardeners to expand knowledge, address specific questions, or explore cultivation techniques. Though not widely adopted, these platforms supplement other learning formats and create access points to broader information networks. Coordination is also supported by everyday peer interaction, including neighbor-to-neighbor phone calls, community workshops, online and in-person courses, WhatsApp groups, and voice-based communication. Institutional actors, including universities and research centers, play a key role in delivering technical training, enabling communities to maintain continuous knowledge exchange and collective learning through direct and dynamic forms of engagement. A second interdependency (c3d) refers to the availability of educational resources on waste management, compost production, and the cultivation of vegetables, herbs, tubers, and medicinal plants. Booklets, work plans, and instructional documents offer structured guidance, while other supports include occasional use of the CERES mobile application and educational websites. Knowledge also circulates informally through neighborly dialogue, video tutorials on platforms like YouTube and Facebook, and participation in local meetings. Together, these mechanisms reflect the varied ways knowledge is adapted and shared within the community, contributing to an active and decentralized learning environment.

In addition, two resource-flow interdependencies (F1) are identified. The first (f1a) addresses the exchange of knowledge and experience related to crop cultivation. Coordination tools include printed guides and training programs, as well as coordination committees, collective work events, expert networks, and instant messaging. These support cross-learning among participants and strengthen connections between actors engaged in agricultural practices. The second interdependency (f1b) refers to access to reliable and updated sources of information. Coordination is driven by peer-led communication such as phone calls, community workshops, experts mobility, WhatsApp groups, and education-oriented activities like talks and personal development sessions. These mechanisms support sustained access to shared knowledge and enable collaborative problem-solving within the community context.

4.3 Community Need 3: Collaboration Management

This need reveals two resource-sharing interdependencies (C3) relevant to collaborative decision-making and collective practices around crop cultivation and organic waste management. The first (c3e) focuses on how individual and group decisions

Table 1: Interdependencies and coordination mechanisms in the case study.

COORDINATION MECHANISMS (CM)		No. COM-MUNITY NEEDS	INTERDEPENDENCIES BETWEEN ACTIVITIES (IBA)										
			f1a	f1b	a2a	a2b	a2c	c3a	c3b	c3c	c3d	c3e	c3f
STANDARDS (M1)	Booklets	2,3	2	1						1	1		1
	Books	2,3								2	2		P
	Training programs	2,3	1							2,P	2		2
	Policies	2,3			1							1	
	Documents and work plans	4				2	F				F		
	Protocols	1,3,4			1		3					2.F	
	Printed guides	2,3	2								1		2
MEDIATION (M2)	Coordination committees	1,2,4	1		1	2	P,F		1,F				
	Technical reports	3											1
	Collective work events (mingas)	1,2,3	1					3					1
	Communities of community experts	1,3	3					2	2				1
	CERES mobile application	1,2			F						3,F		
	Websites	2,3		2						2	2,F		3,F
	Software programs (office suite)	4				2			F				
	Hierarchies	1,2,3	1		1	1	1		1			2	
	Authority figures	1,2,3	2		2	1	1		2			2	
	Internet search systems	2,3		3									2
MUTUAL ADJUSTMENT (M3)	Instant messaging	1,2	2						2				
	Phone calls	1,2		1				1	1	1	1		
	Meetings with local leaders	2,4				3				3,F			
	Community workshops	2,3,4	1	1		1	2,F			1	1		1
	Neighborly dialogue	2,3,4	1	1		1	1				1	1	
	Online and in-person courses	2,3,4				2				2			1
	Experts mobility	1,2,3		2	2								1
	Video conferencing	1						2					
	WhatsApp groups	1,2,3,4	1	1	1			1	1	1	1		1,F
	Posters	1						2	2,F				
	Voice-based communication	1,2,3,4	1		1	1		1	1	1	1	2	
	Video tutorials on YouTube	2,3,4					2			2	1		1
	Video tutorials on Facebook	2									2		2
	Face-to-face gatherings	1,2,3,4	1		1	1	1	1	1	2	1	1	
	e-mail	2									3		
	Discussion / debate	2,3		3,F								1	
	Institutional training sessions	1,2,3,4	1	1	1	2				1			1
	Open forums / public talks	2,3,4		2		2							2,F
	Educational initiatives / personal development workshops	1,2,3,4	2		F	1						F	
	Parish notices	1						2,P	1				
	Personnel rotation	4				1							

are made in these processes. Coordination practices include the use of community protocols and policies that provide structure and clarity for everyday activities. While formal mediation mechanisms—often associated with hierarchies or authority figures—are used infrequently, mutual adjustment practices play a central role. These include neighborly dialogue, open debate, and face-to-face meetings between gardeners and experts, which facilitate shared understanding and collaborative decision-making within the community.

The second interdependency (c3f) involves the network of relationships between community members and external actors such as churches, companies, foundations, and universities. These connections enhance the community's social fabric and expand its access to resources, skills, and opportunities that would otherwise remain out of

reach. Through these links, gardeners strengthen their technical capacities and broaden the scope and sustainability of their collective initiatives. In this context, coordination mechanisms are diverse and consistently applied. Printed guides and training programs provide clear guidance for local practices. Technical reports, collective work events (mingas), and internet search systems enable articulation between internal and external stakeholders. Knowledge exchange also occurs through more adaptive and informal means such as community workshops, YouTube tutorials, WhatsApp groups, and institutional training sessions. Looking ahead, the integration of new interaction spaces—such as open forums and public talks—is anticipated. These would support continuous learning and allow communities to respond more flexibly to evolving challenges. The combination of formal, informal, and context-sensitive coordination strategies enables actors to co-produce knowledge, resolve tensions, and sustain collaborative efforts over time. This highlights the importance of fostering both internal cohesion and external connectivity as key drivers of effective community-based collaboration.

4.4 Community Need 4: Organizational Management

This need reveals two fit interdependencies (A2) associated with the structuring and governance of collective action. The first (a2b) concerns community inclusion in the selection of leaders and representative figures. Coordination is supported by planning documents and work plans that formalize organizational structures and define roles. The coordination committees and software programs (office suite) also contribute to the systematization of information, organizing tasks and enabling a more structured follow-up of ongoing initiatives. These mechanisms strengthen procedural transparency and support community governance. In parallel, mutual adjustment practices—such as neighbor-to-neighbor dialogue, online and in-person courses, and personnel rotation—promote flexible knowledge articulation and ongoing adaptation to changing conditions. These interactions reinforce collaborative dynamics and sustain shared learning processes that underpin community-based knowledge management.

The second interdependency (a2c) centers on addressing conflicts, challenges, and community-level negotiations that arise during agricultural work and waste management. In this case, effective resource adjustment becomes essential to maintaining continuity and responsiveness in the face of emerging obstacles. While formal protocols are part of the organizational repertoire, their application remains sporadic and context dependent. Defined roles within hierarchical structures support mediation practices that facilitate conflict resolution and guide decision-making. These approaches provide stability, especially in complex or tense situations. However, mutual adjustment remains a key coordination strategy. Face-to-face gatherings and the use of digital resources such as YouTube tutorials foster informal interaction, fluid information exchange, and rapid collective responses to emerging needs. These flexible mechanisms do not rely on formal procedures, which allows participants to respond effectively to challenges and maintain strong levels of engagement.

Altogether, the combination of formal tools, mediated roles, and informal practices ensures that organizational processes are both structured and adaptable. This hybrid coordination approach supports shared leadership, enhances responsiveness, and promotes the development of resilient and participatory community governance systems. The case study not only identifies the coordination practices implemented to manage each interdependency associated with the community needs but also examines how frequently these mechanisms are chosen from the broader repertoire and the criteria that guide such selection. Table 1 illustrates the relationship between coordination practices and the types of interdependencies observed, using a scale from 1 (frequently used) to 3 (rarely used). Additionally, the symbols "P" and "F" indicate whether a mechanism was previously applied or is projected for future implementation, as reported by participants. While these markers provide insight into the possible evolution and adaptability of coordination strategies, a deeper analysis of these trajectories lies beyond the scope of this article.

Finally, the selection and adequacy of coordination mechanisms in response to community needs and their associated interdependencies are influenced by several factors related to the characteristics of the information and knowledge involved. These include the volume of information to be managed, its public or private nature, and its specific attributes—such as format, level of detail, organization, accuracy, and timeliness. The diversity of formats—ranging from written documents and visual materials to multimedia content and technical plans—also conditions the suitability of standard-based tools, mediated interactions, or mutual adjustment practices. Recognizing and addressing these variables enhances the effectiveness of

coordination, strengthens knowledge exchange, and allows communities to adopt flexible and context-sensitive strategies for managing shared tasks and solving complex challenges.

5 DISCUSSION

The coordination model developed in this study reveals a strategic coexistence between ICT-based coordination mechanisms and traditional, face-to face practices rooted in community dynamics. This dual approach reflects an adaptive response to the sociomaterial conditions of the communities involved, where knowledge circulation depends on both digital platforms and in-person interactions (Nova and González, 2016). Tools such as WhatsApp, video conferencing, institutional websites, and mobile applications enhance the speed and breadth of information exchange. However, physical coordination mechanisms—such as traditional community work gatherings, notice boards, community meetings, and word-of-mouth communication—remain essential for strengthening social bonds, building trust, and ensuring the collaborative management of local knowledge.

This finding aligns with recent studies that emphasize the importance of hybrid coordination environments, where formal structures and informal dynamics interact to foster knowledge exchange in decentralized contexts (Brennecke et al., 2024b). In such environments, digital tools extend the reach of technical information and facilitate access to broader networks, while traditional practices enable contextual interpretation and promote community engagement. However, the successful integration of these tools depends heavily on the capacity of actors to align technological resources with local values, communication preferences, and relational norms (Toukola and Ahola, 2022).

In the case of the Terraza Verde project, the use of ICTs has helped expand networks, access new sources of information, and streamline some coordination tasks. Yet, the empirical evidence shows that many information flows within these communities still depend on external facilitators—such as universities, NGOs, and local government officials—to be fully consolidated and appropriated. This observation supports the argument that the appropriation of technology in community contexts is not only a matter of infrastructure availability, but also of continuous support, relational trust, and contextual adaptation (Baladron, 2021), considering that the most effective interventions tend to incorporate mechanisms for building trust among actors, strengthening local capacities, and implementing flexible frameworks that allow strategies to be adjusted in response to the social, organizational, and territorial changes each community experiences.

This aligns with the notion of organizational flexibility as a key condition for effective knowledge exchange in community settings. Flexible coordination structures, capable of adjusting to changing environments, reconfiguring alliances, and absorbing contextual pressures, are essential to sustaining innovation and community resilience (Li et al., 2017). From this perspective, the proposed coordination model should be understood not as a static structure, but as a dynamic framework that evolves with the transformations experienced by the community. Moreover, the analysis of coordination practices highlights several challenges for community-based knowledge management. Beyond ensuring access to information, effective knowledge management requires mechanisms that contextualize knowledge, embed it in local practices, and transform it into actionable insights.

This involves managing not only the technical dimensions of coordination, but also the social and relational aspects that condition how knowledge is shared, validated, and applied (Choi et al., 2008). The role of communities of practice becomes particularly relevant in this regard. As Wenger-Trayner and Wenger-Trayner (2015) suggest, the value created in community settings depends on the integration of knowledge into everyday interactions, learning routines, and shared meaning-making processes. These communities foster collective knowledge management by directly linking learning with performance and enabling the circulation of both tacit and explicit knowledge. Because of their flexible and autonomous nature, they can transcend formal institutional boundaries and foster dynamic knowledge flows that respond to evolving local needs (Cohendet et al., 2015). However, this also introduces a set of challenges for traditional institutions with hierarchical structures.

When coordination mechanisms fail to adapt to local dynamics, they may fragment knowledge flows, reproduce inequalities in information access, and erode the trust necessary for collective action as shown in (Nova and González, 2016; Palma-Huertas, 2024). In this study, such tensions became evident in activities that simultaneously fulfill multiple roles—such as community training workshops, which not only serve to disseminate information but also foster experience-sharing and strengthen social cohesion.

Therefore, the complexity and multifunctionality of these spaces should be recognized and supported through coordination mechanisms that are both flexible and inclusive.

In this sense, coordination should be understood as an inherently social and adaptive process that articulates local knowledge, situated practices, and trust-based relationships. It plays a crucial role in enabling environmental governance at the community level, where diverse actors and knowledge must align around shared goals. Accordingly, designing coordination mechanisms for community-based knowledge management requires embracing organizational flexibility, valuing territorial knowledge, and promoting inclusive, dialogical, and collaborative practices (Lange et al., 2020). Such a shift calls for the development of sustainable knowledge ecosystems—spaces that go beyond information transfer and actively promote social innovation, critical knowledge appropriation, and collective resilience. In peri-urban contexts, where institutional support may be fragmented and social capital is unevenly distributed, this means building interaction platforms that empower communities to self-organize, manage knowledge autonomously, and strengthen their adaptive capacity to face environmental, economic, and social challenges. This study also confirms that coordination mechanisms in community settings cannot be reduced to standardized instruments or rigid structures. Instead, they must be conceived as adaptive processes that accommodate diversity, respect local rhythms, and evolve with the needs and priorities of the collective. Only through such a sensitive and flexible approach can coordination strategies foster equitable, sustainable, and transformative knowledge processes in peri-urban communities.

Based on these findings, we propose three design guidelines to strengthen Information and Communication Technology (ICT)-based coordination mechanisms within community contexts. First, it is crucial to foster digital co-creation. This involves enabling local actors to actively participate in the design and adaptation of digital content and tools. Such participation promotes knowledge appropriation and contextual relevance. Second, we recommend incorporating technological intermediation structures. These could include community facilitators or institutional partners who can support the progressive integration of technologies and effectively reduce gaps in access and usage. Third, activating distributed knowledge networks through digital community micro-platforms is essential. These platforms would function as autonomous nodes for managing local information in a decentralized, resilient, and scalable manner (Lange et al., 2020) . These guidelines aim to advance more inclusive, adaptive, and sustainable forms of coordination. Here, technology not only mediates information flows but also enhances collective learning, local autonomy, and the co-creation of solutions in direct dialogue with the communities themselves.

6 CONCLUSIONS

This study demonstrates that Coordination Theory offers a robust analytical framework for examining knowledge management in community-based settings, particularly within urban agriculture and organic waste recovery initiatives. By analyzing activity interdependencies and the coordination mechanisms employed to manage them, we identified how communities develop context-sensitive arrangements that are not solely dependent on formal structures, but also on trust-based relationships and locally embedded knowledge. Our findings indicate that the selection of coordination mechanisms is neither arbitrary nor purely functional. Rather, it emerges from the interaction of sociotechnical variables such as the epistemological nature of knowledge (tacit or explicit); the source of knowledge (technical, ancestral, or Indigenous); the degree of information structuring and codification (e.g., informal knowledge transmitted through oral practices vs. formally documented technical protocols); organizational learning trajectories (e.g., prior experience with empowerment, self-management, or collective organization); and the availability of technological infrastructures (e.g., limited internet access or lack of digital tools to support communication and knowledge sharing). These variables configure dynamic conditions that determine both the technical feasibility and social legitimacy of each coordination mechanism. Accordingly, coordination must be understood as a situated practice in which collaboration and knowledge circulation rely on actors' capacity to mobilize cognitive, relational, and technological resources.

The case study reveals how community-led initiatives can generate tangible outcomes by combining knowledge sharing, collective organization, and sustainable practices. These processes contribute to food resilience and the localized management of organic waste, while also strengthening community governance structures and

collaborative learning dynamics. Although derived from a specific context, the findings suggest coordination patterns and boundary conditions relevant for broader application. This study, focused on communities in Usme and Rafael Uribe Uribe (Bogotá), provides analytical principles and design guidelines for ICT-based coordination. However, applying these insights elsewhere requires a critical understanding of local dynamics, institutional conditions, and specific technological contexts. Future research should thus examine how coordination mechanisms evolve in diverse sociotechnical environments, particularly with Industry 4.0 technologies and the potential of generative AI to enhance knowledge flow, task assignment, and real-time collective decision-making in community settings.

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