Places and Spaces of Collaborative R&D and Innovation: Navigating the role of physical and virtual contexts

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Abstract: The context in which collaborative R&D and innovation activities take place is a critical driver of success and failure. However, innovation management research tends to often abstract the context away, leaving the crucial contingency factors unaddressed. This special issue explores multifaceted collaborative R&D and innovation contexts across physical and virtual domains. An array of ten articles dissect various contexts, including cross-sector partnerships, innovation hubs, living labs, makerspaces, and virtual collaboration spaces and communities, highlighting their impact on innovation processes and outcomes. In this editorial we develop a "Collaborative Innovation Space Matrix" to firstly integrate the insights from the special issue focusing on collaboration dynamics and type of spaces, and secondly, to propose a call for action for innovation researchers to better understand the crucial role of context in collaborative R&D and innovation.

1. Introduction: The Evolving Landscape of Collaborative R&D and Innovation

Collaborative R&D and innovation, which involves the creation of new products, services, or processes through collaboration with various stakeholders, is crucial for organizations to

remain competitive and adapt to changing environments (Heil and Bornemann, 2018; Najafi-Tavani et al., 2018). While collaboration has always been important, especially for research, development, and innovation (Chesbrough, 2003), there are also other drivers that lead individuals and organizations to seek ways to connect and collaborate. For instance, a growing focus on sustainability and social responsibility has led organizations to seek collaborative approaches for addressing complex global issues through varied governance forms such as partnerships and multi-actor networks where each stakeholder's unique differences, experiences and resources contribute to the sustainability innovation outcome (Greer and Lei, 2012; Ferraro et al., 2015; Mariani et al., 2022; Ritala, 2023). Public sector organizations have utilized collaborative innovation to both formulate and enact novel policies (Lopes and Farias, 2022), as well as to co-create innovative products and services together with companies and citizens (Leminen et al., 2017a, 2021). Furthermore, the rise of digital technologies such as video conferencing has enabled organizations and individuals to more easily and more affordably organize, collaborate, and interact with one another, irrespective of their geographical distance (Heil and Bornemann, 2018; Dąbrowska et al., 2022).

The complexity of collaborative innovation is heightened by its sensitivity to *context* or the specific *places and spaces* in which the innovation activities occur. Various physical, virtual, and cognitive spaces can offer places for citizens and other stakeholders to jointly innovate (Leminen et al., 2016; 2020). Physical and virtual environments are more than just the spaces, platforms, and frameworks for collaborative R&D and innovation; they also shape the cognitive processes of innovation actors, influencing collaboration and the creation of new knowledge (Clark, 2008; Peschl and Fundneider, 2012). Scholars and practitioners have identified diverse spaces and places for innovation, including but not limited to hackathons, fab labs, living labs, and co-location hubs (Hausberg and Spaeth, 2020; Greve et al., 2020, 2021; Mortara and Parisot, 2018; Nevens et al., 2013; Leminen et al., 2020). Although these contexts are important in shaping the way organizations and individuals collaborate to generate new ideas and bring them to market, the multitude of conceptualizations, definitions, and operationalization give rise to challenges in effectively discerning how the unique affordances of a given collaborative space exert influence on the dynamics of innovation processes and their ultimate outcomes advancing our understanding of these different places and spaces for collaborative R&D and innovation (Bogers et al., 2017; Enkel et al., 2020; Leminen et al., 2017a, 2021).

Recently, scholars also have paid increasing attention to the diversity and breadth of multiple actors and stakeholders in collaborative R&D and innovation activities (Nyström et al., 2014; Davis, 2016; Leminen et al., 2021). Notably, there is a growing and diverse array of collaborators engaged in these activities, including but not limited to partners, suppliers, customers, users, and public organizations. However, prior studies have provided limited insights into the dynamics of interactions among collaborating individuals or actors (Yström and Agogué, 2020; Leminen et al, 2020). Engaging in collaborative innovation can be particularly challenging, as it often blurs the boundaries, motives, and mandates of those involved. Collaborators must navigate multiple agendas and engage in continuous relationship negotiation (Phillips et al., 2000). The diverse landscape of innovation contexts also poses

challenges in terms of generalizing findings across different spaces and places (Nie et al., 2023). Together, the increasing diversity of actors and contexts has led to the emergence of popular concepts such as innovation communities (Fichter, 2009), knowledge networks (Phelps et al., 2012; Ritala et al., 2023), innovation networks (Jarvenpaa and Wernick, 2011; Aarikka-Stenroos et al., 2017), innovation ecosystems (Ritala et al., 2013; Autio and Thomas, 2014), platforms (Gawer and Cusumano, 2014; Helfat and Raubitschek, 2018) and intermediaries (Howells, 2006; De Silva et al., 2018).

Importantly, collaborative R&D and innovation contexts are also increasingly digital, intangible, and virtual. Digital technologies play an increasing role in the ways collaborative R&D and innovation are carried out and theorized (Baldwin and von Hippel, 2011; Nambisan et al., 2017). While research on virtual communities has been popular for a long time (Hercheui, 2011; Tonteri et al., 2011), the new developments in digital technology have changed the dynamics. For instance, digital platforms and ecosystems provide a possibility to drive unprompted, combinatorial innovation in a scalable manner (Thomas and Tee, 2022). In addition, digital infrastructures such as virtual design spaces and collaboration interfaces provide new opportunities for close interaction in inter-organizational settings (Kostis and Ritala, 2020), as well as for broad-based collaborative innovation (Enkel et al., 2020).

Our special issue on "Places and Spaces for Collaborative R&D and Innovation: Physical, Virtual and Cognitive Contexts" addresses the need to better understand the complexities and nuances across different contexts for R&D and innovation. Following a Professional Development Workshop at the Academy of Management (AoM) Annual Meeting in 2021, a paper development workshop organized by the International Society for Professional Innovation Management (ISPIM) in 2021, and a rigorous review process, ten articles were accepted for publication in the special issue. The Special Issue articles span a spectrum of themes, from the theoretical underpinnings of collaborative spaces to the effects of virtual and physical spaces on collaborative innovation. More specifically, they are examining cross-sector partnerships (Dzhengiz and Patala, 2023), collaborative innovation workplaces (Klooker and Hölzle 2023), living labs (Della Santa, Tagliazucchi, and Marchi, 2022), makerspaces (Zakoth, Mauroner, and Emes, 2023), community-based collaborative dynamics (Capdevila and Mérindol, 2022), and hubs as spaces as part of the local innovation ecosystems (Haukipuro et al., 2023). Several articles specifically examine virtual collaboration spaces as a new and under-researched formation. These virtual collaborations are often specialized; focusing on elderly user inclusion (Thomas, Skeie, and Huang, 2022), or the dynamics in open-source software communities (Conaldi et al., 2023). Still further articles explore virtual and mental spaces within national data economy initiatives (Adibe et al., 2023), and the influence of political behavior on the formation of these spaces (Ollila and Yström, 2022).

Overall, by examining a variety of collaborative R&D and innovation in diverse contexts, this special issue provides novel scholarly knowledge and managerial implications in the field of R&D and innovation management. We believe that researchers and practitioners can gain a deeper understanding of how different types of participants, organizations and communities collaborate, and how the physical and virtual environments create meanings and shape the

outcome of these collaborations. This knowledge can help organizations and policymakers identify and replicate successful models of collaboration and make informed decisions about how to design and create innovation-friendly environments. Insights from different types of spaces and places empower organizations and communities and should lead them to optimize their utilization of available resources. These resources include tangible assets like labs and equipment and intangible assets such as shared knowledge and expertise, as well as digital spaces, objects, and artifacts. Furthermore, studying these spaces provides insights into the changing dynamics of innovation, including how innovation ecosystems are evolving, which is important for developing innovation policies and programs. In the following section, we will synthesize the insights across the articles in the special issue, and develop a *Collaborative Innovation Space Matrix* that helps to chart the different spaces and dynamics for collaborative innovation and R&D.

2. Collaborative Innovation Space Matrix: Positioning the Special Issue Contributions

To gain a deeper understanding of collaborative R&D and innovation, we analyze the articles through the lens of two essential dimensions: (i) Type of Space, and (ii) Collaboration dynamics.

The first dimension, *Type of Space*, pertains to the environments wherein collaboration unfolds. The character of these spaces, whether physical or virtual, significantly shapes the dynamics, effectiveness, and outcomes of collaboration. *Physical spaces* typically foster direct interaction, allow non-verbal communication, and promote a sense of camaraderie. Physical spaces are known to foster creativity and encourage communication, and they can be adapted to accommodate the diverse requirements of individuals with varying needs (Oksanen and Ståhle, 2013). For instance, physical spaces tend to be flexible and allow for modifying the degree to which the physical space and its location are the same, equivalent, or independent from the stakeholders' normal operating environment (e.g., work, study, shopping) (Moultrie et al., 2007). This is particularly important as collaborative R&D and innovation tend to capitalize on the benefits of a particular physical space and the innovation climate that the physical space and the participating innovators create (Peng and Jia, 2023). Furthermore, physical spaces facilitate shared experiences when people meet face-to-face, which enriches the mutual understanding of meanings and fosters collaboration (Nyström et al., 2014, Peschl and Fundneider, 2014).

Virtual spaces, in turn, excel in accommodating geographically dispersed teams, leveraging digital tools, and providing time-location flexibility. It is important to acknowledge the distinction between emergent virtual spaces and intentionally designed virtual spaces. Emergent spaces in the realm of virtual environments are those that come into existence unintentionally or organically (Leminen et al., 2021). These spaces typically evolve as a result of shared access to digital design tools or platforms. On the other hand, designed spaces are intentionally created and planned by individuals or teams (Leminen et al., 2020). These spaces are created with specific goals and purposes in mind. Virtual spaces can offer organizations a dynamic medium for rich interactions with their users such as in gathering feedback and

support from users to product innovation design (Füller et al., 2007), as well as the ability to collaborate with other stakeholders at scale (Enkel et al., 2020). Virtual spaces include 2D digital platforms and 3D "virtual worlds" – an early example of which was the Second Life, a virtual world that allowed producers and users to meet in real-time to create new products and services and test, use, and collect feedback on innovation (Ondrejka, 2007; Kohler et al., 2009). Recent developments in virtual worlds involve the vision of "the metaverse"- a real-time and interoperable virtual world; with already some practical implementations by companies underway (Gauttier et al., 2022). Other virtual environments include for example digital fabrication platforms (Gershenfeld, et al., 2017), digital innovation hubs (Kalpaka et al., 2020), Virtual Reality (VR) / Augmented Reality (AR) platforms (Kostis and Ritala, 2020), and virtual smart city networks (Leminen et al., 2020). Finally, it is worth noting that physical and virtual often intertwine; for instance, some physical innovation spaces and platforms incorporate various types of digital tools or even provide purpose-specific virtual arenas and spaces for innovation and development.

The second dimension – *Collaboration Dynamics* – assesses the focus of the collaborative innovation dynamics, either on the level of a group or a community. Group-level collaboration refers to collaboration primarily driven by small groups of users and focuses on the collaboration dynamics that facilitate or regulate the interactions between individuals in collaborative spaces. As such, dynamics that facilitate collaboration between specific individuals and small groups may lead to leaner decision-making processes (Leminen et al., 2021). In contrast, collective dynamics involve larger groups, communities, or even ecosystems of participants, ranging from multiple teams within an organization to global communities of individuals and organizations. Community-level dynamics tend to generate a broader range of ideas, incorporate diverse perspectives from multiple backgrounds, help select the most valuable problems and ideas by focusing on areas that are applicable to a large crowd, and foster a sense of collective ownership for a jointly provided solutions (Leminen et al., 2020; Leminen et al., 2017a, Nyström et al., 2014).

These two dimensions form the basis of a 2-by-2 Collaborative Innovation Space Matrix, which classifies the Special Issue research articles across two dimensions: type of space and collaboration dynamics (See Figure 1). This examination reveals that most of the articles are focused on exploring community-level collaboration dynamics, rather than group-level ones. Of note, the distinction between articles focusing on either physical or virtual spaces was more evenly distributed.

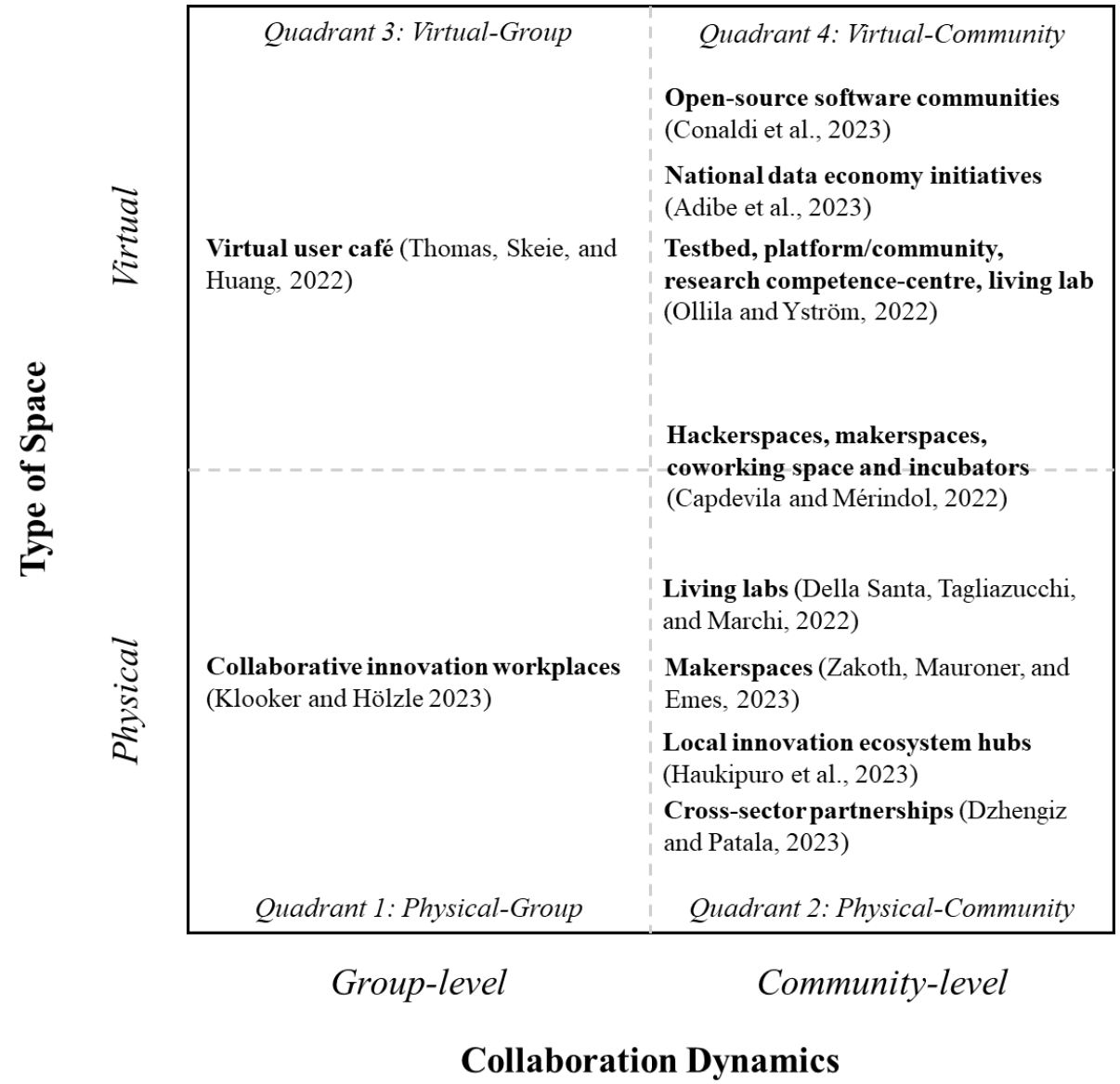

Figure 1. The Collaborative Innovation Space Matrix: Positioning the special issue articles.

2.1 Physical Spaces

In this Special Issue, five articles analyze diverse physical innovation spaces which include living labs, makerspaces, local innovation ecosystem hubs, cross-sector partnerships, and collaborative innovation workplaces. Apart from collaborative innovation workplaces which represent group-level collaboration (Quadrant 1: Physical-Group), these innovation spaces fall under the category of community-level innovation (Quadrant 2: Physical-Community).

Klooker and Hölzle (2023), the sole representative of Quadrant 1 (Physical-Group), investigate the creation and genesis of effective workplaces for collaboration, drawing attention to the

practices involved in their design. The authors studied six diverse collaborative innovation spaces, employing a longitudinal approach for three cases and a retrospective approach for the other three. Qualitative data were collected from primary and secondary sources. The authors found that the successful creation of collaborative innovation spaces requires strong commitment, trust, and support from top management, as well as attention to the socio-material elements involved in the design process. Key practices for designing effective collaborative innovation spaces include involving users in the design process, creating a sense of community and belonging, and providing flexibility and adaptability in the use of the innovation space. Overall, the article offers a holistic understanding of the phenomenon of collaborative innovation space development and provides insights for organizations seeking to create effective collaborative workspaces.

Della Santa et al. (2022) investigate the role of space in fostering innovation processes in living labs, which are characterized by their openness, user involvement, and real-life settings. The authors conducted a comparative case study of two living labs in the automotive industry, examining the physical, social, and organizational spatial dimensions of each living lab. The study argues that these three spatial dimensions of living labs are closely linked to knowledge creation, knowledge transfer, and community-based innovation practices. Specifically, the physical space of living labs influences the design and testing of new products, whereas the social space facilitates collaboration and knowledge sharing among actors. Further, the organizational space shapes the governance and management of living labs. The authors suggest that future empirical studies should consider the epistemological spatial dimension of living labs to further explore the nexus between space and innovation.

Zakoth et al. (2023) analyze the role of makerspaces in supporting innovation processes for makerspace users. The study focuses on the relevance of four types of makerspace resources (social, technological, knowledge, and financial) during different stages of the innovation journey. The authors conducted 20 semi-structured interviews with 10 initiators of innovation projects within an industry-specific makerspace. They used qualitative content analysis to analyze the data and identified several key findings. First, makerspaces democratize technology access and improve chances for innovation and entrepreneurship. Second, makerspace resources are particularly relevant during the ideation stage of the innovation process. Third, makerspace resources can support innovation in different ways, such as by providing access to tools and equipment, facilitating collaboration, and promoting networking, and offering training and education. In this vein, the study provides valuable insights into the role of makerspaces in supporting innovation processes and highlights the importance of makerspace resources for innovation success.

Haukipuro et al. (2023) provide a practical framework for establishing research, knowledge, and innovation-based hubs as part of the local innovation ecosystem. The research process involved identifying and crystallizing the research problem, conducting a state-of-the-art study and literature review, establishing case hubs, and analyzing data within a transdisciplinary research team. Data were collected through workshops, stakeholder interviews, and a desk study. The article answers several key questions related to the establishment of hubs, including

the need for a hub in a certain innovation ecosystem, the vision of the hub, the added value of The hub, key players and strategic partners, and the main functions of research-based, knowledge-based, and innovation-based hubs. The findings suggest that the establishment of a regional Oulu health ecosystem in 2012 in Finland was driven by the need to strengthen innovation in the healthcare sector and create a new partnership model among different actors. The article also acknowledges the limitations of the case study method and the need for further development of hub-specific assessment tools.

Dzhengiz and Patala (2023) explore the role of cross-sector partnerships (CSPs) in the dynamics between places and innovation ecosystems. The study examines two cases, Humber Local Enterprise Partnership in the UK, and Telaketju in Southwest Finland, to develop a conceptual model of how CSPs can regenerate places and revitalize innovation ecosystems. The study finds that CSPs can act as "herding spaces" that alter vicious and virtuous dynamics and identifies four dynamics that enable CSPs to do so: (1) creating shared visions and goals, (2) building trust and relationships, (3) facilitating learning and experimentation, and (4) mobilizing resources and capabilities. The study concludes that CSPs have the potential to play a critical role in shaping the dynamics between places and innovation ecosystems, and offers insights for policymakers, practitioners, and scholars interested in promoting sustainable and inclusive development.

The articles representing Quadrants 1 and 2 – and physical spaces – uniformly point out the importance of cognitive and socio-material elements such as access to shared resources including knowledge, space, and tools, as well as trust and organizational and individual commitment to innovation. In particular, the articles discussing innovation spaces in Quadrant 1 stressed the shared physical space as a key resource whereas articles discussing Quadrant 2 emphasized that knowledge, skills, and relationships are essential resources in these innovation spaces. The creation, transfer, and use of knowledge and skills in a collaborative setting was discussed across all articles. Knowledge is gathered through research and sharing valuable information with the community, while skills are transferred to participants in collaborative innovation through training. Given the physical nature of the innovation space, learning takes place through close interaction among the participants, and social networking not only offers means for the transfer of skills in the short term but also as social resources in the long term.

2.2 Virtual Spaces

Four articles in the special issue discuss virtual spaces for collaborative innovation. These spaces include a virtual user café as well as open-source software communities, national data economy initiatives, testbeds, platforms/communities, research competence centers, and living labs. While the first of these represents an innovation space characterized by group-level innovation collaboration (Quadrant 3: Virtual-Group), the others provide examples of community-level collaboration (Quadrant 4: Virtual-Community).

Representing Quadrant 3, Thomas et al.'s (2022) study discusses the importance of including elderly users in the early stages of the innovation process and the challenges that firms face in doing so. The authors conducted a case study of a Norwegian Smart Care Cluster that involved elderly users in a virtual user cafe to generate ideas for new products and services. The study found that involving elderly users in the innovation process can lead to more user-driven and relevant products and services, but it presents a variety of technical and interpersonal challenges. The authors suggest that participatory action research can be used to develop methods for including elderly users in collaborative innovation processes. Overall, the article highlights the potential benefits of involving elderly users in the innovation process and provides insights for firms looking to do so.

As one of the Quadrant 4 articles, Conaldi et al. (2023) investigate the antecedents of collaboration in virtual spaces, using the Linux kernel open-source software community as a case study. The authors investigate the role of proximity, trust, and shared goals in fostering collaboration among software developers in this community. They find that proximity, both physical and cognitive, is a key driver of collaboration, as it facilitates the development of trust and shared goals. They also find that shared goals are more important than trust in driving collaboration, and that trust is more important for sustaining collaboration over time. Finally, they suggest that these findings have important implications for businesses and organizations seeking to foster collaboration in virtual spaces, as they highlight the importance of creating opportunities for proximity-building and goal-sharing among team members.

Adibe et al. (2023) study the early phases of collaborative innovation through a national data economy initiative in Finland. The authors investigate how individuals' sensemaking narratives manifest the different dimensions of liminality (i.e., confusion–clarity, isolation–communal, and stagnation–movement) and their motivations for collaborative innovation. A thematic model of narrative analysis is employed to identify themes in the interview data, showing that the informants' narratives reflect a sense of ambiguity, fluidity, and transformation in their experiences of the initiative. The study also highlights several practical implications for fostering successful collaborative innovation, including the importance of creating a shared sense of purpose, building trust and psychological safety, and embracing experimentation and learning. Overall, the study sheds light on the complex and dynamic nature of collaborative innovation spaces and highlights the potential of liminality as a useful lens for understanding these phenomena.

Ollila and Yström (2022) examine the role of political behavior in collaborative innovation processes. The authors argue that political behavior can be both necessary and essential part of pushing collaborative innovation forward, but it can also create challenges and conflicts that need to be managed effectively. The article presents several case studies to illustrate the triggers, behaviors, and shaping mechanisms of political behavior in collaborative innovation spaces. These case studies highlight the importance of clear communication, shared goals, and effective project selection processes in managing political behavior and ensuring successful collaboration. Overall, the key findings of the article suggest that political behavior is a complex and multifaceted phenomenon that can have both positive and negative effects on

collaborative innovation processes. Effective management of political behavior requires a deep understanding of the underlying dynamics and a willingness to engage in open and honest communication with all stakeholders.

Finally, as an article that represents both physical and virtual spaces, Capdevila and Mérindol (2022) explore the emergence of communities in collaborative spaces and how they develop over time through interdependent dynamics of physical, cognitive, and virtual contexts. The research is based on a comparative case study of 11 collaborative spaces in France and Spain, and the methodology is based on an iterative process of data collection and analysis. The study identifies four distinct patterns of community evolution and highlights the importance of integrating physical, cognitive, and virtual contexts for successful community building and collaboration. The research offers valuable insights for managers and policymakers looking to foster innovation through collaborative spaces.

Overall, the articles representing Quadrants 3 and 4 – and virtual spaces – demonstrate several important nuances that are distinctive to the virtual context. It is shown that shared objectives and understanding of the users in virtual spaces are crucial drivers in the formation and maintenance of collaborative efforts. Having a mutual understanding and purpose, in other words, shared mental models and cognitive alignment regarding reasons and visions in joint innovation development also fosters the creation of trust, which is important for successful innovation collaboration. Furthermore, some virtual spaces and the ongoing collaboration within them are often characterized by ambiguity and fluidity, which require a strong communal narrative and psychological safety to motivate the users to continuous participation and innovation. In this vein, shared mental models can provide collaborative innovation activities and the involved participants with protective cognitive benefits.

3. Navigating Physical and Virtual Contexts: Integrative Implications

The above discussion of the ten special issue articles and their associations with our conceptual framework highlights that there are several implications to be derived. In the following discussion, we aggregate the findings from the ten articles and integrate them with the cumulating literature on the spaces and places for collaborative R&D and innovation. We conceptualize this integrative research agenda in the *Collaborative Innovation Space Matrix* (Figure 2). Using the same dimensions as illustrated in Figure 1, the matrix depicts particularly the core research themes that arise in the intersection of the physical and virtual spaces, and of the group-level and community-level dynamics. In interpreting the results, it is important to note that we are highlighting the most prominent distinctions related to the implications, while all the mentioned themes are relevant for collaborative R&D and innovation.

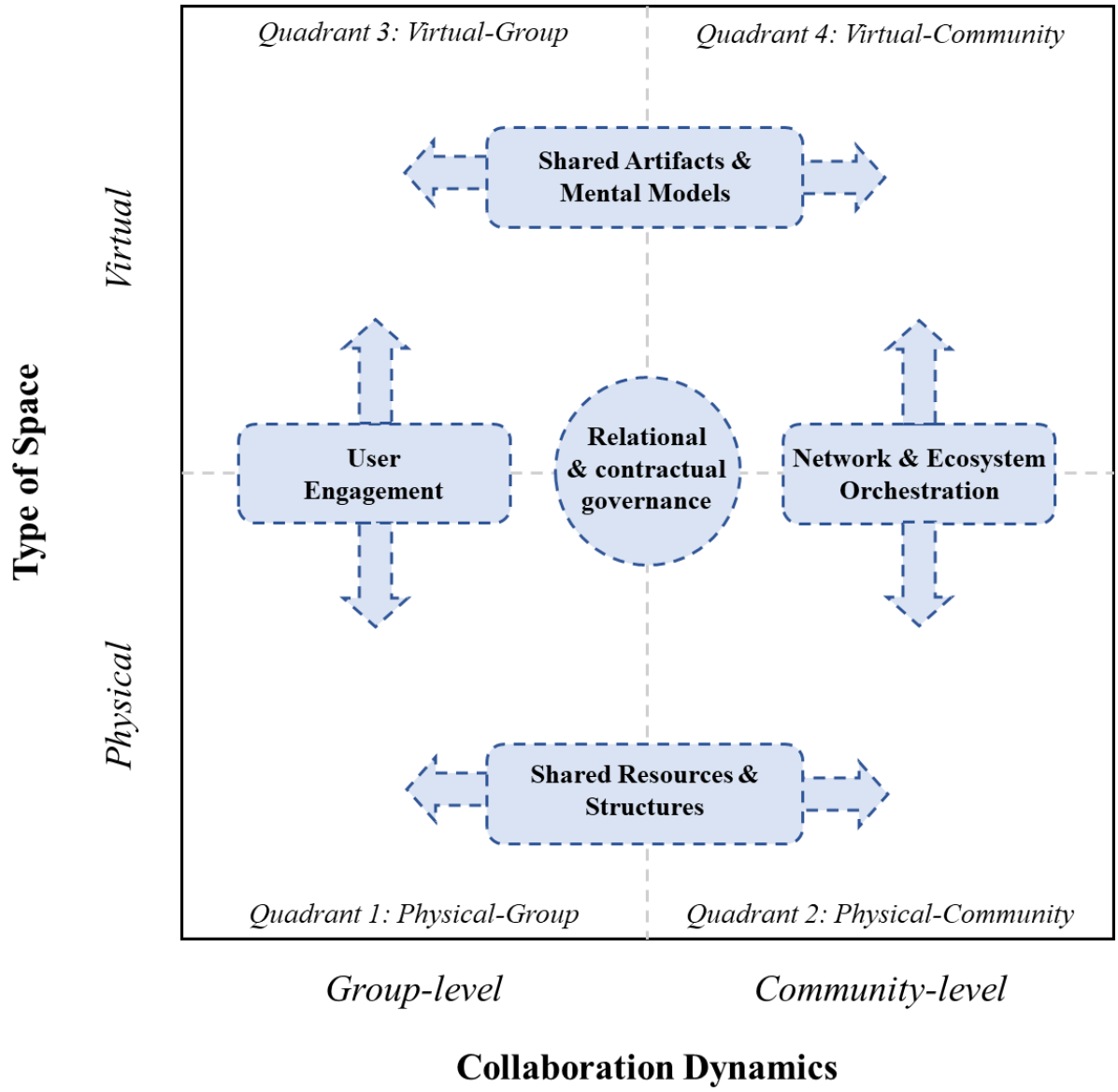

Figure 2. The Collaborative Innovation Space Matrix: Mapping the research themes.

First, comparing the quadrants based on the type of space, it seems that, in physical innovation spaces, *shared resources and structures* play a significant role in innovation. This finding holds regardless of whether the collaborative innovation takes place at a group=level (Quadrant 1) or community level (Quadrant 4). Such resources and structures relate to the physical space in itself, as well as the available tools, functions, and also the social interaction-enabling aspects that occupy physical innovation (Klooker and Hölzle, 2023). In physical innovation spaces, participants need to learn to cope with constraints related to the shared use of limited physical resources and structures. This might lead to increased creativity (Oksanen and Ståhle, 2013), but it might also result in encounters with collisions and tensions among individuals (Hakkarainen and Hyysalo, 2013). Nevertheless, effectively managing these collisions and tensions has the potential to pave the way for more profound collaboration.

In virtual innovation spaces, *shared artifacts and mental models* are highlighted, including the vision and the purpose of that space as a collaboration space. Shared artifacts refer to any available digital artifacts, including jointly accessed textual material, figures, design sketches, or even 3D objects, rather than physical resources (cf. Kallinikos et al., 2013; Kostis and Ritala, 2020). Mental models relate to shared goals and a sense of purpose (see e.g., Tonteri et al., 2011) which act as important and cohesive glue that brings participants to share the virtual innovation space and interact with each other. In fact, such shared mental models are crucial since it is rather easy for the participants of a virtual space to stop or downscale their participation in case the collaboration does not meet their expectations or goals. The actual resource sharing may be less of a concern in this context in comparison to physical spaces, since virtual spaces have the advantage of scaling efficiently, and one person's utilization of the innovation space is unlikely to impede others from using it simultaneously.

Second, a comparison of quadrants based on the collaboration dynamics shows that in innovation spaces where group-level dynamics are prevalent, *user engagement* is highly emphasized. This is understandable as the articles in Quadrants 1 and 3 highlighted that diverse users and user groups are involved especially in the early parts of the innovation process. User engagement is crucial because it ensures that innovations are user-centric, capitalizing on early feedback, embracing diverse perspectives, and harnessing firsthand knowledge of challenges. This approach not only mitigates risks but also enhances problem-solving capabilities, fostering a sense of user ownership and facilitating widespread adoption (Ballon et al., 2018; Mahr and Lievens, 2012; McGann et al., 2021).

Network and ecosystem orchestration plays a significant role in innovation spaces where community-level collaboration takes place. Orchestration, in this regard, refers to the coordinating efforts made by key actors, including collaborative space coordinators or dedicated brokers (Giudici et al., 2018; Ritala et al., 2023), as well as more extensive teams with diverse facilitating roles (for review, see Hurmelinna-Laukkanen and Nätti, 2018) or the roles that companies can assume or create within ecosystems (Brea, 2023; Leminen et al., 2017b). Orchestration – as a metaphor – signifies the type of coordination that takes place in loosely coupled systems (Dhanaraj and Parkhe, 2006) – which is typical to collaborative spaces where the participants are often voluntarily involved and have their own goals and motivations. Articles placed into Quadrants 2 and 4 clearly illustrate that multi-stakeholder relationships – both in physical and virtual spaces – are an important means of collaborating, communicating, learning, and delivering value with and to others in the innovation space. Additionally, relationships act as important social resources for the future needs of participants. Therefore, a careful orchestration of such relationships is critical for the success of collaborative innovation spaces.

Third, *relational and contractual governance* was found to be a prevalent and important factor in all four quadrants. Relational governance refers to the "soft factors" such as trust and relational norms among the collaborating entities, while contractual governance relates to the "hard factors" – i.e., for instance, the role of intellectual property and the terms under which participation in the collaborative endeavors takes place (see e.g., Olander et al., 2010; Cao and

Lumieau, 2015). The article in this special issue especially highlighted trust-building as a strong linkage to the characteristics and challenges across the four quadrants. Indeed, trust and relational commitment are typically considered essential antecedents of successful relationships in any inter-personal or inter-organizational setting (Fulmer and Dirks, 2018). This result is also highlighted broadly across the articles of this special issue but pronounced with different nuances depending on the type of collaborative space and its goals. Similarly, while not as prominently featured in the articles, contractual governance as a complementary mechanism to relational issues such as trust is important to clarify the formal roles, responsibilities, and rights of the participants in collaboration innovation spaces (see e.g. Moorefield-Lang, 2015; Radniecki, 2018). Finally, Figure 2 illustrates the above-discussed findings.

4. Places and Spaces for Collaborative Innovation - Looking Forward

Overall, the articles in this Special Issue provide a novel and relevant understanding of the role of *context* in collaborative R&D and innovation in *context.* The findings discovered in the articles, as well as the aggregated insights developed in the previous section (Fig. 2), suggest numerous opportunities for further research in this area.

First, there is an opportunity to delve deeper into the distinction between place and space – as we originally endeavored in the special issue call for papers. We argue that a space turns into a place through meanings and activities that people associate with it (Tuan, 1977). For example, previous literature suggests that the collision of participants' thinking can speed up innovation activities in particular environments (Leminen et al., 2021). Similarly, the articles in this issue demonstrated how both individual and collective sensemaking are shaped in virtual spaces (e.g., Adibe et al., 2023; Ollila and Yström, 2022), or how a shared vision is communicated (Dzhengiz and Patala, 2023). All in all, the articles in this issue provided more understanding of a shared "place" where meaning-making takes place, and which affects how actors act by themselves and about each other. However, we feel that more understanding is needed on how physical and virtual spaces affect the participants' sense of belonging: collaboration motivation, and several other cognitive factors could be further studied.

Second, most of the articles in this special issue discuss innovation spaces characterized by community-level collaboration. This focus may be attributed to their heightened visibility, which could stem from their business models, necessitating the need for people to become aware of their existence. Therefore, following the recent stream of studies pursuing to explain how orchestrators and brokers can better enable collaborative innovation and knowledge sharing (e.g., Giudici et al., 2018; Ritala et al., 2023), there is a need for more studies to explain what those dynamics are and what can they accomplish in different types of physical and virtual spaces. Similarly, we need to better understand how the participants of the collaborative innovation "co-construct" the collective dynamics themselves, and negotiate the rules of using the shared resources, structures, and artifacts, for instance. Furthermore, there is also a need for further research into collaborative innovation spaces where collaboration mechanisms are designed to address the processes taking place between individual creators and innovators.

Focusing on such micro-level interactions would be useful as it can uncover more about how to engage individual users, as well as how individual users can make the largest impact and add value with their activities and interactions. Consequently, there is a need for more research on the business models associated with the different types of collaborative innovation spaces. We deem that this area is under-researched, perhaps because of the multiplicity of the types.

Finally, the articles highlighted the existence of shared goals, mental models, and purpose in both physical and virtual spaces. This calls for further research to be more mindful of the process of setting those shared goals, i.e., who is setting them, how focused those goals are, and who will benefit from them. For example, involving the elderly in collaborative innovation (see Thomas et al., 2022), serves not only the purpose of addressing the needs of elderly individuals in their daily lives but also benefits organizations seeking user-informed solutions that align better with their needs and deliver higher value to all stakeholders. Accordingly, we call for further research on collaborative R&D and innovation spaces that incorporate a variety of shared but also individual goals – including economic, social, technological, and ecological – to understand how innovation can serve the needs of a diversity of stakeholders.

References

Aarikka-Stenroos, L., Jaakkola, E., Harrison, D., and Mäkitalo-Keinonen, T. (2017). How to manage innovation processes in extensive networks: A longitudinal study. *Industrial Marketing Management*, 67(11), 88-105.

Adibe, P., Vesin, S., Almpanopoulou, A. and Blomqvist, K. (2023). A threshold for collaborative innovation: exploring the dimensions of liminality in a data economy initiative. *R&D Management*. https://doi.org/10.1111/radm.12585

Autio, E., and Thomas, L.D.W. (2014). *Innovation ecosystems: implications for innovation management.* M. Dodgson, D.M. Gann, N. Phillips (Eds.), Oxford Handbook of Innovation Management, Oxford University Press, Oxford (2014), pp. 204-22.

Baldwin, C., and von Hippel, E. A. (2011). Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation. *Organization Science*, 22(6), 1399–1417.

Ballon, P., Van Hoed, M. and Schuurman, D. (2018). The effectiveness of involving users in digital innovation: Measuring the impact of living labs. *Telematics Informatics*, *35*(5), pp.1201-1214.

Bogers, M., Zobel, A.K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S. and Hagedoorn, J. (2017). The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. Industry and Innovation, 24(1), pp.8-40.

Brea, E. (2023). A framework for mapping actor roles and their innovation potential in digital ecosystems. *Technovation*. 125, 102783.

Cao, Z., and Lumineau, F. (2015). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management*, 33, 15-42.

Capdevila, I. and Mérindol, V. (2022). Emergence of communities through interdependent dynamics of physical, cognitive and virtual contexts: The case of collaborative spaces. *R&D Management*. https://doi.org/10.1111/radm.12561

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.

Clark, A. (2008). *Supersizing the mind. Embodiment, action, and cognitive extension*. Oxford, New York: Oxford University Press.

Conaldi, G., De Vita, R., Ghinoi, S. and Foster, D.M. (2023). Virtual collaborative spaces: a case study on the antecedents of collaboration in an open-source software community. *R&D Management.* https://doi.org/10.1111/radm.12599

Dąbrowska, J., Almpanopoulou, A., Brem, A., Chesbrough, H., Cucino, V., Di Minin, A., Giones, F., Hakala, H., Marullo, C., Mention, A-L., Mortara, L., Norskov, S., Nylund, P., Oddo, C., Radziwon, A. and Ritala, P. (2022) Digital transformation, for better or worse: A critical multi-level research agenda. R*&D Management*, 52(5), 930-954.

Davis, J.P. (2016). The group dynamics of interorganizational relationships: collaborating with multiple partners in innovation ecosystems. *Administrative Science Quarterly*, 61(4), 621-661.

De Silva, M., Howells, J., and Meyer, M. (2018). Innovation intermediaries and collaboration: Knowledge–based practices and internal value creation. *Research Policy*, 47(1), 70-87.

Della Santa, S., Tagliazucchi, G. and Marchi, G. (2022). How does the space influence Living Labs? Evidence from two automotive experiences. *R&D Management*. https://doi.org/10.1111/radm.12554

Dhanaraj, C., and Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31(3), 659-669.

Dzhengiz, T. and Patala, S. (2023). The role of cross-sector partnerships in the dynamics between places and innovation ecosystems. *R&D Management*. https://doi.org/10.1111/radm.12589

Enkel, E., Bogers, M., and Chesbrough, H. (2020). Exploring open innovation in the digital age: a maturity model and future research directions. *R&D Management*, 50(1), 161-168.

Ferraro, F., Etzion, D., and Gehman, J. (2015). Tackling grand challenges pragmatically: Robust action revisited. *Organization Studies*, 36(3), 363-390.

Fichter, K. (2009). Innovation communities: the role of networks of promotors in Open Innovation. *R&D Management*, 39(4), 357-371.

Fulmer, A., and Dirks, K. (2018). Multilevel trust: A theoretical and practical imperative. *Journal of Trust Research*, 8(2), 137-141.

Füller, J., Jawecki, G. and Mühlbacher, H. (2007). Innovation creation by online basketball communities. *Journal of Business Research*, 60, pp. 60–71.

Gauttier, S., Simouri, W., and Milliat, A. (2022). When to enter the metaverse: business leaders offer perspectives. *Journal of Business Strategy*. https://doi.org/10.1108/JBS-08-2022-0149

Gawer, A., and Cusumano, M.A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3), 417–433.

Gershenfeld, N., Gershenfeld, A. and Cutcher-Gershenfeld, J. (2017). *Designing reality: How to survive and thrive in the third digital revolution*. Hachette UK.

Giudici, A., Reinmoeller, P., and Ravasi, D. (2018). Open-system orchestration as a relational source of sensing capabilities: Evidence from a venture association. *Academy of Management Journal*, 61(4), 1369-1402.

Greer, C.R., and Lei, D. (2012). Collaborative innovation with customers: A review of the literature and suggestions for future research. *International Journal of Management Reviews*, 14(1), 63-84.

Greve, K., De Vita, R., Leminen, S. and Westerlund, M. (2021) Living Labs: From niche to mainstream innovation management. *Sustainability*, 13(2), 791-816.

Greve, K., Leminen, S., De Vita, R. and Westerlund, M. (2020) Unveiling the diversity of scholarly debate on living labs: A bibliometric approach. *International Journal of Innovation Management*, 24(08), 2040003-1 – 2040003-25.

Hakkarainen, L. and Hyysalo, S. (2013) How Do We Keep the Living Laboratory Alive? Learning and Conflicts in Living Lab Collaboration, *Technology Innovation Management Review*, 3(11), 16–22.

Haukipuro, L., Väinämö, S., Virta, V. and Perälä-Heape, M. (2023). Key aspects of establishing research, knowledge, and innovation-based hubs as part of the local innovation ecosystem. *R&D Management*. https://doi.org/10.1111/radm.12584

Hausberg, J.P., and Spaeth, S. (2020). Why makers make what they make: motivations to contribute to open source hardware development. *R&D Management*, 50(1), 75–95.

Heil, S., and Bornemann, T. (2018). Creating shareholder value via collaborative innovation: the role of industry and resource alignment in knowledge exploration. *R&D Management*, 48(4), 394-409.

Helfat, C.E. and Raubitschek, R.S. (2018). Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems. *Research Policy*, 47(8), pp.1391-1399.

Hercheui, M. D. (2011). A literature review of virtual communities: the relevance of understanding the influence of institutions on online collectives. *Information, Communication & Society*, 14(1), 1-23.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*, 35(5), 715-728.

Hurmelinna-Laukkanen, P., and Nätti, S. (2018). Orchestrator types, roles and capabilities–A framework for innovation networks. *Industrial Marketing Management*, 74, 65-78.

Jarvenpaa, S.L, and Wernick, A. (2011). Paradoxical tensions in open innovation networks. *European Journal of Innovation Management*, 14(4), 521-548.

Kallinikos, J., Aaltonen, A., and Marton, A. (2013). The ambivalent ontology of digital artifacts. *MIS Quarterly*, 357-370.

Kalpaka, A., Sörvik, J. and Tasigiorgou, A. (2020). *Digital Innovation Hubs as policy instruments to boost digitalisation of SMEs: A Practical Handbook & Good Practices for regional/national policy makers and DIH Managers* (No. JRC121604). Joint Research Centre (Seville site).

Klooker, M. and Hölzle, K. (2023). A generative design of collaborative innovation space. *R&D Management*. https://doi.org/10.1111/radm.12582

Kohler, T., Matzler, K. and Füller, J. (2009). Avatar-based innovation: Using virtual worlds for real-world innovation. *Technovation*, 29(6-7), pp.395-407.

Kostis, A., and Ritala, P. (2020). Digital artifacts in industrial co-creation: how to use VR technology to bridge the provider-customer boundary. *California Management Review*, 62(4), 125-147.

Leminen, S., Nyström, A.-G., and Westerlund, M. (2020). Change processes in open innovation networks – exploring living labs. *Industrial Marketing Management*. 91, 701-718.

Leminen, S., Rajahonka, M., Westerlund, M., and Hossain, M. (2021). Collaborative Innovation for Sustainability in Nordic Cities. *Journal of Cleaner Production*. 328, 129549.

Leminen, S., Rajahonka, M., and Westerlund, M. (2017a). Towards Third-Generation Living Lab Networks in Cities. *Technology Innovation Management Review*. 7(11), 21-35.

Leminen, S., Rajahonka, M., and Westerlund, M. (2017b). Actors in the emerging Internet of Things ecosystems. *International Journal of E-services and Mobile Applications* (IJESMA). 9(1), 57-75.

Leminen, S., Westerlund, M., Nyström, A.-G., and Kortelainen, M. (2016). The Effect of Network Structure on Radical Innovation in Living Labs. *Journal of Business & Industrial Marketing*, 31(6), 743-757.

Lopes, A.V. and Farias, J.S. (2022). How can governance support collaborative innovation in the public sector? A systematic review of the literature. *International Review of Administrative Sciences*, 88(1), pp. 114–130.

Mahr, D. and Lievens, A. (2012). Virtual lead user communities: Drivers of knowledge creation for innovation. *Research Policy*, *41*(1), pp.167-177.

Mariani, L., Trivellato, B., Martini, M., and Marafioti, E. (2022). Achieving Sustainable Development Goals Through Collaborative Innovation: Evidence from Four European Initiatives. *Journal of Business Ethics*, 180, pp. 1075–1095

McGann, M., Wells, T. and Blomkamp, E. (2021). Innovation labs and co-production in public problem solving. *Public Management Review*, *23*(2), pp.297-316.

Moorefield-Lang, H. M. (2015). User agreements and makerspaces: A content analysis. *New Library World*, 116(7/8), 358-368.

Mortara, L. and Parisot, N. (2018). How do fab-spaces enable entrepreneurship? Case studies of 'makers'–entrepreneurs. *International Journal of Manufacturing Technology and Management*, 32(1), 16-42.

Moultrie, J., Nilsson, M., Dissel, M., Haner, U.-E., Janssen, S., and Van der Lugt, R. (2007). Innovation Spaces: Towards a Framework for Understanding the Role of the Physical Environment in Innovation. *Creativity and Innovation Management*, 16(1), 53–65.

Najafi-Tavani, S., Najafi-Tavani, Z., Naudé, P., Oghazie, P., and Zeynaloof, E. (2018). How collaborative innovation networks affect new product performance: Product innovation capability. *Industrial Marketing Management*, 73, 103-205.

Nambisan, S., Lyytinen, K., Majchrzak, A., and Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS Quarterly*, 41(1), 223–238.

Nevens, F., Frantzeskaki, N., Gorissen, L., and Loorbach, D. (2013). Urban Transition Labs: co-creating transformative action for sustainable cities. *Journal of Cleaner Production*, 50, 111-122.

Nie, W., De Vita, K. and Masood, T. (2023). An ontology for defining and characterizing demonstration environments. *Journal of Intelligent Manufacturing*, pp.1-21.

Nyström, A.-G., Leminen, S., Westerlund, M., and Kortelainen, M. (2014). Actor roles and role patterns influencing innovation in living labs. *Industrial Marketing Management*, 43(3), 483–495.

Oksanen, K., and Ståhle, P. (2013), Physical environment as a source for innovation: investigating the attributes of innovative space. *Journal of Knowledge Management*, 17(6), 815–827.

Olander, H., Hurmelinna-Laukkanen, P., Blomqvist, K., and Ritala, P. (2010). The dynamics of relational and contractual governance mechanisms in knowledge sharing of collaborative R&D projects. *Knowledge and Process Management*, 17(4), 188-204.

Ollila, S. and Yström, A. (2022). Political behavior in collaborative innovation spaces: outlining triggers, behaviors and shaping mechanisms. *R&D Management*. https://doi.org/10.1111/radm.12562

Peng, L., and Jia, R. (2023). Exploring the Interplay of the Physical Environment and Organizational Climate in Innovation. *Sustainability*, 15(20), 15013.

Peschl, M.F. and Fundneider, T. (2012). Spaces enabling game-changing and sustaining innovations: Why space matters for knowledge creation and innovation. *Journal of Organisational Transformation & Social Change*, 9(1), 41-61.

Peschl, M.F. and Fundneider, T. (2014). Why space matters for collaborative innovation networks: on designing enabling spaces for collaborative knowledge creation. *International Journal of Organisational Design and Engineering*, 3(3-4), pp.358-391.

Phelps, C., Heidl, R., and Wadhwa, A. (2012). Knowledge, networks, and knowledge networks: A review and research agenda. *Journal of Management*, 38(4), 1115-1166.

Phillips, N., Lawrence, T.B. and Hardy, C. (2000). Inter-organizational collaboration and the dynamics of institutional fields. *Journal of Management Studies*, *37*(1), pp.no-no.

Radniecki, T. (2018). Intellectual property in the makerspace. Journal of Library Administration, 58(6), 545-560.

Ritala, P., Agouridas, V., Assimakopoulos, D., and Gies, O. (2013). Value creation and capture mechanisms in innovation ecosystems: a comparative case study. *International Journal of Technology Management*, 63, 244-267.

Ritala, P., De Kort, C., and Gailly, B. (2023). Orchestrating knowledge networks: alter-oriented brokering. *Journal of Management*, 49(3), 1140-1178.

Ritala, P. (2023). Grand challenges and platform ecosystems: Scaling solutions for wicked ecological and societal problems. *Journal of Product Innovation Management*. https://doi.org/10.1111/jpim.12682

Tuan, Y. (1977). *Space and Place: the perspective of experience*. University of Minnesota, Minneapolis.

Thomas, E., Skeie, K.B. and Huang, H. (2022). Inclusion of elderly users via virtual spaces in the early stages of the innovation process. *R&D Management*. https://doi.org/10.1111/radm.12551

Thomas, L. D., and Tee, R. (2022). Generativity: A systematic review and conceptual framework. *International Journal of Management Reviews*, 24(2), 255-278.

Tonteri, L., Kosonen, M., Ellonen, H. K., and Tarkiainen, A. (2011). Antecedents of an experienced sense of virtual community. *Computers in Human Behavior*, 27(6), 2215-2223.

Zakoth, D., Mauroner, O. and Emes, J. (2023). The role of makerspaces in innovation processes: an exploratory study. *R&D Management*. https://doi.org/10.1111/radm.12594

Yström, A. and Agogué, M. (2020). Exploring practices in collaborative innovation: Unpacking dynamics, relations, and enactment in in-between spaces. *Creativity and Innovation Management*, *29*(1), pp.141-145.