Letter from Academia

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Future Research Avenue for Living Labs and Collaborative Innovation

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Abstract

In this letter from Academia, we aim to identify emerging research directions in the field of living labs and collaborative innovation. This paper reviews existing literature on living labs and highlights recent articles on living labs as collaborative innovation published in the special issue of the Journal of Innovation. Our goal is to stimulate further research to deepen the understanding of living labs and collaborative innovation by addressing four types of living lab studies: contextualization, holization, revitalization, and reformation. We propose four research questions for each of these research avenues. We encourage future studies to focus on the challenges and opportunities inspired by suggested research avenues and research questions within the field of living labs.

Keywords: living lab; collaborative innovation; research avenue; contextualization; holization; revitalization; reformation.

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" The only way to discover the limits of the possible is to go beyond them into the impossible."

Arthur C. Clark

1 Introduction

Living abs are gaining popularity as innovation platforms (Greve et al., 2020, 2021; Leminen et al., 2012; Ballon et al., 2018; Westerlund et al., 2018a). These platforms utilize shared resources to organize stakeholders into collaborative networks that depend on representative governance, participation, open standards, and a variety of activities and methods to gather, create, communicate, and deliver new knowledge, validated solutions, professional development, and social impact in real-life contexts (Westerlund et al., 2018b; Paskaleva & Cooper, 2021). Acting as intermediaries of open innovation, living labs connect the domains of open and user innovation and encompass three distinct but interconnected levels of analysis: the living lab organization, living lab projects, and user and stakeholder involvement activities (Hossain et al., 2019).

Living labs have demonstrated their ability to develop innovations and integrate resources to benefit diverse stakeholders in cities (Leminen & Westerlund, 2012; Nyström et al., 2014;

Leminen & Westerlund, 2019; Robaeyst et al., 2023) and to provide environmental and social improvements (Hossain et al., 2019; Nevens et al., 2013; Voytenko et al., 2016). As a result, living labs in both the public and private sectors play a vital role in fostering innovation across diverse ecosystems and industries (Gascó, 2017; Shin, 2019). They are also recognized as venues where innovations occur (Bergvall-Kåreborn et al., 2015; Della Santa et al., 2022, 2024; Leminen & Westerlund, 2019). In urban contexts, studies view cities and their neighbourhoods as platforms that enhance diverse forms of innovation (Leminen et al., 2017), especially allowing stakeholders such as municipalities and companies to open their data, needs, and operations to foster innovation and urban development (Leminen et al., 2020). Similarly, in rural, environmental, and agricultural contexts, living labs are increasingly seen as a means to accelerate the co-creation and adoption of innovations, promote sustainability, and facilitate system transitions (Gamache et al., 2020; Beaudoin et al., 2022).

This letter from academia examines the conceptual and theoretical foundations of living labs. It draws significant insights from thirteen special issue articles published in 2024 and 2025 in the Journal of Innovation Management, aiming to advance historical achievements, current developments, and future directions.

2 A Framework for Understanding the Living Lab Research Field

After a brief introduction to innovation paradigm and innovation endeavours, we present a framework to enhance the understanding of the living lab research field, based on two dimensions identified through a review of living labs: innovation paradigm ("*reductionism*" versus "*systemic*") and living lab endeavours ("*accretive*" versus "*renewal*"). In the realm of innovation, reductionism and systemic perspectives offer distinct paradigms to understanding and contextualizing innovation. The systemic perspective examines the system as a whole and the connections between its parts, which is crucial in business and innovation studies (Doz & Prahalad, 1991), whilst reductionism dissects complex systems into individual parts to comprehend their workings. By studying these parts separately, we can learn about the mechanisms and interactions that drive the entire system (Burgelman, 2011). Reductionism is beneficial in various scientific fields, including business studies, for understanding organizational and strategic processes (Eisenhardt, 1989). However, critics argue that reductionism can overlook emergent properties arising from interactions between parts (Pettigrew, 1990). By breaking down the innovation process into its individual components and studying each part in isolation, reductionism stresses the importance of understanding each element separately. It assumes that the behaviour of the entire system can be understood by summing the behaviours of its parts (Ballon & Schuurman, 2015). Typically, reductionism assumes linear interactions between components, which can oversimplify the complexity of real-world systems. This perspective is often used in more predictable and controlled environments where the interactions between parts are well understood and relatively simple (Richardson & Stephan, 2009).

Systemic management integrates different functional areas to achieve overall effectiveness and tackle complex global challenges (Senge, 1990; Mintzberg, 1994). Linkages within an ecosystem of organizations emphasize external relationships and interdependencies, fostering innovation and adaptability (Granstrand & Holgersson, 2020). They promote resource sharing, collaboration, and network effects, enhancing organizational effectiveness (Davis et al., 2020; de Vasconcelos Gomes et al., 2018). Finally, ecosystem thinking focuses on holistic value creation for all stakeholders, leading to sustainable and inclusive growth (Lindhult, 2023). According to Oxford Languages, "accretive" refers to being characterized by gradual growth or increase. Extending this definition to

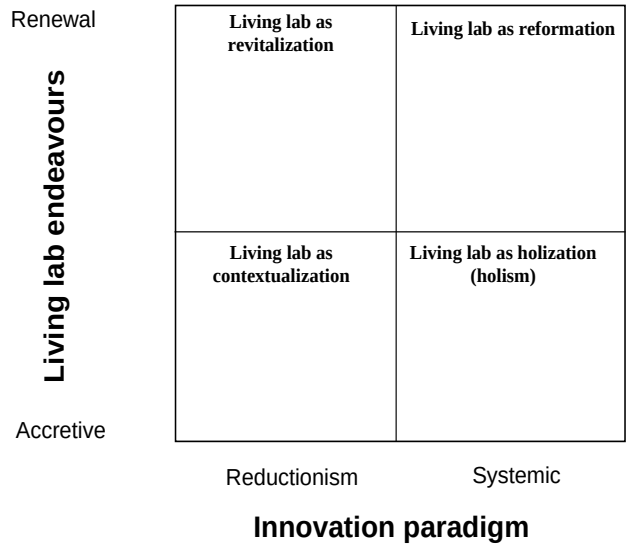

Figure 1. RSAR framework for living labs
Source: Authors

business studies, we understand that "accretive" describes business practices or strategies that lead to gradual and incremental growth or improvement over time. This often involves contemporary or modern business practices and trends, incorporating prevailing ideas, strategies, and discussions within the business community at a given time.

In essence, an accretive perspective in business focuses on steady, incremental gains that enhance overall value and performance. In contrast, "renewal" is a multifaceted concept that encompasses the revitalization or rejuvenation of something to make it new, fresh, or strong again (modified from Cambridge Dictionary and Meriam-Webster). This can involve resuming activities such as modernizing and enhancing existing systems or structures. Additionally, renewal may signify emotional rejuvenation of individuals or communities.

Figure 1 incorporates the Reductionism-Systemic-Accretive-Renewal (RSAR) Framework for living labs, also known simply as the RSAR Framework for living labs. The selected unique living lab types should not be interpreted as indicating that one type is superior to another; rather, they illustrate the role of the chosen paradigm and the endeavors of each living lab. Next, we provide a brief explanation of the diversity of living labs (see Fig. 1).

Living lab as contextualization adopts a reductionism perspective to frame its current activities. Typically, this involves breaking down the innovation process into individual components and examining each part separately to gain a thorough understanding. The studies, which adopt the perspective of a living lab for contextualization, emphasize the various contexts and roles within the overall system. For example, Bary et al. (2024) view living labs as user-centric, open-innovation environments that improve the acceptability of products and services through stakeholder collaboration and focusing on specific variables without considering the interconnectedness of broader systems. While Leminen (2013) study coordination and participation in living lab. Living labs design and test solutions in real-world settings, focusing on the unique needs, characteristics, and cultural contexts of the local community (Bergvall-Kåreborn et al., 2009). They engage local stakeholders in the co-creation process, ensuring that innovations are relevant,

adaptable, and culturally sensitive (Følstad, 2008). By leveraging contextual data and continuous feedback, living labs strive to develop sustainable and effective solutions that are deeply integrated into the specific environment or context they serve (Hossain et al., 2019). Although reductionism can efficiently address well-defined problems with clear boundaries, it may struggle with complex, interconnected issues (Leal Filho et al., 2022; Voytenko et al., 2016).

Living lab as holization adopts a systemic perspective on innovation and focuses on accretive innovation endeavours. Holization addresses complex systems or phenomena by recognizing and integrating the interconnectedness and interdependence of all parts within a whole, ensuring that the whole is greater than the sum of its parts. Systemic thinking recognizes that new properties and behaviours can emerge from these interactions, which cannot be understood by examining individual parts alone (Gharajedaghi, 2011). This approach aligns well with the principles of living labs, which emphasizes real-life experimentation, user co-creation, and iteration to address complex, adaptive challenges (Ballon & Schuurman, 2015; Leal Filho et al., 2022; Voytenko et al., 2016). Typically, living labs consider the innovation process in its entirety, emphasizing the interactions and relationships between different components within an ecosystem. For example, Leal Filho et al. (2022) highlight the importance of the multidisciplinary nature of living labs to maximize their impact. Their study underscores the interactions and relationships between various components within the ecosystem, focusing on quality education and sustainable cities and communities. Zivkovic (2018) describes how addressing "wicked problems" involves adopting a place-based and transition approach. This approach facilitates coherent action among diverse actors, involves users as co-creators, and supports networked governance and aids in understanding and addressing the complex interdependence within the innovation ecosystem. Valkokari et al. (2024) highlighted the need to understand impacts beyond short-term techno-economic outcomes, focusing on long-term systemic and societal renewal. Consequently, they suggested a comprehensive impact indicator framework to ensure ecosystem success. Rojas Gómez et al. (2025) use a systemic perspective to show that the biocultural approach reveals non-human components, beside human, as active participants in innovation, not just passive resources.

Living lab as revitalization adopts a reductionism view and focuses on renewing its efforts in various accretive ways by deconstructing innovation endeavors into manageable components, incorporating advanced technologies, and implementing innovative solutions to tackle both current and future challenges, thereby renewing living lab activities. Such studies break down the innovation process into smaller, manageable parts to thoroughly understand each component (Bergvall-Kåreborn et al., 2009). To revitalise, the living lab integrates advanced technologies such as quantum computing to enhance its capabilities (Leminen et al., 2023) and adopts ideas such as analyzing social contracts and power relations for collective problem-solving (John, 2024). These living labs introduce innovative solutions that go beyond projects, addressing emerging challenges and exploring deeper engagement and new opportunities, such as developing advanced flood management systems and resilient infrastructure to better adapt to climate change impacts (UNaLab Handbook, 2020). Activities include implementing smart city technologies to tackle urban issues like traffic congestion, energy management, and public safety (Leminen et al., 2020; Greve et al., 2021), engaging in cross-sector partnerships to combine expertise from different fields (Leminen & Westerlund, 2012), and adopting new methodologies to quickly iterate and improve solutions based on real-time feedback from stakeholders (Leminen & Westerlund, 2017). By incorporating these innovative novelties, the living lab not only addresses needs but also anticipates and prepares for future opportunities, ensuring its endeavours remain relevant and impactful (Bary

et al., 2024; Leminen et al., 2020, 2023).

Living lab as reformation adopts a systemic perspective to continuously reform its efforts, integrating various processes and considering social, environmental, and economic factors to address complex challenges and drive comprehensive systemic change, ultimately achieving innovative solutions. For example, Voytenko et al. (2016) highlight the importance of managing complex urban interactions to create sustainable and adaptable solutions by focusing on the interdependencies among stakeholders, technologies, and infrastructure. Such living labs emphasize the importance of fostering collaboration among diverse stakeholders to drive systemic innovation (Edwards-Schachter, 2019). Secondly, they highlight the integration of various innovation processes and stakeholders to achieve holistic outcomes (Bergvall-Kåreborn et al., 2009). The living labs focus on co-creation, where systemic innovation is achieved through collaborative efforts (Følstad, 2008). A living lab as reformation reflects the comprehensive nature of addressing complex challenges through systemic and inclusive innovation approaches (Greve et al., 2021). Living labs consider various aspects of the system, such as social, environmental, and economic factors (Leal Filho et al., 2022). Bary et al. (2024) emphasize that this process is steered by facilitators, enriched by user insights, and bolstered by researchers generating new understandings and revitalizing living labs and their theories. (pp. 215, 220). Beckett and O'Loughlin (2024) framed living lab operations using socio-technical and cultural-historical models, viewing Australian living labs as systems within a broader ecosystem. Rosetti et al. (2025) also view living labs as interconnected systems within broader ecosystems when focusing on general definitions and applications within the cultural and heritage sector.

3 Conclusions

By fostering collaboration and innovation, living labs can effectively address complex urban challenges and promote sustainable development. This letter aims to underscore the significance of interdisciplinary approaches and community engagement in crafting impactful solutions. To this end, we propose four research questions for each of the identified research avenues of living lab studies—contextualization, holization, revitalization, and reformation (see Fig. 2). These questions aim to support both scholars and professionals engaged in living labs.

3.1 Future Research Avenues for Living Labs as Contextualization

The living labs as contextualization employ reductionism to structure its activities by breaking down the innovation process into individual components. This facilitates thorough examination and comprehensive understanding. Gradual improvements enhance research opportunities and serve the stakeholders of living labs, thereby strengthening the theoretical focus of living lab research.

How does the reductionism perspective impact the innovation activities in living labs?

Understanding the impact of reductionism on innovation activities within living labs is essential, as it can uncover both the advantages and drawbacks of this approach. While reductionism facilitates a detailed analysis of individual components, it may overlook the complexity and interconnectedness of broader systems. Examining this impact can aid in optimizing innovation strategies, ensuring they are both comprehensive and effective. Such research is significant because it leads to the further development of innovation activities that address the multifaceted nature

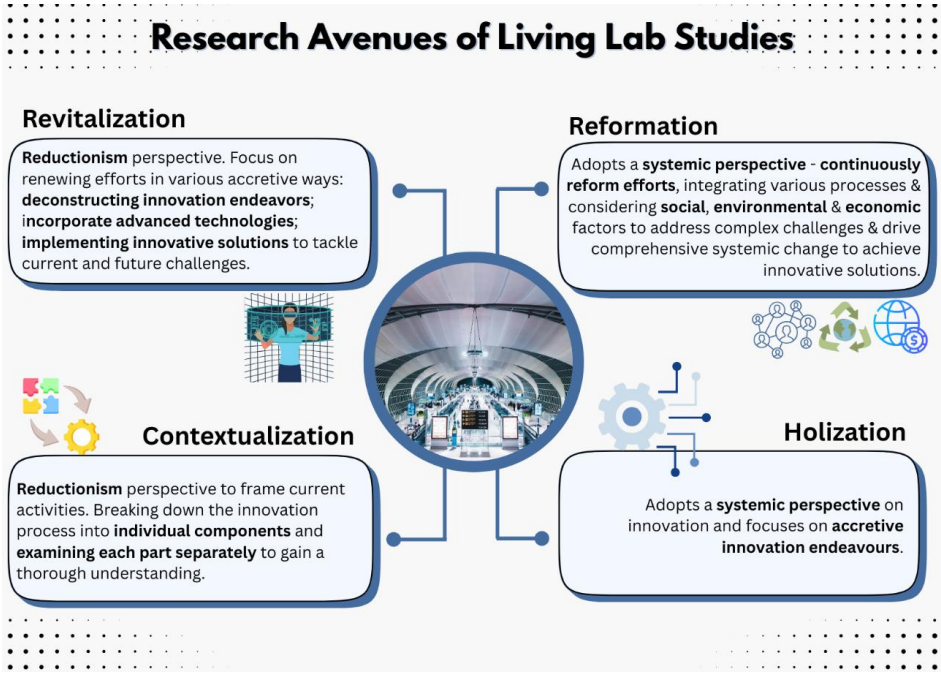

Figure 2. Research avenues of living lab studies

of real-world problems. Ultimately, this can enhance the overall effectiveness of living labs in promoting innovation.

What are roles stakeholders make and take in the co-creation process in living labs?

Exploring the roles of local stakeholders in the co-creation process is essential because their involvement ensures that innovations are relevant and culturally sensitive. Stakeholder collaboration enhances the acceptability and success of new products and services. By understanding these roles, researchers can improve the effectiveness of living labs in real-world settings. Such research is important as it highlights the value of integrating the unique needs and characteristics of the local community into the innovation process. It can lead to more sustainable and impactful innovations that are better suited to the specific contexts they serve.

How can living labs leverage contextual data and continuous feedback to develop sustainable solutions?

Investigating how living labs can leverage contextual data and continuous feedback is vital for developing sustainable solutions. Contextual data provides insights into the specific environments served by living labs, while continuous feedback allows for the refinement and adaptation of solutions to meet evolving needs. Such research is relevant as it can contribute to the development of more impactful living lab initiatives. Understanding these mechanisms is crucial for creating adaptive and resilient solutions that are deeply integrated into the local context. This can enhance the overall effectiveness and sustainability of living labs.

What factors contribute to the success of industry-focused Living Labs in transforming various sectors?

Understanding the elements that drive the success of industry-focused Living Labs is essential for achieving sustainability, climate adaptability, economic stability, and social equity. These labs play a pivotal role in empowering communities and enhancing performance across ecological, economic,

and social dimensions. Investigating these factors is crucial as it can optimize the effectiveness of Living Labs, ensuring they deliver impactful and transformative initiatives. This research is relevant because it addresses the urgent challenges faced by contemporary industries, providing insights that can lead to profound and lasting improvements. Ultimately, identifying these driving elements can help develop innovative solutions that are both sustainable and responsive to the needs of diverse sectors.

3.2 Future Research Avenues for Living Labs as Holization

Living labs as holization adopt a systemic perspective on innovation emphasizing accretive endeavors. Systemic thinking acknowledges that new properties and behaviors emerge from interactions within the system, which cannot be fully understood by examining individual components in isolation. Consequently, this paper proposes four research questions to further explore these dynamics.

How does shifting from examining individual components to systemic thinking change living lab research?

Investigating this shift is crucial as it emphasizes viewing living labs as interconnected components rather than isolated entities. This perspective enhances understanding of the effects of various variables on the living lab by broader system, enabling researchers to develop more comprehensive and effective strategies. Recognizing this interconnectedness can lead to more impactful and sustainable innovations, contributing to long-term systemic change. Additionally, this approach aligns with the principles of real-life experimentation and user co-creation, which are central to living labs. Ultimately, adopting systemic thinking can significantly improve the overall effectiveness and relevance of living lab research.

What is systemic perspective(s) of innovation activities in living labs?

Investigating the enhancement of innovation processes through systemic perspectives is crucial because it acknowledges the emergence of new properties and behaviours from interactions within the innovation ecosystem. This approach aligns with the principles of living labs, which emphasize real-life experimentation, user co-creation, and iterative processes to tackle complex, adaptive challenges. Understanding how systemic perspectives contribute to innovation can provide valuable insights into optimizing these processes, leading to more effective and holistic strategies. This research is important as it addresses the multifaceted nature of real-world problems, ultimately improving the overall impact and success of living labs.

How can living labs effectively address "wicked problems" through place-based and transition approaches?

Addressing "wicked problems" through place-based and transition approaches in living labs is vital because these complex issues require coherent action among diverse actors and support networked governance. By involving users as co-creators, living labs can manage complex interdependencies within the innovation ecosystem. Investigating these approaches can provide valuable insights into developing strategies that are responsive to local contexts and adaptive to changing conditions. Such research is crucial as it enhances the effectiveness of living labs in solving complex societal challenges, leading to more resilient and adaptive solutions.

What role does non-human actors play in living labs?

Examining the collaboration between non-human and human actors in living labs is crucial as it combines diverse expertise to solve complex issues. The diversity of actors emphasizes the interactions and relationships among various stakeholders within the ecosystem, promoting a more

comprehensive understanding of the innovation process. Studying how different actors contribute to living labs can uncover best practices for effective collaboration. Such research is important as it can improve the capacity of living labs to address multifaceted challenges, resulting in more impactful outcomes.

3.3 Future Research Avenues for Living Labs as Revitalization

Living labs, viewed through the lens of revitalization, adopt a reductionist perspective by breaking down innovation endeavors into manageable components. They incorporate advanced technologies and implement innovative solutions to address current and future challenges. Consequently, this paper proposes four research questions to further explore these dynamics.

How does the integration of advanced technologies, such as artificial intelligence and quantum computing, enhance the capabilities of living labs?

Investigating the integration of advanced technologies is crucial because it can significantly enhance the capabilities of living labs. Quantum computing, for example, offers unprecedented computational power that can solve complex problems more efficiently. Understanding how these technologies can be incorporated into living labs can lead to innovative solutions that address both current and future challenges. Such research is important as it can help living lab research stay at the forefront of technological advancements, ensuring their activities remain relevant and impactful. Ultimately, this can drive the continuous renewal and improvement of living lab initiatives.

How do the social dynamics and stakeholder engagement enhance the effectiveness of living labs?

Investigating the social dynamics and stakeholder engagement is crucial because it ensures that living labs address the needs and expectations of all involved actors. Analyzing social contracts and power relations within living labs can reveal their role in collective problem-solving. Understanding how stakeholder engagement can be integrated into living labs can provide insights into improving their effectiveness. Such research is important as it can lead to more inclusive and participatory innovation processes. By fostering social inclusion, living labs can achieve more significant and impactful results.

How do smart city technologies implemented in living labs address urban issues like traffic congestion, energy management, and public safety?

Investigating the implementation of smart city technologies in living labs is important because it tackles pressing urban issues. Technologies such as traffic management systems, energy-efficient solutions, and public safety enhancements can significantly improve the quality of urban life. Understanding how these technologies can be integrated into living labs can provide insights into optimizing urban management. This research is crucial as it may lead to more efficient and sustainable urban solutions. By addressing these issues, living labs can contribute to the development of smarter and more livable cities.

What impact do innovative solutions, such as advanced flood management systems, have on the adaptability of living labs to climate change?

Exploring the impact of innovative solutions on the adaptability of living labs to climate change is essential because it addresses emerging environmental challenges. Advanced flood management systems and resilient infrastructure are critical for mitigating the impacts of climate change. Understanding how these solutions can be implemented within living labs can provide valuable

insights into enhancing their adaptability. Such research is crucial as it can lead to the development of more effective strategies for climate resilience. By addressing these challenges, living labs can contribute to sustainable urban development and environmental protection.

3.4 Future Research Avenues for Living Labs as Reformation

Living labs, viewed through the lens of reformation, adopt a systemic perspective to continuously refine their efforts. By integrating diverse processes and considering social, environmental, and economic factors, they address complex challenges and drive comprehensive systemic change. This paper proposes four research questions to further investigate living labs from the perspective of reformation, aiming to benefit both academics and practitioners interested in Living Lab research.

How do living labs integrate social, environmental, and economic factors to address complex challenges and drive systemic change?

Investigating the integration of social, environmental, and economic factors is crucial as it enables living labs to address multifaceted challenges comprehensively. This aligns with systemic thinking, which recognizes the interdependencies among various components within the innovation ecosystem. Understanding how living labs incorporate these factors can provide insights into developing holistic solutions that drive systemic change. Such research is important as it can enhance the effectiveness of living labs in creating sustainable and adaptable solutions. Ultimately, it can lead to more impactful and long-lasting innovations.

How living labs do apply socio-technical system models to enhance their operations and outcomes?

Investigating the application of socio-technical system models is crucial because it provides a framework for understanding the interactions between social and technical components within living labs. These models can guide the design and implementation of living lab activities, ensuring that they are both comprehensive and effective. Understanding how living labs can apply socio-technical system models can provide valuable insights into optimizing their operations. This research is important as it can enhance the ability of living labs to address complex challenges. By adopting these models, living labs can achieve more impactful and sustainable outcomes.

What role does stakeholder collaboration play in fostering systemic innovation within living labs?

Exploring the role of stakeholder collaboration is essential because it brings together diverse expertise to address complex problems. Collaboration among stakeholders can lead to innovative solutions that are more comprehensive and effective. Understanding how stakeholder collaboration can be fostered within living labs can provide valuable insights into optimizing these efforts. This research is crucial as it can enhance the ability of living labs to tackle multifaceted challenges. By leveraging diverse perspectives, living labs can achieve more significant and sustainable outcomes.

How can living labs utilize co-creation processes to achieve holistic innovation outcomes

Investigating the utilization of co-creation processes is important because it involves collaborative efforts to achieve systemic innovation. Co-creation allows for the integration of diverse insights and expertise, leading to more comprehensive solutions. Understanding how living labs can effectively implement co-creation processes can provide valuable insights into optimizing these efforts. Such research is crucial as it can enhance the ability of living labs to address complex challenges. By fostering collaborative innovation, living labs can achieve more impactful and sustainable outcomes.

We hope this Letter from Academia serves as a source of inspiration for both researchers and practitioners engaged in the exciting and impactful field of living labs.

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