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From Policy to Practice: Social Innovation and Systemic Transformative Governance Boosting Science, Technology and Innovation Through Living Labs

Research Paper

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Abstract: **Research purpose.** The conceptual framework for this study is grounded in third-generation innovation policies, often referred to as transformative or mission-oriented, which aim to tackle complex societal challenges posed by the Triple Transition through systemic innovation. Systemic governance frameworks are underpinned by multi-dimensional transformative social innovation (SI) with Living Labs (LLs) serving as platforms and mechanisms to identify and prioritise actors' needs and challenges. Encompassing SI, systemic governance and next-generation LLs can better support the definition of STI policies to effectively respond to real community/context-driven demands, addressing persistent European competitiveness issues (e.g. the European Paradox of Innovation, which refers to the difficulty of translating scientific advancements into viable innovations). The driving research question is how social innovation can create tailored STI policies to address specific challenges in regional and national innovation ecosystems through the next-generation LLs.

Design / Methodology / Approach. This study adopts a qualitative research methodology to explore the role of social innovation in shaping the next generation of LLs and their capacity to create tailored STI policies. Given the complexity of multi-actor innovation ecosystems, qualitative methods are well-suited for capturing nuanced perspectives, contextual dynamics and transformative governance processes across diverse regional and national settings. The research follows a case study approach, examining initiatives of varying maturity in different geographical and socio-cultural contexts. Purposeful and snowball sampling techniques identify key actors and initiatives prioritising diversity and representativeness. Data collection consists of 24 semi-structured in-depth interviews with experienced and emerging leaders involved in collaborative innovation initiatives.

Data analysis employs advanced keyword coding using Atlas.ti, enabling a systematic exploration of key themes and patterns that inform the development of tailored STI policies within diverse innovation ecosystems.

Findings. This research provides a comprehensive understanding of how SI contributes to the evolution of next-generation Living Labs, identifying key governance models, co-creation mechanisms and multi-stakeholder engagement strategies that enhance policy adaptability and responsiveness to local challenges. The findings will likely reveal best practices in integrating SI into policy design and implementation, offering insights into effective collaboration among public, private, academic and civil society actors (quadruple or n-helix cooperation).

Originality / Value / Practical implications. The research will contribute to the broader discourse on innovation governance and provide actionable recommendations for policymakers seeking to enhance regional and national STI frameworks through socially driven innovation approaches.

Keywords: *Social Innovation • Systemic Transformative Governance • Next-generation Living Labs • Triple Transition • Science Technology Policies*

JEL codes: code 1; code 2 (system can be found on the website of the American Economic Associationhttps://www.aeaweb.org/econlit/jelCodes.php)

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Introduction

The growing complexity of global challenges—ranging from climate change and digital transformation to social inequality—requires new approaches to science, technology, and innovation (STI) policy. Traditional top-down models of policy design often fail to capture the diversity of societal needs and the dynamic character of technological change. In this context, Living Labs (LLs) have emerged as critical intermediaries between STI policies and the pursuit of social, environmental and technological impact, the triple transition (Caro-Gonzalez, 2023a).

Living Labs, as described by Westerlund, Nyström and Leminen, are "physical regions, virtual realities, or interaction spaces, in which stakeholders form public–private–people partnerships (4Ps) of companies, public agencies, universities, users and other actors, collaborating for creation, prototyping, validating and testing of new technologies, services, products and systems in real-life contexts" (Leminen et al., 2020). Their value lies in creating arenas for experimentation where diverse actors can collectively address systemic challenges, co-develop solutions and generate context-sensitive knowledge that bridges the gap between policy and practice.

This participatory and experimental character positions LLs as a promising vehicle for transformative governance, an approach that seeks to reconfigure institutional structures and processes to enable systemic change and just transitions. LLs make it possible to test and adapt STI strategies in ways that are inclusive, adaptive and responsive to local realities by embedding co-creation in real-world environments. Against this backdrop, the present paper explores the potential of LLs to support the co-creation of STI policies in different contexts (e.g., Belgium, Chile, Denmark, Estonia, Philippines, Spain, etc.), with a particular focus on how multi-actor collaboration mechanisms, dynamics and impacts can be structured and sustained.

The aim of this paper is to understand, conceptualise and assess how LLs, informed by social innovation, facilitate multi-actor collaboration and transformative governance in the co-creation of STI policies across diverse contexts. Particular attention will be paid to the mechanisms, dynamics and impacts of multi-actor collaboration in tailoring innovation policies to regional and national challenges. The driving research question is: How does social innovation (SI) influence the development of next-generation LLs to create tailored STI policies that address specific challenges in regional and national innovation ecosystems?

There is a growing recognition of the need for systemic, transformative approaches that transcend conventional policy frameworks, as traditional STI policies often fall short in addressing the complex, multifaceted global challenges. The research examines next-generation LLs, informed by quadruple, quintuple and n-helix models, as vital instruments for enacting transformative governance in STI policies.

The quadruple helix model expands the traditional triple helix of university-industry-government interactions by incorporating civil society, stressing the role of public engagement and societal needs in innovation processes. The quintuple helix integrates advocates for sustainable development. These models provide a more holistic framework for understanding and fostering innovation that is inclusive, participatory and environmentally conscious.

LLs facilitate co-creation, real-world experimentation and iterative development by bringing together diverse actors in collaborative settings. Despite the theoretical appeal of these models, there is a paucity of empirical research examining how they operate in practice in diverse global contexts. To address this gap, this study employs a qualitative research design, conducting 24 semi-structured, in-depth interviews with key actors from various innovation ecosystems and initiatives worldwide.

Literature review

The conceptual framework for this study is grounded in third-generation, mission-oriented innovation policies (Edler et al., 2025; Haddad et al., 2022; Mazzucato, 2018), which address complex societal challenges through systemic innovation. This approach integrates complementary innovations within ecosystems, generating transformative solutions. LLs serve as intermediaries bridging societal needs and technological advancements while promoting Responsible Innovation (Fauth et al., 2024; Widjaja, 2023). Transformative governance (Caro-Gonzalez, 2023b; Loorbach & Kemp, 2003) facilitates multi-level, place-based transformations aligned with community and regional priorities (e.g. community– I1-PE, I5-MX, I12-ES, I15-ES; territory–I7-PL, I8-ES, I13-ES, I21-ES, I22-ES; city– I3-EE, I6-DE, I20-JP). Historical lessons from early innovation ecosystems, such as Silicon Valley and the Cambridge

Phenomenon, illustrate how foundational network structures, university-industry collaboration, and entrepreneurial culture shaped the conditions for sustained innovation, providing a basis for contemporary ecosystem development and Living Lab initiatives (Piqué et al., 2018). For reasons of confidentiality, interview excerpts are referenced using anonymised codes corresponding to the "Code" column in Table 1, ensuring participant privacy while allowing consistent citation throughout the text.

Table 1. List of 24 in-depth interviews conducted (Source: Eoh-for-Good©).

Code	Location	Scope	Gender	Fields	Target groups
European setting					
I3-EE	Estonia	National	F	Cultural & Creative Industries (CCIs), museums, development, intergenerational use of media, digitalisation	Society, public admin. & local culture preservation
I4-BE	Belgium	International	F	Education, inclusion, integrity, common language, social movements	Youth, academia
I6-DE	Germany	Regional	M	Economy, innovation, startups, advanced technology, health, civic engagement	Public administration, ministry, civil society
I7-PL	Poland	European	M	Territorial development-rural/urban, civic participation and participatory practices, CCIs	Culture institution, civil society
I8-ES	Spain	Regional	M	Helix participation, innovation, universal systems, research and innovators, governance	Innovation ecosystems, connection & collaboration helices
I9-NO	Norway / Romania	International	F	Sustainable innovation, engineering, education, tech transfer, gender, health technology	Academia, women, society
I10-NL	Netherlands	International	M	Ecosystem redesign, blockchain technology	Business, academia, technology
I11-DK	Denmark	National	M	Techno-antropology, fire & security technologies, information and communication technologies (ICT)	Society, public administration
I12-ES	Spain	Regional	F	Inclusion, integration, diversity, social change, education	Civil society, territory balance, public administration
I13-ES	Spain	National	M	Politics, re-urbanisation of rural areas, territorial and social innovation	Civil society, public sector, government, policy makers
I14-CH	Switzerland	International	M	Sustainable energy, electrification of transport, energy policy, urban regeneration, knowledge & tech transfer	Researchers, policymakers, energy & sustainable experts
I15 - ES	Spain	International	M	Youth, civic and non-political organisations dedicated to improving society: society helix	Young activists, innovation managers and civic entities
I18-BE	Belgium	European	M	EU and innovation policies, Regional Development & Cohesion policy, economic development, public & strategic communication	EU policymakers and institutions, regional/local governments, civil society, academics/research institutions
I21-ES	Spain	Regional	F	Basque economy, family business management, entrepreneurship, economic development, resilience and crisis management	Entrepreneurs, civil society, business leaders, researchers in the regional economy
I22-ES	Spain	National	M	Basque economy & regional development, economic impact of terrorism and political violence, public policy and governance in the BC, social ethics and civic responsibility	Regional policymakers, public administration, media and opinion leaders, NGOs
I24-ES	Spain	Regional	F	Educational leadership, school management, positive school climate, democratic citizenship education, community engagement, diversity and inclusion, educational governance	Educational policymakers & institutions, youth, civil society, NGOs, teachers, training institutions & facilitators
International setting					
I1-PE	Peru	National	F	Gender Intersectional approach, Entrustment of women	Women, Society
I2-CL	Chile	National	M	Technology Education, Social Sustainability	Society, academia, public policy makers

(*continued*)

Table 1. Continued

Code	Location	Scope	Gender	Fields	Target groups
I5-MX	Mexico	National	M	Digitalisation, AI, technology, culture, language inclusion, innovation and indigenous practices	Indigenous communities, civil society
I16- PH	Philippines	National	F	Education, youth engagement and volunteer work: Society Helix	Non-profit organisations, education
I17 - JP	Japan	National	F	Economic cooperation, Public administration	Public administration, OECD, academia,
I19-RO	Romania / UK / Taiwan	International	M	Youth rights, education and youth empowerment, diversity and inclusion, political science, public policy and social justice, social impact	Youth, educators in political science, NGOs, policymakers, HE stakeholders, international organisations
I20-JP	Japan	International	F	Science & technology policy, public policy and governance, STI strategy, circular economy & resource efficiency	Policymakers, academics, innovators, international bodies, educators and industry leaders
I23-KR	South Korea	International	F	Living labs, EU research & innovation policy, HE programme, education, entrepreneurship	Civil society, NGOs, policymakers, innovation hubs

Emerging in the 1990s, LLs have integrated open innovation principles to inform product and service development, offering a valuable methodology for shaping STI policy frameworks (Leminen et al., 2012; Leminen et al., 2020). A Living Lab is a user-centred, open-innovation ecosystem that enables stakeholders to co-create solutions in real-life contexts. According to Leminen et al. (2020), LLs are innovation networks characterised by a natural setting, multiple stakeholders, diverse methods, a medium- to long-term perspective, user-centricity and infrastructure. This definition is supported by Schuurman et al. (2013), who describe LLs as innovation networks with six defining elements: a natural setting, multiple stakeholders, multiple methods, short- and long-term views, user-centricity and infrastructure. Additionally, Hossain et al. (2019) highlight that LLs are physical or virtual spaces where various stakeholders collaborate to address societal challenges, particularly in urban areas. Furthermore, Tercanli and Jongbloed (2022) conducted a systematic review of 93 university-governed LLs, revealing how higher education institutions implement and manage these labs to align with their core missions of education, research and social engagement. Emerging fields are increasingly contributing to shaping a more human-centred digital society by experimenting with novel approaches to innovation and societal transformation. Among these, various forms of experimental environments—such as Living Labs, Fab Labs, Collaboratories, Superlabs and Policy Labs—have proliferated as key actors within evolving innovation ecosystems (Serra et al., 2014). These “labs” serve as spaces for co-creation, experimentation and participatory engagement, aiming to reconfigure how innovation is conceived and implemented across multiple domains of society. Collectively, the concept of “the Lab” means a broader paradigm shift, representing a constellation of decentralised and often loosely connected initiatives that together suggest the emergence of a new social infrastructure. This evolving landscape is paralleled by the development of interdisciplinary fields such as techno-anthropology and techno-sociology, which seek to integrate insights from social sciences with design and technological development. These disciplines reinforce the lab-based innovation ethos by emphasising the importance of contextual, ethical and human-centric considerations in the design and governance of sociotechnical systems.

Recent advances in the field of STI development have stressed the importance of understanding LLs’ contribution, as they provide real-world environments in which policies and innovations can be tested, adapted and refined in collaboration with multiple stakeholders—including policymakers, researchers, businesses and citizens (OECD, 2024). LLs reduce the risk of mismatches between policy objectives and societal needs by fostering co-creation and continuous feedback, while enhancing legitimacy and trust in STI strategies. In this way, they strengthen the adaptability and evidence base of policies, ensuring that STI systems remain flexible and better equipped to respond to emerging societal challenges. Fauth et al. (2024) introduced the concept of “LLs as innovation orchestrators,” underlying their role in coordinating stakeholder networks within the Quadruple Helix framework. This orchestration operates across multiple levels, with particular emphasis on the organisational level, where LLs assume responsibilities for managing, monitoring and aligning diverse innovation initiatives.

Carayannis and Campbell (2021) argue that the success of innovation ecosystems depends on the interaction between actors from the Quadruple and Quintuple Helix models and the policy environment, which is essential for fostering systemic innovation and developing new practices in STI policies for transition. They argue that democracy acts as an "innovation enabler," creating a participatory space where knowledge is co-created and shared among stakeholders. In this context, the democratic interplay between actors and the policy environment becomes a crucial mechanism through which STI policies can adapt and respond to emerging challenges. In the Quintuple Helix model, environmental considerations are not merely externalities but foundational elements. Ecology and climate concerns serve as constraints and as catalysts for innovation (Cui & Yang, 2025; Görg et al., 2017), further reinforcing the systemic nature of the transformation that LLs aim to support.

LLs have garnered attention across a wide range of fields and sectors due to their perceived capacity to deliver multifaceted benefits to diverse stakeholder groups. Their participatory and user-centred approach positions them as promising platforms for collaborative innovation. LLs serve as dynamic platforms involving diverse stakeholders (Compagnucci et al., 2021), facilitating democratic participation and fostering ecological consciousness. This collaborative environment enhances the responsiveness and adaptability of STI governance. The inclusion of fifth helix actors supports the operationalisation of systemic, responsive approaches to the triple transition—social, green and digital—as outlined by Caro-Gonzalez (2023a), addressing both local and '*glocal*' challenges in support of human and planetary well-being.

However, despite their potential, maintaining long-term stakeholder engagement remains a significant challenge. This is illustrated by the deceleration or discontinuation of several LL initiatives across Europe, often attributed to difficulties in sustaining collaboration and managing complex actor dynamics. Consequently, a nuanced understanding of participants' expectations, motivations, and contributions is essential for their long-term viability and effectiveness. Such insight can inform the design of more resilient governance structures and engagement strategies, ultimately enhancing the sustainability and impact of LLs within innovation ecosystems (Nguyen & Marques, 2021; Vrontis et al., 2021).

Multi-stakeholder engagement in LLs follows a continuous cycle: initial mobilisation shaped by stakeholder expectations, followed by coordination, communication and evaluation during implementation and a final phase where stakeholders assess their experience in an interdisciplinary way (Fonseca Peso et al., 2020; I11-DK; Nguyen & Marques, 2021). According to the OECD recommendations (OECD, 2024), there is a need for new policy approaches to promote the engagement and collaboration of stakeholders in STI.

Accelerating the triple transition requires cross-sectoral and interdisciplinary collaboration, alongside enhanced development and diffusion of underutilised green technologies. This demands stronger linkages between research and industry, as well as international cooperation to foster disruptive innovation. While governments play a key role in orchestrating socio-economic visions and aligning stakeholders, their success depends on contributions from industry and research ecosystems. Equally critical is citizen engagement, as behavioural shifts and public acceptance are essential for technological and organisational innovations to succeed.

The application of LLs to thematic policy domains gives place to a novel typology of LLs that we have nominated the Eoh-Living Lab proposal, as they integrate transversal, problem-oriented perspectives (the horizontal line of the T) with sector-specific depth (the vertical line of the T). Within this emerging model, the cultivation of multi-faceted competences is essential. This entails the enrichment of domain-specific expertise through the incorporation of interdisciplinary and transdisciplinary skills, enabling actors to navigate complex policy challenges more effectively. As Carayannis and Campbell (2021) argue, creativity and creative competences play a pivotal role in driving innovation processes, which in turn underpin the development of the knowledge society, economy and democracy. In this context, the integration of arts and artistic research components of advanced innovation systems contributes to the generation of new ideas and to the expansion of interpretative and reflexive capacities among stakeholders. Furthermore, the role of emerging technologies should be understood as a complementary force that enhances human cognitive capabilities.

Building on the gaps identified in the literature, this study aims to examine how Living Labs contribute to the development of innovation ecosystems. To address this aim, we adopt a multi-source qualitative design combining desk research, Living Lab data and semi-structured interviews. This approach allows us to capture both the contextual dynamics of collaborative environments and the individual perspectives of stakeholders, thus providing a robust foundation for the methodological choices detailed in the following section.

Research methodology

This study adopts a qualitative research methodology to explore the role of social innovation in shaping the next generation of LLs (e.g., quadruple/n-helix, Eoh-Living Lab proposal-T-shaped) and their role and capacity to create tailored STI policies. Given the complexity of multi-actor innovation ecosystems, qualitative methods are well-suited for capturing nuanced perspectives, contextual dynamics and transformative governance processes across diverse regional and national settings. Three types of data were used in this study: desk research to establish the state of the art, Living Lab data derived from observational records of participants' interactions within the real-life collaborative environment, and interview data consisting of self-reported experiences, perceptions, and reflections collected through semi-structured interviews.

The research follows a case study approach, examining initiatives of varying maturity in different geographical and socio-cultural contexts. The sample design prioritises diversity and representativeness, encompassing cases from Europe, America and Asia, with additional insights from Africa through experts collaborating in specific undertakings. Purposeful and snowball sampling techniques have been employed to identify and select key actors and initiatives, ensuring consistency with the research objectives.

Interviews were conducted in person or online via Google Meet, depending on participants' availability, and all sessions were audio-recorded with prior informed consent. Face-to-face interviews were documented using mobile recording devices. Participants were purposely selected for their expertise in Living Labs and innovation ecosystems through professional networks, conferences and social media outreach. A semi-structured interview guide focused on innovation ecosystems and was flexibly applied to each participant's context. Interviews lasted 45–75 minutes, providing rich, context-sensitive data for comparative analysis. The semi-structured, in-depth interviews were designed around a set of WH-questions to ensure comprehensive exploration of the research topic. Specifically, the interviews addressed four fundamental questions: why new approaches to STI policies are necessary, who the key actors involved in transformative processes are, how these processes are organised and implemented, and what types of Living Lab initiatives are most suitable and achievable. Using WH-questions allowed for a flexible yet systematic approach, guiding discussions while enabling participants to elaborate on context-specific experiences and insights. This structure facilitated the collection of rich, detailed qualitative data suitable for comparative analysis across diverse innovation ecosystems. All interviews were transcribed verbatim in their original language by trained research assistants. For interviews not conducted in English, professional translation and cross-checking procedures were applied to ensure accuracy and consistency. Translations were reviewed by bilingual members of the research team to preserve meaning, context and nuance, thus adhering to established qualitative research standards and ensuring the validity of the results.

As illustrated in Table 1, data collection consists of 24 semi-structured in-depth interviews with experienced and emerging leaders involved in collaborative innovation initiatives. Participants include professionals, activists and policymakers engaged in governance, education, public policy, cultural industries and social movements advocating for positive impact-driven STI policies.

Desk research complements the interviews to determine the state of the art and contextualise the findings. Transcripts were analysed using advanced keyword coding in Atlas.ti, allowing for a systematic identification of key themes and patterns that support the formulation of context-specific STI policies across varied innovation ecosystems.

The exclusive use of a qualitative methodology is justified by the exploratory nature of the research, which seeks to understand how social innovation shapes emerging models of LLs and their capacity to inform STI policy design. Quantitative approaches would have been insufficient to capture the depth of contextual, relational and governance dynamics inherent to multi-actor ecosystems. By focusing on qualitative methods, the study is able to elicit rich, situated insights from diverse stakeholders, which are essential for uncovering processes, meanings and interactions that cannot be adequately measured through standardised indicators or statistical analysis.

Research results

The model integrates six interrelated components, grounded in both theory and practice. Mission-Oriented Innovation Policies (MOIPs) guide systemic responses to complex societal challenges (Edler et al., 2025; Haddad

et al., 2022; Mazzucato, 2018). Responsible Social Innovation ensures that ethical, societal and stakeholder values are embedded in innovation processes (Fauth et al., 2024; Widjaja, 2023). Complementary Innovations within Ecosystems highlight how diverse innovations co-evolve to generate transformative solutions. Multi-Actor and Multi-Level Collaborative Frameworks facilitate alignment between local priorities and broader policy objectives (Caro-Gonzalez, 2023b; Loorbach & Kemp, 2003). Living Labs (LLs) act as intermediaries bridging societal needs and technological development through co-creation and iterative learning (Fauth et al., 2024; Widjaja, 2023). Finally, Transformative Governance supports adaptive, participatory and reflexive approaches to enable sustainable systemic change (Caro-Gonzalez, 2023b; Loorbach & Kemp, 2003). While the model was initially designed deductively, iterative feedback from practical lessons learned through over 20 years of expertise in the field and interviews refined each component, ensuring both theoretical rigour and empirical relevance.

Four fundamental questions—*why*, *who*, *how* and *what*— frame and deepen the interpretation of the qualitative analysis, as portrayed in the following illustration, underpinning how their interrelations within emerging social and digital innovation ecosystems are derived in what we have called '*Eoh-Living Lab proposal*' (See Figure 1).

This visual framework serves as both a conceptual map and an analytical tool, highlighting the dynamic interplay between actors, motivations, processes and tested interventions. It is intended to guide the reader through the core findings by visually articulating how these elements converge to inform more participatory, context-based and challenge-driven approaches to innovation policy and practice.

The guiding dimensions allow for a critical examination of emerging global efforts to foster more sustained, systemic and context-driven approaches to social and digital innovation. The urgency of this need is increasingly evident in contexts where innovation is challenge-driven and oriented toward inclusivity and participation. The discussion highlights what is being tested in various LLs and innovation ecosystems through the exploration of these four questions and how such experiments may contribute to more coherent and collaborative STI policies and practices.

Why: the rationale for systemic and challenge-driven innovation

The WHY dimension of the analysis examines the underlying motivations driving the search for more integrative and participatory forms of innovation that are capable of delivering on the principles of equity, sustainability and long-term resilience.

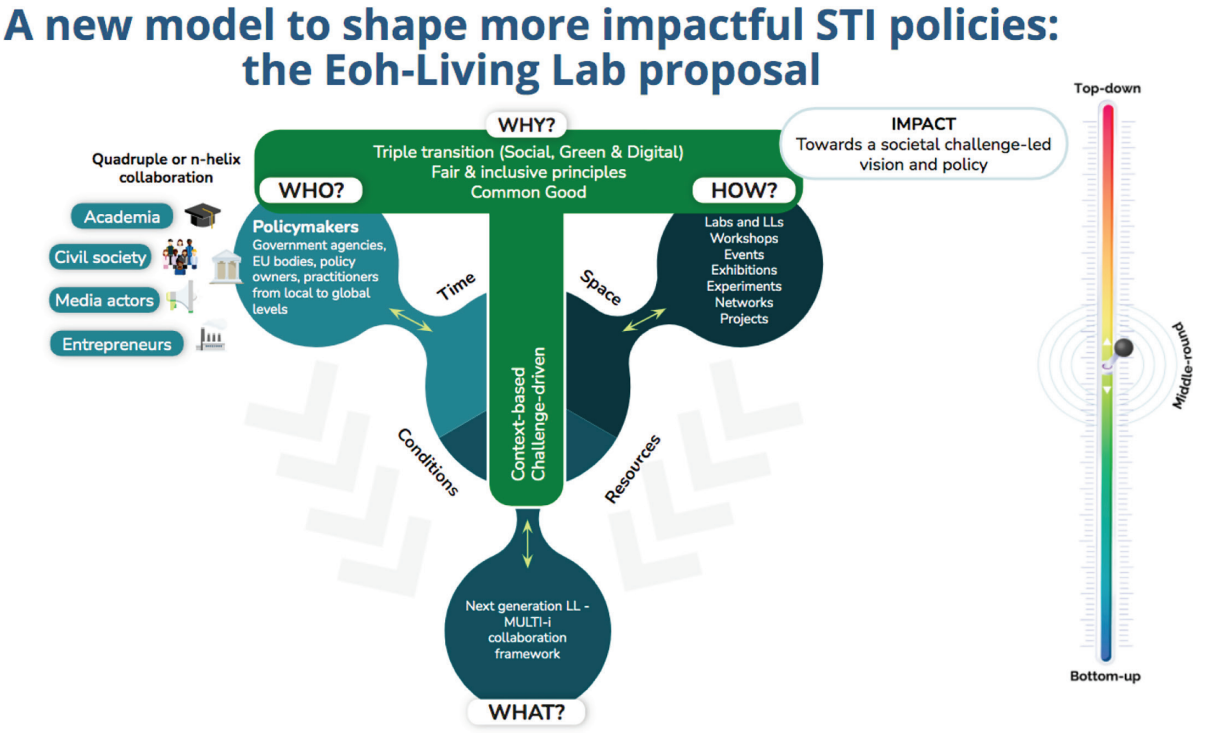

Figure 1. Eoh-Living Lab proposal. (Source: Eoh-for-Good©).

Understanding *why* new approaches to social and digital innovation are urgently needed requires situating current experimentation within the broader context of escalating societal and planetary challenges from climate change to widening inequalities. Existing models of innovation often fall short in addressing the complex, interdependent and place-specific nature of these issues, intertwining local and global scopes. Systemic approaches advocating for an encompassing triple transition (social, green and digital) driven by just and inclusive principles (Caro-Gonzalez, 2023b).

The rationale for a more sustained, systemic and challenge-driven approach lies in the limitations of fragmented and short-term interventions. There is a huge gap between our technological capacity and our social innovation and commitment as humanity. The essence of innovation lies not merely in developing tools to assist humans but in cultivating relationships that reflect human-centred innovation principles, as rightly pointed out by one of the experts with over 30 years of experience in the field:

> *'We still see that the technology we have is very sophisticated and very advanced, but the uses are traditional. You only have to look at the conflict in Gaza or the war in Ukraine to see the huge gap between the potential of our machines and our digital innovation, and the huge gap with social innovation. We have a technology like ChatGPT and still a political system that is 200 years old. The effort now has to be to bridge this gap.' [Translated from Spanish] (I8-ES 19:50:00).*

The aim is not to create a machine that helps humans, but rather the relationship that is established between people, in line with human-centred innovation. Supporting this view, an actor remarked:

> *'This shows that innovation should not only be seen in terms of machines or objects, but also in how people can be transformed through these processes. The citizen laboratory allowed me to take the idea of the laboratory as an organisational symbol of this knowledge era or society' [Translated from Spanish] (I8-ES 00:07:00).*

Integrating socio-technical transitions theory with strategic foresight and human-centred design might offer more comprehensive frameworks to analyse the co-evolving complexities of systemic approaches to designing multi-actor transformative governance dynamics to manage the complexity of emerging systems. Advanced models must navigate the dichotomies of collaboration versus competition and of individual/institutional interests versus the common good, all within a systemic perspective that values inclusiveness and sustainable business models (I16-DE, I9-NO). This requires better-prepared policymakers to tackle the complexities, challenges and opportunities involved in place-based transformations. The principle is to have a vision of something possible and to convince other people to be inspired by this idea. As one interviewee noted:

> *'It is the vision not of what exists, but of what can exist. This is a discussion I have had with myself and with science; in science, it starts a little bit from what exists, and technology starts from what can exist. But then you must prove that it can actually be achieved' [Translated from Spanish] (I8-ES 00:14:00).*

Resulting from the analysis, we propose to learn from what is functioning and to develop novel processes for innovation within quadruple, quintuple and n-helix transformative governance frameworks, underlying the need for adaptive, human-centred participatory approaches that balance diverse stakeholder interests. Recent studies highlight how new business models co-evolve with energy systems, influencing technological innovation, user practices and policy regimes (Hall et al., 2022; I14-CH). However, there remains a lack of recognised processes for researching transformative governance models aimed at managing triple transitions (Ateş et al., 2024). Therefore, we advocate for a more formalised and theoretically grounded approach to address these challenges, positioning transformative governance as central to achieving equitable and sustainable innovation outcomes for humanity and the planet.

> *'We should work on it to have, like, not a common European market, but common European standards for the companies to know what to do in each country. (...) At least a quality approved, similar to the European models' (I6-DE 00:57:14).*

Who: actors and forms of participation

The *who* dimension questions which actors are engaged, focusing on the constellation of actors involved in emerging innovation ecosystems. Innovation is never the fruit of a single hero, but most of the time, innovation is the result of cooperation. Collaborating at the local and regional levels enhances international competitiveness, as innovation—essential for global success—emerges most effectively through cooperative efforts (I18-BE 00:24:50).

These include:

- senior and mid-level policymakers, junior policymakers or emerging leaders, government advisors and policy analysts;
- civil servants and public administration staff at different levels (local, regional, national and European), heads of government agencies, elected officials at various levels, legislative staff members and policy consultants;
- regions' representations at local or community level, in regional networks or STI sectoral working groups (e.g. RIS3 priority areas), staff of European Institutions (European Commission, European Parliament and Committee of the Regions) or other supra-national levels (OECD, UN, The African Union Development Agency – NEPAD (AUDA-NEPAD).
- civil society leaders involved in policy making, international organisation representatives and policy researchers;
- managers of policy programmes, advocacy specialists in policy reform, decision-makers in regulatory bodies and strategists responsible for policy communication; and
- often-overlooked communities and vulnerable populations. Special attention is given to the inclusion of traditionally marginalised voices and the conditions necessary for meaningful, long-term participation. This analysis foregrounds the role of collaborative governance and networked agency in shaping more inclusive, democratic and equitable innovation processes.

This diverse range of participants will ensure a comprehensive and impactful learning experience, fostering professional growth across all levels of decision-making in open learning discovery processes. This task requires involving many people to have the vision, creating working groups that bring together different actors from different areas of expertise to address social coexistence and sustainability from different perspectives *[Translated from Spanish] (I2-CL 00:10:20).* It is up to the community to decide, as an interviewee points out: *'who we work with, why and how—and to ensure we do not engage in any form of greenwashing or anything that even resembles it.' [Translated from Spanish] (I5-MX 00:27:18)*.

How: processes, methods and governance approaches

The *how* explores the methodological and procedural dimensions through which innovation is organised, facilitated and sustained. It delves into the design of LLs as open, iterative and adaptive environments that enable co-creation, experimentation and learning. This section also highlights the importance of transformative governance approaches that go beyond coordination and participation to support systemic alignment and long-term institutional change. The analysis emphasises how reflexive practices, multi-level governance and integrated evaluation frameworks can contribute to the robustness and legitimacy of innovation processes in addressing complex societal challenges.

> *'We are particularly concerned with how public spaces are used and how they can contribute positively. This involves recognising and valuing cultural diversity in Chile as a key element in addressing issues of coexistence and social equity. The goal is to create environments that actively promote social cohesion, recognising it as a public good in its own right' [Translated from Spanish] (I2-CL 00:08:30)*

As described by Schuurman et al. (2013), LLs are stable multi-stakeholder organisations that implement multiple projects and initiatives using user-centric and co-creative methods and tools, as noted by one interviewee:

> *'A successful innovation ecosystem (...) is a kind of infrastructure, and we make the first part of the train (the locomotive) and the wagon. But you can put your own wagons behind it, and you can even own those wagons. So, the locomotive is ours, and the first wagon is ours. The concept is ours, but you can add your own wagon to the whole train. And when you have a passenger, he pays the ticket for the train, but the money he pays goes into the treasury of the whole community, and we spread the*

contents of the treasury to all. So, the wagon stays yours, and when you want to improve your wagon, please do so; it's an entrepreneurial culture community' (I10-NL 00:36:20).

The distribution of power, knowledge and resources among actors in innovation ecosystems is deeply influenced by efforts to foster trust, collective identity and inclusive participation. As highlighted by interviewee I13-ES (00:14:00), the initial challenge lies in shifting mindsets from adversarial dynamics to collaborative engagement, particularly in addressing public service needs. This resonates with the broader democratic imperative to mobilise latent civic capacity, as democracy increasingly struggles to engage citizens in public affairs. The Demoslab initiative exemplifies this approach by connecting typically disengaged individuals with institutions and experts, creating deliberative spaces that bridge sociopolitical and territorial divides *(I13-ES 00:22:00)*.

The Multi-i Transformative Governance Model (see Figure 2) provides a useful lens for interpreting the operational dynamics of LLs, particularly their emphasis on decentralised power and collective action. In contrast to traditional hierarchical governance structures, LLs foster distributed agency, where citizens, researchers, policymakers and private actors co-create knowledge and solutions through iterative experimentation. This aligns closely with the principles of the Multi-i model, which integrates multiple forms of intelligence—such as individual, institutional and infrastructural—and stresses interconnectivity, inclusion and innovation as drivers of systemic transformation. This multi-'i' transformative model encompasses 10 interconnected dimensions, each beginning with the letter 'i', which collectively offer a holistic perspective: interpersonal, intercultural, intersectional, intergenerational, interdisciplinary, interhelix, intersectoral, intra and interinstitutional, interregional and international[1].

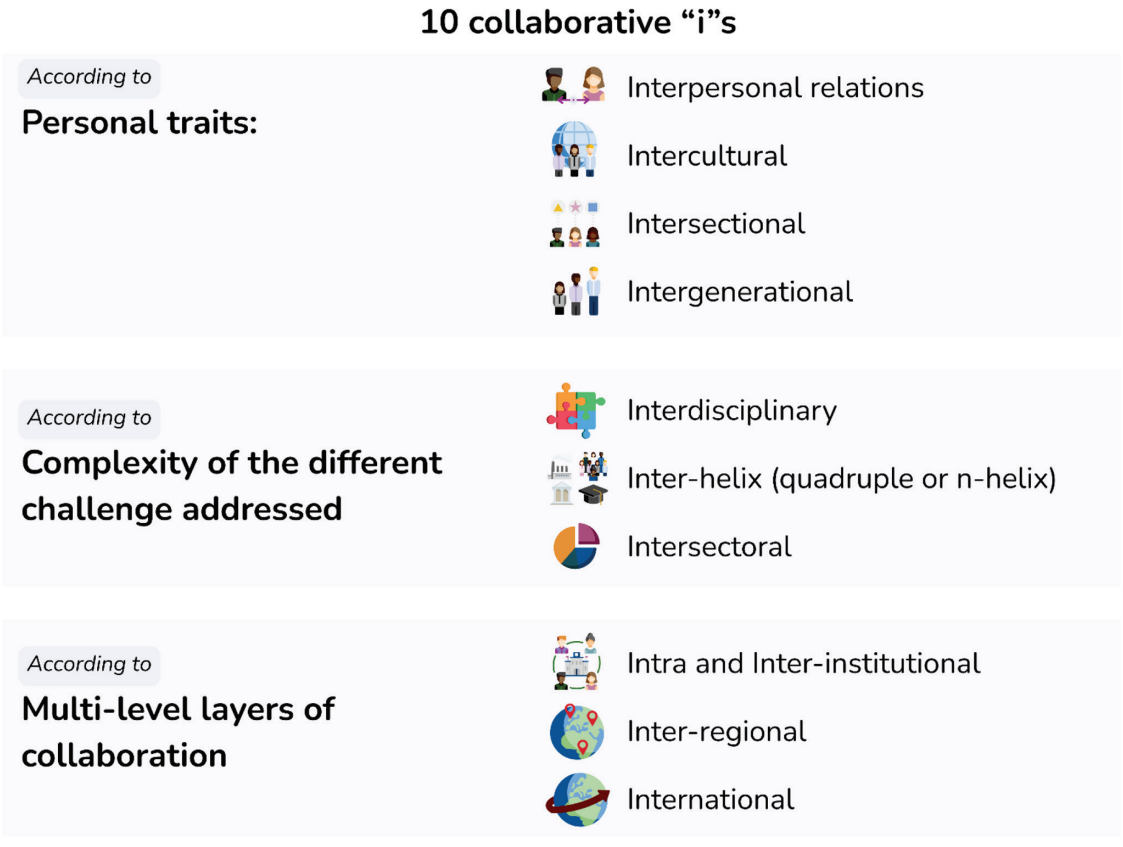

Figure 2. Multi-i Transformative Governance Model. (Source: Eoh-for-Good©).

1 In several European regions (Hamburg, Krakow, Catalonia), interdisciplinary models have proven essential for ensuring the long-term viability of initiatives, particularly in addressing market failures and inefficiencies in existing systems.

'In connecting the dots, it's crucial to understand what works, but more important, it is what didn't work across different contexts' (I9-NO, 2024; 0:07:24).

They will be present transversely across all initiatives to promote change and governance processes in organisations, ecosystems and shared agendas. As the interviewee from the Philippines pointed out: '*Change can only occur when it is done in an ecosystem' (I16-PH 00:01:54).*

As the respondent in the interview I10-NL noted, '*when you bring the power to the individuals, you get the collective action; and technology can make this collective action happen*' *(I10-NL 00:13:25),* highlighting the enabler role of digital platforms in facilitating participatory governance. LLs operationalise this shift through methods like co-design, urban prototyping and real-life experimentation, where decisions are informed by local knowledge, contextual insight and reflexive learning rather than top-down mandates, indeed, as I13-ES reflects, *'there is also a need for social awareness towards institutions' (I13-ES 00:15:03)*. This practice exemplifies the transition from linear planning to adaptive, emergent forms of governance that are central to the Multi-i *Eoh-Living Lab* approach.

'Now we have many kinds of collaboration to solve a social issue...., many researchers from many fields, private companies and the government come to me, and they discuss with us how we can solve this social issue and how we can promote a circular economy in Japan and in the world. And so actually, I made a platform for discussing it with many researchers, in many different fields and with the private company, the government… and we built this kind of consortium two years ago' (I17-JP 00:19:28).

We are trying to bridge the gaps, but not on the economic levels (...), we are using culture which has this extreme power (...); I would say that the culture is creating this sort of the ambience for the mindset to grow, for the mindset of change, positive change for the mindset to take responsibility for your local environment and not only nature and the urban or rural development (I7-PL 00:20:10).

The *what* dimension focuses on the concrete innovations, interventions and models being developed and tested within LLs and other experimental settings. This includes technological and digital solutions and new social practices, institutional arrangements and policy frameworks.

Leminen et al. (2012) propose 4 types of LLs functioning as open-innovation networks, very linked with the idea of putting the user in the centre:

a) Utiliser-driven living labs, with the focus on developing and testing firm products and services
b) Enabler-driven living labs, typically public-sector projects that pursue societal improvements
c) Provider-driven living labs, launched as a result of actions by various developer organisations such as educational institutes, universities or consultants
d) User-driven living labs, to solve specific problems in a way that is consistent with the values and requirements of users and user communities.

Our analysis points to the emergence of a new form of LL—one that builds on a systemic and integrative vision and is grounded in transformative governance for shared/negotiated purposes, that uphold the principles of: (1) inclusion and diversity, (2) *'no harm*', (3) *'leave no one behind',* (4) *'from egocentric to eco centred principle'* and (5) *'win-win' (Caro-Gonzalez, 2023b,36-40)*. This evolving model has the potential to generate dynamic and adaptive responses to the complex challenges facing humanity today in ways. The initiatives analysed in this study underline long-term systemic alignment, ethical responsibility and transformative impact at scale, as stated by one expert:

'If we want a different society, one that is fairer, more caring, more sustainable... we have to start with how we build it from the bottom up' [Translated from Spanish] (I24-ES 00:06:00).

Building upon existing LL frameworks, such as those proposed by Leminen et al. (2012), we propose a new model that integrates these principles to address complex societal challenges more effectively. This model extends prior frameworks by incorporating a comprehensive approach that aligns with the Sustainable Development Goals (SDGs), particularly focusing on inclusivity, sustainability and ethical considerations in innovation processes (Filho et

Table 2. Types of Living Labs (Based on the Table developed by Leminen et al. 2012).

Characteristic	Type of Living Labs				
	Utiliser-driven	*Enabler-driver*	*Provider-driven*	*User-driven*	*T-shape*
Purpose	Strategic R&D activity with preset objectives	Strategy development through action	Operations development thought increased knowledge	Problem-solving through collaborative accomplishments	Systemic, ethical and transformative innovation
Organisation	Network forms around a utiliser who organises action for rapid knowledge results	Network forms around a region (regional development) or a funded project (e.g. public funding)	Network forms around a provider organisation (s)	Network initiated by users lacks formal coordination mechanisms	Multi-actor, inclusive and adaptive governance
Action	Utiliser guides information collection from the users and promotes knowledge creation that supports the achievement of preset goals	Information is collected and used together, and knowledge is co-created in the network	Information is collected for immediate or postponed use; new knowledge is based on the information that the provider gets from others	Information is not collected formally and builds upon users' interests; knowledge is utilised in the network to help the user community	Co-creation, experimentation and iterative learning (progress based on constructive feedback learning loops)
Outcomes	New knowledge for product and business development	Guided strategy change into a preferred direction	New knowledge supporting operations development	Solutions to users' everyday-life problems	Scalable, sustainable and equitable solutions
Lifespan	Short	Short/medium/long	Short/medium/long	Long	Long-term, evolving and impact-driven engagement

al. 2023; Howaldt et al., 2024). This new LL model aims to facilitate transformative impacts that are sustainable and scalable by fostering collaborative environments that prioritise ethical responsibility and systemic alignment. The 'Eoh-Living Lab' proposal complements existing frameworks and provides a practical orientation for implementing LLs that are responsive to the multifaceted needs of society and the planet (See Table 2).

Our results corroborate research portraying Living Labs (LLs) as boundary-spanning platforms that connect science, policy and society through collaborative experimentation and public–private–people partnerships (Evans et al., 2016; Schuurman et al., 2016; Trencher et al., 2013). This aligns with conceptual work emphasising LLs' mediating roles and co-creative capacities in real-life contexts (Frantzeskaki et al., 2025; Mahmoud et al., 2021). Yet, in contrast to studies that highlight LLs' potential to foster policy integration and public-sector innovation (Tõnurist et al., 2017), our cases reveal persistent fragmentation and insufficient institutionalisation within broader policy frameworks. Similar concerns have been raised regarding the project-based nature of urban experimentation, which can limit systemic impact (Torrens & von Wirth, 2021), and the lack of durable anchoring of LLs in organisational structures and governance arrangements (Fuenfschilling et al., 2018; Raven et al., 2019; Tercanli & Jongbloed, 2022). These gaps suggest that realising the full potential of LLs requires stronger integration into STI governance through clearer mandates, durable resourcing and alignment with formal policy instruments (OECD, 2024).

Conclusions

This contribution synthesises the lessons generated on multi-actor and multi-level collaboration across diverse settings and sectors involving quadruple, quintuple and n-helix actors. The study identifies distinct processes adopted in these collaborations and the insights they generated. Many of these processes reflect the *Eoh-Living Lab* approach, in which the horizontal axis embodies a cross-cutting systemic perspective that connects science and technology policy with community needs. This transversal dimension enhances collaboration capacity among industrial, business, academic, governmental and societal sectors by enabling the integration of multiple visions, connecting public and private sectors with society, addressing complexity in decision-making and responding to context- and people-driven needs. In turn, the vertical axes correspond to context-specific implementations that align with strategic sectoral priorities and generate meaningful local impacts.

The analysis demonstrates that social innovation influences Living Labs by enabling the co-creation of tailored STI policies by explicitly addressing our research question. This occurs through the design of inclusive processes that mobilise diverse expertise, foster participatory governance and balance systemic integration with local adaptation. Social innovation thus serves as both a driver and an enabler of next-generation Living Labs, enhancing

their capacity to deliver sustainable, just and forward-looking solutions. Our findings support previous research that highlights the potential of LLs as mediators between science, policy and society and as platforms for collaborative experimentation. However, our analysis also reveals persistent fragmentation and insufficient institutionalisation of LLs within broader policy frameworks, a divergence that underscores the need for more structured integration into STI governance.

The practical implications of these findings are twofold. First, they provide guidance for policymakers and practitioners seeking to design governance mechanisms that are adaptive, transparent and capable of sustaining participatory engagement. Second, they offer evidence that the Eoh-Living Lab systemic proposal can enhance the legitimacy and effectiveness of LLs in shaping STI policies, while still remaining sensitive to local contexts and needs. Theoretically, this work advances the understanding of transformative governance models by showing how social innovation can act as a bridging mechanism across levels, sectors and actors.

Nevertheless, this study faces several limitations. The qualitative data are based on a purposive sample of stakeholders, with interviewees drawn from proven professional track records. While this approach ensured informed perspectives, it may not fully capture the diversity of actors within innovation ecosystems. Furthermore, the cases examined are context-specific, which may limit the generalisability of findings. Future research should build on this work by expanding the scope of empirical studies, testing the framework in different settings and exploring additional stakeholder perspectives.

Finally, the model proposed here holds significant potential for usability across different contexts. Its systemic design allows adaptation to regional and national innovation ecosystems, provided that sufficient alignment with local governance structures and stakeholder readiness is ensured. The Eoh-Living Lab proposal is particularly valuable for connecting transversal priorities—such as sustainability and inclusiveness—with sectoral strategies, enabling both convergence and differentiation across contexts. This adaptability suggests that the model can serve as a guiding framework not only for academic inquiry but also for policy experimentation and practice, ultimately contributing to the evolution of Living Labs as drivers of transformative social innovation.

Declaration of generative AI in scientific writing

During the preparation of this work, the author(s) used ChatGPT to correct and refine some sentences of the text. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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