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Living Labs as Enablers for Collaborative Innovation – Exploring Success Factors and Impacts

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Abstract

The starting point of this study is a broad review of the literature related to collaborative innovation and innovation partnerships. Based on this review, the concept of Living Labs was identified as a proper enabler of regional collaborative innovation among a variety of stakeholders. The aim of this study was to identify practices for successful collaboration of Living Labs through a comparative case study in five European countries, i.e. Austria, Denmark, Finland, the Netherlands, and Sweden. As a result, we clustered the success factors into four categories: 1) shared vision, 2) interaction between partners, 3) actors, resources, and activities 4) operational model and supporting structures. These success factors are a prerequisite for impacts of the collaboration. Furthermore, the second phase of the study deepened the understanding of impacts of collaborative innovation through a participatory case study with 16 Finnish city cases. As a practice-oriented comparative case study, there was a limited number of theoretical contributions. Thus, the linkages among different concepts were demonstrated both in the literature and in practice.

Keywords: living lab, collaborative innovation, success factors, benchmarking, shared vision, funding, operational model, orchestration, impact.

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1 Introduction

Living Labs and other forms of collaborative innovation have been documented to develop innovations and integrate innovativeness and resources for the benefit of diverse stakeholders in cities (Leminen & Westerlund, 2019; Leminen et al. 2015; Haug & Mergel, 2021) and to provide environmental and social improvements (Hossain et al., 2019; Nevens et al., 2013). Thus, a discussion of academic research and practical application is strongly linked to several other concepts related to networked innovation activities and innovation partnerships, such as collaborative innovation, co-innovation, and open innovation. In addition, public-private innovation partnerships and industry-academy collaboration are considered within the literature of the triple helix and quadruple helix.

The literature on Living Labs has a strong connection to the city agenda, and Living Labs are discussed as open platforms for innovation and citizen engagement (Leminen et al., 2020). In

addition, the recent discussion around innovation ecosystems also emphasises the role of public actors (especially cities) as enablers of systemic change and innovation (Osborne et al., 2021) and broader societal, economic and environmental improvements, i.e. impacts (Djellal & Gallouj, 2013). However, there is still a need to explore the success factors of Living Labs as mechanisms for collaborative innovation.

To close this research gap, this paper asks:

1) *What success factors and related practices are used in Living Labs for coordinating a multi-actor collaborative innovation?*
2) *What are the key dimensions for highlighting the impacts of Living Labs?*

Accordingly, the paper has two purposes. First, the paper explores the success factors of Living Labs as a means of coordinating the collaborative innovation among different participants, and second, it aims to provide an understanding of the key dimensions for highlighting the visibility of the impacts of Living Labs. To achieve these goals, the impacts generated to all partners and the collaborative setting itself, as well as broader society, are emphasised.

The paper is structured as follows: First, a systematic literature review was conducted to explore the current understanding of different forms of collaborative innovation and to especially define the success factors of Living Labs. Second, a preliminary research framework was built based on this literature review. The empirical part of the study has two phases in line with the two research questions. First, the research framework of success factors was tested by benchmarking international cases in Austria, Denmark, Finland, the Netherlands and Sweden. The focus on the international benchmark was to reflect the current state of practices of collaborative innovation and their success factors. Second, we completed the complementary study phase of impacts of collaborative innovation by comprehensively reviewing 16 case studies in the context of innovation ecosystems led by the Finnish university cities. The focus of the second phase of the study was to develop a framework and to identify the impacts of these collaborative innovation settings. Last, we discuss the findings and their theoretical and managerial implications, the limitations of the study, and directions for future studies.

2 Theoretical background

2.1 Setting the scene of different collaboration forms

The starting point of the study was the diverse collaboration models within public-private innovation collaborations and partnerships. We defined the public-private innovation partnerships as '*combining private-sector research and development with public interest of social impact*'. The partnerships consider all phases of research, development, and innovation (R&D&I). The aim of the broader review was to explore the *critical success factors of these collaboration models for R&D&I*. A systematic literature review was conducted with the following keywords: public-private partnership, ecosystem, innovation ecosystem, innovation cluster, regional cluster, public-private partnership in services, Living Labs, test beds, innovation collaboration, industry-academy collaboration, collaborative innovation, co-innovation, triple helix, and quadruple helix. This review included a general review of literature on innovation partnership models with a special focus on the selected benchmark countries. The literature review included relevant scientific literature and more practical policy reports and was based on a robust empirical bibliometric analysis followed by a qualitative analysis of the most cited key documents.

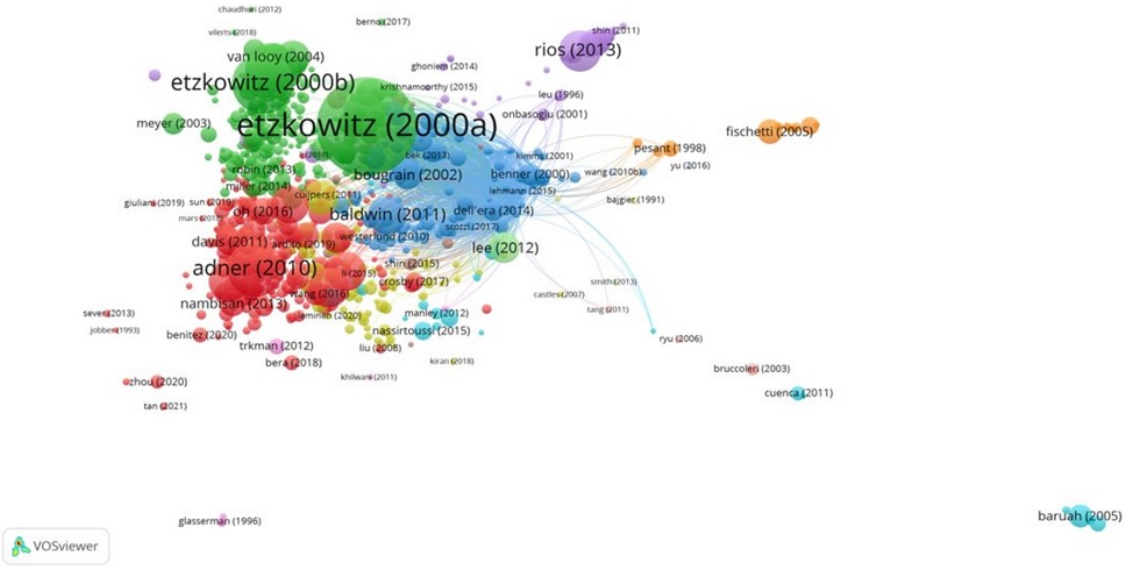

Figure 1. Longitudinal theoretical forefront of BC. BC occurs when two works reference a common third work in their bibliographies. BC is an indication that a probability exists that the two works treat a related subject matter.

As a starting point, the literature search resulted in 3243 articles (2224 journal articles, four book chapters, and 1211 conference proceedings) published during the period 1989-2022. From the collected data, the articles that describe the theoretical basis and the current forefront of science were searched by reference analysis. Figure 1 presents the longitudinal theoretical forefront of science through bibliographical coupling (BC).

According to the literature review, most of the literature focused on partnerships with geographically proximate parties within one region or country and viewed the partnership from the perspective of one of the involved actors. Furthermore, the sampled articles have a limited view on the success factors of the partnerships (only 31 articles mention 'success factors' in the title or abstract). When the success factors were discussed, the article(s) typically focused on one factor, which is tested through quantitative data or qualitative approaches. Typically, the empirical data of collected views present a snapshot of one case, i.e. longitudinal approaches are limited.

Based on the review, we elaborated Living Labs as a suitable means of coordinating the collaborative innovation among different (typically geographically proximate) participants. There are several literature reviews focusing on Living Labs; thus, the main foci of the reviews have been the concept, theoretical foundations, possible outcomes, and Living Labs as a research approach (Fuglsang et., 2021). According to the literature, Living Labs engage a variety of actors, cities, companies, end users, and research organisations to solve challenges via collaboration and collective ideation. Here, we followed the definition of collaborative innovation presented by Leminen et al. 2020 as follows: *'the actor's interaction and co-creation with different parties such as, but not limited to, suppliers, customers, competitors, and research organisations for the purpose of developing new services and products'*. To further explore the success factors of Living Labs, we investigate their role from regional and national perspectives as enablers of collaborative innovation.

2.2 Living Labs as enablers of collaborative innovation

The literature on Living Labs strongly emphasises regional perspectives. Living Labs that are physical and/or virtual open development environments in which cities, companies, research organisations, and various stakeholders aim to solve challenges via collaboration and collective ideation. We follow the definition of Gascó (2017 p. 91) and describe Living Labs as a '*collaborative platform for research, development, and experimentation in real-life contexts, based on specific methodologies and tools, and implemented through specific innovation projects and community-building activities*'.

Living Labs work in a live setting, which explains why social experiments of technology solutions are realised in the real urban space (Hossain et al., 2019; Steen and van Bueren, 2017; Leminen et al., 2017). However, most of the case studies focus on one regional Living Lab, while Leminen et al. (2015) have provided a comparative study of consumer innovation within 26 Living Labs in Finland, South Africa, Spain, and Sweden. According to their study, end user role mechanisms influence innovation outcomes, i.e. radical innovation versus incremental innovation.

Furthermore, the literature review in the context of case countries showed that there was a slightly different emphasis among the benchmarked countries[1]. Additionally, the literature was not limited to Living Labs, and the triple helix and quadruple helix were emphasised. According to our literature review, the triple or quadruple helix models, which highlight the importance of a *shared vision*, were characteristic in Sweden (see for instance Fogelberg & Thorpenberg, 2012), whereas *coordination and different partner roles* were highlighted in Denmark (Brem & Radziwon, 2017). Furthermore, Living Labs' strategies and innovation ecosystems' *orchestration* were the focus of discussions in the Netherlands (Visscher et al. 2021; von Wirth et al., 2019). Both perspectives of Living Labs and the triple helix model were noted in Austria (Haug & Merkel, 2021). Thus, in addition to Living Labs (Leminen et al., 2021), innovation ecosystems were significantly highlighted in Finland, and in particular, the policy reports' *impacts of collaboration* were emphasised (Laasonen et al., 2019).

2.3 Examples of success factors of Living Labs

The literature review indicated that the articles provide scattered views on success factors. Because recent literature typically conceptualises Living Labs as open development environments in the analysis of their success factors, the literature of open innovation and user-driven innovation have been applied (Haug & Mergel, 2021; Schuurman et al., 2013; Leminen et al., 2012). Therefore, in the analysis of the success factors, the focus is typically on the co-creation process, the actors and their roles in knowledge creation and sharing, and entrepreneurship. The following success factors for Living Labs have been identified in the literature:

- Emphasising those affected by the solutions being developed. In successful Living Labs, citizens and other service users have been placed at the centre of the solution design process to build an understanding of the problems and to improve the outcomes of living labs (Haug & Mergel, 2021; Mergel, 2015)
- In-depth stakeholder involvement and participation. The key stakeholders are involved from an early stage to identify the goals and challenges. Key actors include municipalities, research

1. The literature review of the Swedish cases resulted in 40 articles from 2009 to 2019; the literature review of the Danish cases resulted in 11 articles from 2009 to 2107; the literature review of the Austrian cases resulted in 10 articles, of which two were relevant (2015 and 2021); the Netherland review resulted in 34 articles, of which five discussed success factors; and the literature review of the Finnish cases resulted in seven articles relevant to the focus of the study.

actors, companies, and citizens (Haug & Mergel, 2021; Schuurman et al., 2013).

- Operational model of Living Labs, which refers to the level of autonomy of parent organisations and the freedom to experiment (Haug & Mergel, 2021; Tõnurist et al., 2017).
- Ways to generate impact on Living Labs, which focus on the approach, how the process is organised and managed, and the methods to analyse the impacts created in Living Labs (Fuglsang et al., 2021; Haug & Mergel, 2021).

Subsequently, practical examples of success factors that have distinct relevance to our research problem were identified based on the above findings. In summary, we define the success of Living Labs as enabling impacts for its participants by balancing the interdependencies of underlying shared goals set by (the orchestrator and) participating actors. Consequently, the success of Living Labs focuses on impact that can be extracted from it and that can directly benefit individual actors, Living Labs as a whole, or broader society in certain geographical areas. In the recent review of Living Labs, Fuglsang et al., 2021 analyses the impact of Living Labs in terms of public value and identified four types of public values: (1) administrative, (2) citizen, (3) societal, and (4) economic. From the private actors' perspective, the appropriated impact is often measured in terms of innovation performance, as Living Lab's activities relate to collaboration for research, development, and experimentation in real-life contexts (Gascó, 2017). From the perspective of Living Labs, the impacts gained (and therefore the success) concern correspondingly its survival and continuation, despite internal and external events and disruptions. This view is closely linked to the operational model and funding of Living Labs.

2.4 Preliminary framework of success factors

In this section, we present a conceptual model of the success factors and their linkages as a preliminary research framework (Figure 2). There are both relational and structural dimensions that influence the success of Living Labs. The structural dimensions represent the actors involved, all activities, and supporting structures that enable an efficient use of resources, whereas the relational dimensions refer to the interaction and connections between the involved actors. Furthermore, the shared goal is an evident part of the relational success factors.

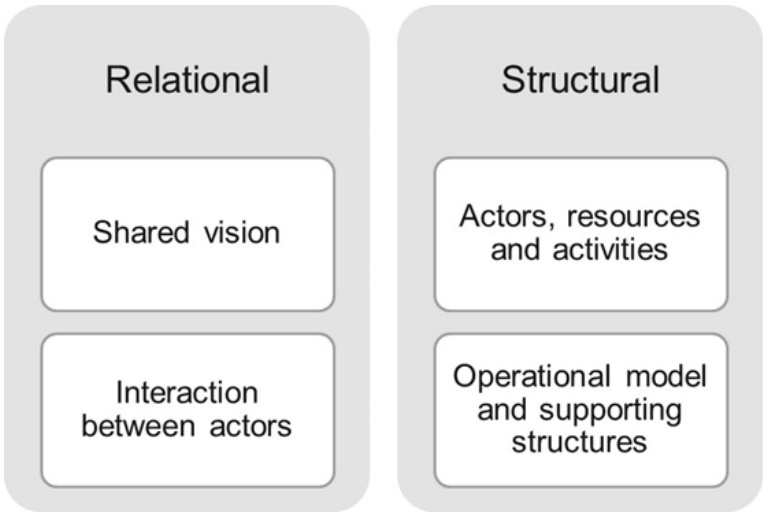

Figure 2. Preliminary research framework of success factors of Living Labs as a means of collaborative innovation.

Regarding the structural dimensions, the previous literature has identified differences between Living Labs in the public sector and those in the private sector. In the private sector, Living Labs are often established as independent organisations, whereas in the public sector, Living Labs may operate as in-house innovation units or are directly sponsored by a government (Haug & Mergel, 2021). In this study, we consider Living Labs in both the private sector and public sector but do not consider it necessary to independently evaluate them.

3 Research design and methods

Building theory from case studies is a research strategy that involves using one or more cases to create theoretical constructs, propositions, and midrange theory from case-based, empirical evidence (Eisenhardt, 1989). This method is appropriate when the exploratory nature of investigation is emphasised (Eisenhardt & Graebner, 2007). The goal of the study is to explore the success factors of Living Labs as a means of coordinating the collaborative innovation among different participants. We aim to create a new understanding of collaboration practices in enhancing the multi-actor innovation process and concurrently generating impact, including the impact on partners and whole Living Labs, as well as the broader societal impact. Accordingly, we formulate the following two research questions:

1) What are the success factors and related practices used in Living Labs for coordinating a multi-actor collaborative innovation?
2) What are the key dimensions to highlight the impacts of Living Labs?

Consequently, the methodological approach is based on a qualitative case study research strategy.

3.1 Research design

Consistent with the two research questions, our study had two phases with complementary empirical case data. All Living Lab cases were selected based on their availability for researchers (access to cases) and their variety. They all support and accelerate broad-based cooperation between different-sized companies, universities, research institutions, cities, and other parties. In the first phase, innovation partnership models were investigated in five European countries (Table 1) to reflect the current state of practices and success factors of collaborative innovation compared with the literature. In the second phase, a special focus was placed on ecosystem-based models as they are more likely to ensure broader social impacts of collaborative innovation efforts. Therefore, an in-depth participatory case study was implemented in the context of 16 innovation ecosystems led by university cities in Finland (Table 2).

Through the first research question, we explore the success factors of Living Labs and related practices used in Living Labs for coordinating a multi-actor collaborative innovation. We examine Living Labs in different innovation process phases and how they enhance the progress of regional collaborative innovation. In particular, we aim to understand how the coordination appears at different levels from strategic decisions to operative activities and to determine the capabilities and practices required to ensure the impact on all participating actors, the Living Lab itself and broader society. The second research question guided us to complete the empirical case data in the context of 16 ecosystems coordinated by university cities in Finland with the particular aim to gain an understanding of the types of impact generated for the actors and broader society, and measures of impacts, as well as practices and mechanisms to ensure their generation. In the study context, impacts are comprehensively understood so that traditional techno-economic impacts

on economy, environment, and society at large are also emphasised. Similarly, the focus is on understanding the impacts from the perspective of different actors, including companies, research institutions, citizens and broader society.

3.2 Data collection and analyses (phase 1)

In the first phase, empirical material was collected and analysed by six researchers, including the authors of this paper. Data collection was performed by compiling practices of Living Labs from various documents and supplementing them with interviews with case representatives. A total of 14 interviews were conducted with Living Lab coordinators and the companies who had participated in Living Lab activities (Table 1). The cases were selected based on the discussion with national experts and their recommendations. In addition, the availability of public material on cases as well as their representatives' willingness to participate had an influence on case selection.

Table 1. Summary of case data in the first phase.

Country illustrative case	Illustrative case	Goal of the collaboration	Number of interviews	Actors involved
Austria (A)	Austrian Blockchain Center	Develop use cases, prototypes, and proof of concepts	2	> 100 members
Denmark (D)	Danish Food and Bio Cluster	Strengthen knowledge-based innovation	4	350 members
Finland (F)	crEATe	Provide a shared test infrastructure; develop and test proof-of-concepts	2	~50
Netherlands (N)	Breed4Food partnership	Create scientific breakthroughs by shared research and development	3	~10
Sweden (S)	RE:Source	Competence centre funded by a national innovation program	3	~30

The Austrian Blockchain Center was founded in 2019, originally as a university-led initiative. It is an interdisciplinary, application-oriented organisation that brings together competencies in the field of the fundamentals and application of blockchain technologies in one place. At the core is the development of use cases, prototypes, and proof of concepts.

The Danish Food and Bio Cluster was founded in 2020 as a result of the Danish reform of national clusters. Therefore, it works nationwide with a decentralised organisation to facilitate dialogue between the cluster organisation and municipalities.

The crEATe was founded in 2018, with the aim to co-create sustainable food and eating solutions that are important to consumers, clients, and communities. The core actors make investment decisions on a joint test bed, which is open for other actors (a fee is required).

The Breed4Food consortium was formed in 2013 by one university and four companies. It works in strategic periods, and a partnership agreement is renewed every five years when the strategic period changes.

RE:Source has run from 2016 to 2022. As it receives external public funding, membership is free of charge. Although it is led by one university, there is a board that makes decisions on strategic projects and funding within open calls.

The analysis of the case examples follows a descriptive and qualitative approach to create a comprehensive understanding of their success factors at the practical level. The analyses were guided by the preliminary framework of success factors (Figure 2) and were supplemented by illustrative examples of the practices.

3.3 Data collection and analyses (phase 2)

In the second phase, our study focused on the 16 collaborative innovation settings led by university cities in Finland (InnoCities). InnoCities act as platforms for competence-building activities related to R&D&I and investments that are important for the future development. InnoCities have signed an ecosystem agreement with the state of Finland in 2021 to create an internationally attractive experimentation and innovation environment for ecologically, socially, and economically sustainable solutions. Therefore, these collaborative innovation initiatives were called innovation ecosystems.

The empirical material included group interviews, participatory workshops, and document analysis, and it was collected and analysed by three researchers (authors of this paper) in spring 2023. Table 2 specifies the data type, timeline of the data collection, quantity of data sources and focus of the data in the second phase.

Table 2. Summary of case data in the second phase.

Data type	Timeline	Quantity	Focus
Group interviews	1/2023 – 3/2023	- 16 group interviews - 36 interviewees	- Ecosystem targets, involved actors, value expectations, impact dimensions, related impact indicators, processes, and mechanisms for achieving impacts
Participatory workshop	3/2023 – 6/2023	- Participatory workshop (face-to-face workshop) - 34 participants in face-to-face workshop	- Impact dimensions to describe value for actors and broader society - Impact indicators to evaluate success factors
Documents	1/2023 – 2/2023	- 16 ecosystem agreements - 16 operative action plans	- Ecosystem agreements between the city and state of each ecosystem (background of the agreement, description of operational environment, and targets) - Operative action plan to concretise the implementation of an agreement

In total, 16 group interviews were conducted with 36 interviewees, including the ecosystem coordinators (representatives of the cities) and other selected representatives in each ecosystem (representatives of cities, universities, and city-owned development companies). Interviews provided an understanding of the ecosystem targets, actors, value expectations, impacts, and related indicators, as well as mechanisms for achieving impacts. Furthermore, one participatory workshop was organised with the aim of building 'an impact framework' to identify ecosystem impact

dimensions and related impact indicators to evaluate the impacts that ecosystems generate for the different actors and broader society. In total, 34 actors including ecosystem coordinators and representatives of cities, research institutions, universities, and development companies, participated in the workshop. In addition, documents focusing on ecosystem agreements between cities and states and related operative action plans were analysed.

4 Results

4.1 Exploring success factors of Living Labs

The key characteristics of the five cases of the first phase are summarised in Table 3, following our preliminary research framework (Figure 2) of success factors. Accordingly, the study considers both the relational dimensions (shared vision and interaction for generating impact) and the structural dimensions (actors, resources, and activities, as well as the operation model and supporting structures).

In each of the cases, national level decision-making on themes for collaborative innovation and partnerships is seen to impact the strategic choices and *shared visions* of the interviewed organisations. Typically, the national ambitions were related to fostering solution development for grand challenges, growth, and competitiveness of the country. Thus, all cases have a concrete, jointly defined vision to steer the implementation. It has been agreed upon by the members with distinct membership in the Living Lab partnership.

The *impact* goals were addressed by steering funding for strategic projects that benefit the broader ecosystems and by allowing, in parallel, a different funding stream for projects developing solutions more specifically geared toward one or more industry partners (e.g. in Sweden).

In addition, Living Labs and incubator services, for example, EU project proposal preparation work, were provided by the *orchestration* entity (sometimes also to non-members). These services were included in the membership fee or formed an additional income stream for the partnership entity.

The *funding* of the interviewed organisations consists of a mix of private and public funding. Although public funding was mostly only available for companies operating within the country in question, in some cases, international companies also had an opportunity to join the partnership or organisations had sister organisations in other countries.

Table 3. Summary of case data of the first phase.

	Relational		Structural	
Case	Shared vision	Interaction	Actors and activities (orchestration)	Operational model
A	One-stop-shop	Joint measures	Formal structures	Legal status
D	Five growth paths	Member surveys	Decentralised structure	Membership fees
F	Jointly shared infrastructure	Iterative	Core group	Fees
N	Scientific breakthroughs	Periodical evaluation	Board	Fees and in-kind
S	Strategic research agenda	Indicators for governmental funding	Board	Free of charge, open

As a result of the first phase, we identified several practices supporting the collaborative innovation within different Living Labs. We clustered these relational and structural success factors

into four categories: 1) **shared vision** emphasises on the way in which the strategy is built (e.g. interaction between top-down perspective and bottom-up perspective) as well as the time horizon for reaching common goals; 2) **collaboration model and complementary actors**, including the ways in which the partnership is coordinated, actors' engagement in the partnership, and the use of platforms (including physical, digital, or social platforms) to enable collaboration; 3) **funding and operational model**, including perspectives on governance and management models, as well as contractual and financial aspects of the partnership; and 4) **impact of the collaboration**, which is gained through **interaction** between actors. Furthermore, it highlights the importance of appropriated outcomes for all involved actors as well as comprehensive and broad-based goals and measures to accelerate the generation of impacts at the level of the innovation partners, collaboration itself, and broader society. Based on the empirical data of five international examples (Table 1 and Table 3), we provide below practical examples of these success factors.

First, **shared vision** helps the parties collectively proceed in the appropriate direction. It is important to notice that the vision may change during the collaboration according to the business environment or the needs of society. For instance, representatives of case S noted how the vision expanded during the collaboration, helping it to remain timely and attract new partners and funding sources. Upgrading the vision with the partners as society began to view the circular economy more as a systemic transformation than as pure waste management was key to the continuing success.

Second, regarding the **actors, activities, and resources**, the five analysed Living Labs differ significantly. As a rule of thumb, it could be stated that the larger and more complex is the collaboration model, the greater the need for coordination resources. A good orchestrator acts as an interpreter between different expectations of the involved actors to fulfil their diverse needs. On some occasions, such as in the context of case A, it is necessary that the orchestration has an extensive understanding of a specific industry to be able to help the partners create and execute a shared vision and to define the roadmap towards it.

Third, it was noted, that national policies have a distinct influence on the **operational model and supporting structures.** For instance**,** case D demonstrated that obtaining funding from local governments has kept the actions relevant from the perspectives of different actors in the communities. On the other hand, acquiring funding at the regional level has established a connection among actors that do not have a national presence and therefore do not participate in national innovation activities. Consequently, different funding instruments (private and public sources on national, regional, and international levels) should be streamlined to form a visible and continuous funding pipeline, where the different funding sources and instruments complement each other and are dynamically available for the specific needs along the flow in the innovation funnel.

Last, in most of the investigated cases there were member surveys or other related tools used to collect data about **impacts of collaboration**. Data on organisation-specific impacts need to be provided by the companies and other organisations. In addition, it was realised that data should be collected from a variety of sources so that the resulting picture is as comprehensive as possible. Thus, a typical challenge of current indicators was that they do not measure impact. Instead, the focus was typically on input indicators defined as resources (e.g. funding, personnel, facilities, time, and material) or indicators making the interaction visible (number of meetings, working groups and projects). Therefore, the second part of the study focused on the key dimensions for highlighting the impact.

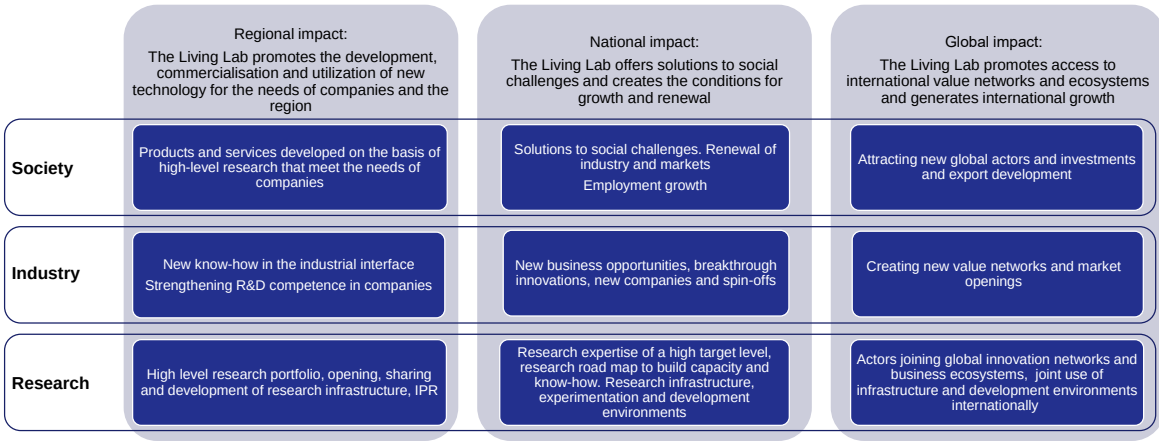

Figure 3. Impact indicators of Living Labs at different levels of collaborative innovation.

4.2 Framing impact on actors and society

At second phase of the study, group interviews of the actors revealed that expectations are based on the rationale and core tasks of each involved organisation, and thus impacts cannot be highlighted using one-size-fits-all indicators. Instead, it is important to align the impact indicators of collaborative innovation in accordance with the expectations of each participating actor and the broader societal targets. To understand the impact that the collaborative innovation initiative, such as the studied innovation ecosystems, generate, it is necessary to broaden the understanding of the short-term techno-economic outcomes that they produce towards the more long-term systemic and societal renewal that they generate. To achieve this task, impacts need to be considered from multiple perspectives, including the different target levels, and from the perspectives of various actors. In practice, such a governance task requires comprehensive impact targets and related impact indicators to determine the impacts generated by ecosystems.

Figure 3 presents a framework that was created based on an analysis of the studied ecosystem agreements, ecosystems operative action plans, and interviews. The figure examines the impacts from the perspectives of different target levels, emphasising Living Lab's role in 1) regional: promoting the development, commercialisation, and utilisation of new technology for the needs of companies and the region; 2) national: offering solutions to social challenges and creating the conditions for growth and renewal; and 3) global: promoting access to international value networks and ecosystems and international growth. Linking impact evaluation to the target setting helps clarify the objectives of collaborative innovation, concretise the impacts generated for different actor groups, and ensure the success of ecosystems.

In addition to three main targets, the framework includes perspectives of core actors involved in collaborative innovation and thus considers the impacts from the perspective of the research community (including universities and research and technology organisations (RTO)), industrial actors, and broader society (including The economy, environment, and citizens). Concrete indicators for measuring impacts have been identified at the junctures of these perspectives.

The drafted framework was introduced to the ecosystem's actors in a workshop. The aim of the workshop was to have a joint discussion of the framework and to ensure its adequacy to the different ecosystem contexts. The workshop participants agreed that the focus should be on the global competitiveness of the ecosystems as well as national growth and renewal. To be able to

generate impacts at the regional level, ecosystem management was considered highly important. Indicators such as growth and competitiveness of companies, as well as sustainability of the society, were considered cross-cutting themes in the framework. One notion that the workshop participants had was related to the level of impact that was pursued. They had problems placing the indicators on a certain level and they felt that many of the indicators drifted among regional, national, and global levels.

5 Discussion

Our analysis demonstrated that there was no single model in the investigated cases identified as a perfect model for collaborative innovation within Living Labs. Each of the benchmarked models of international cases contain well-functioning and interesting components worthy of further exploration. In each of the models, there are also aspects that the involved actors considered challenging or limiting. Overall, it seems that studied countries have been able to master some elements, such as achieving coordination among future-oriented agendas and balancing research and industry-driven interests. In addition, the national innovation policies and system structures had a significant influence on the choices made by the case organisations. The identified success factors in the sampled cases were at least partially aligned with the topics highlighted in the literature (the preliminary research framework presented in Figure 2 based on our literature review).

From the perspective of the relational dimensions, the shared vision was highlighted in all cases. Consequently, both the Swedish case and the literature (see for instance Fogelberg & Thorpenberg, 2012) highlighted the importance of a *shared vision.* Furthermore, both the literature and our case examples noted that the key actors should be involved from an early stage of vision building to identify goals and challenges (Haug & Mergel, 2021; Schuurman et al., 2013). In addition, interaction for *impact* was mentioned in all analysed cases as an important element for success. This finding is aligned with the literature review by Fuglsang et al. (2021). Furthermore, Austrian and German case examples presented by Haug & Mergel (2021) emphasised both intangible value and tangible value created in Living Labs similar to our cases (Table 3). Hence, the interaction practices for impact building vary significantly.

Regarding the structural dimensions, according to the literature review, the actors, *coordination* of their activities, and *different partner roles* were highlighted in Denmark (Brem & Radziwon, 2017) as well as in the Netherlands (Visscher et al. 2021; von Wirth et al., 2019). In addition, the previous literature emphasises the role of citizens and other service users at the centre of the solution design process of Living Labs (Haug & Mergel, 2021; Mergel, 2015). However, in these cases, the end users were not specifically highlighted; instead *operational model and supporting structures* such as regional activities and *funding* were emphasised. Subsequently, the literature emphasises how the operational model of Living Labs refers to the level of autonomy of the parent organisation and freedom to experiment (Haug & Mergel, 2021; Tõnurist et al., 2017). Furthermore, the concept of innovation ecosystems was highlighted in Finland (Laasonen et al., 2019) and the Netherlands (Visscher et al., 2021). This finding is aligned with the identified need to consider the impact of collaboration beyond the regional focus.

As a result of the analysis of the first phase, we identified the need to provide a comprehensive view on the impacts of collaborative innovation as a second phase of the study. In accordance with the analysis, there is a need to understand the impact of collaborative innovation on regional, national and global levels as well as from the perspective of actors involved in the collaborative innovation. Additionally, combining the success factors in the impact framework was deemed critical to gaining an understanding of the enabling impact factors.

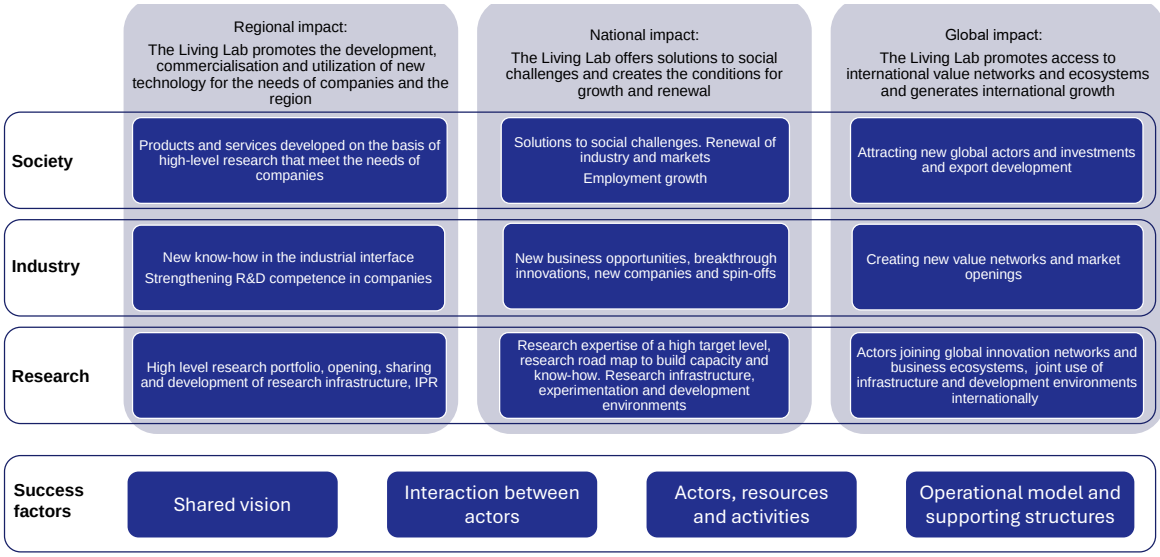

Figure 4. Success factors and impact indicators of Living Labs at different levels of collaborative innovation.

In accordance with the analysis, we summarised the following four dimensions as critical success factors to enable the generation of impacts: 1) shared vision; 2) interaction between actors; 3) actors, resources, and activities; and 4) operational model and supporting structures. Success factors are considered a prerequisite for creating impacts, which is then indicated from the perspective of various actors involved in collaborative innovation and impact dimensions (Figure 4).

6 Conclusions

This paper discusses the success factors of Living Labs that coordinates the realisation of the joint innovation process through collaborative arrangements. We explored the practices of Living Labs through five case studies. In addition, we concluded how impact targets and indicators were used to highlight the different expectations and interests among Living Lab actors.

6.1 Research contribution

The research contribution of the study was more practical than theoretical. Thus, the empirical examples of our study demonstrated a significant variety of collaborative innovation models as well as the conceptual chaos of the terms used. This variety is aligned with the literature review, which shows the multitude of connections among the theoretical discussions. Furthermore, the practical case examples indicated that the concepts are modified more often based on changes in the national innovation policies than based on the experiences of the involved actors or a research-based understanding of the success factors of different collaborative innovation approaches. Regarding the second research question, it was noted that such impact indicators might seem challenging, especially if striving towards true growth and a business impact, which involves aspects at the borderline of confidentiality. Two types of indicators were required to demonstrate the impact of collaborative innovation within Living Labs. First, there is a need for indicators that are adjusted to each organisation's own objectives, and second, there is need for common indicators that highlight the broad societal value. Therefore, we established a framework to help actors better understand the impacts of collaborative innovation (Figure 4) at different levels, i.e.

individual organisations (both public and private), Living Labs themselves, and broader society considering national and international aspects.

6.2 Practical implications

The findings benefit professionals and managers that have an interest in understanding collaborative innovation in the context of Living Labs. Each collaborative innovation setting is unique and thus detailed practices may vary. However, the success factors identified in this paper provide a framework for identifying practices to support the collaborative innovation processes. Indeed, practical implications relate to an appreciation of the vast diversity of Living Labs. Collaborative innovation undertakings are heterogeneous with their own specialties. Therefore, it is not feasible to develop a detailed, predefined set of management practices. Based on the results, we noticed that high flexibility of the collaboration framework is important, taking the form of, for instance, a checklist that guides practitioners on what issues are to be taken into account when defining their own collaboration models. Then, each Living Lab can use the checklist as a basis and develop practices suitable to their particular circumstances.

To build impact through shared agendas, broad-based impact targets and related indicators should be incorporated into operational day-to-day management and governance of collaboration. Success and progress should be systematically monitored based on jointly identified indicators. Systematic follow up based on the selected indicators provides data-based support to enable joint decision-making among partners.

6.3 Limitations

This study has the typical limitations related to qualitative (case) studies and more specific limitations related to research design, which might influence the generalisability of the findings. First, the structure of the selected Living Labs vary due to different national innovation policies and related choices. This variation directly influenced the relational dimensions of the analysed Living Labs. Therefore, the findings, i.e. the identified success factors, might not be directly applicable to Living Labs located in other contexts. Second, the internal validity of the findings is limited because of the data collection process. The interviews were conducted by online meetings, which makes it more difficult to build a shared understanding of the intangible elements of success, and therefore, interpretations may become limited (Yin, 2016). Third, the interviews were conducted by six researchers, which may have negative and positive influences. A negative feature is the risk that different questions will be emphasised by different interviewers during the interview process, although there were typically two researchers participating in each interview. On the other hand, a positive influence was a rich triangulation process among the six researchers, who had different backgrounds.

In conclusion, despite the limitations of the research process and design, this study provides an overview of relevant success factors of Living Labs that influence the collaborative innovation process. Furthermore, a framework for conceptualising the impacts at different levels and from different perspectives was presented. However, further research is necessary to validate and extend the findings.

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