
Living Lab Assessment Method (LLAM): Towards a methodology for context-sensitive value assessments

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Abstract: In the past 15 years, Living Labs (LLs) have been emerging as a process for implementing Social Open Innovation in Urban Innovation Ecosystems. This approach has shown significant contributions to for example urban transition, garnering substantial interest from academia, practitioners, and policymakers. Nevertheless, LLs face criticisms regarding sustainability, monitoring and scalability. In this context, a key aspect for both understanding and managing LLs is the perpetual evaluation of the value creation that is being created through these processes. Existing (LL) assessment frameworks often fall short in providing both generalizable and context-specific insights. Therefore, this study bridges this gap by drawing upon established literature and frameworks, such as the Theory of Change framework, participatory assessment approaches, and existing LL value assessment literature. Through two co-creative focus groups, these theoretical foundations were applied to develop the Living Lab Assessment Method (LLAM). The LLAM represents a methodology for context-sensitive value assessments of Living Labs.

Keywords: Living Labs; Value creation; Theory of Change; Participatory Research

1. Introduction

The Open Innovation (OI) concept, popularized by Henry Chesbrough (2010, 2014), provides a collaborative paradigm for technological innovation development. In his seminal work, Chesbrough advocates for enterprises to not only harness internal ideas and market routes but also tap into external sources for innovation development. While Open Innovation has its roots in a corporate context, over the past decades, organizations with societal agendas have also adopted OI strategies, leveraging for example local resources for services and knowledge transfers from, to, and between

communities (Ahn et al., 2019), and demonstrating its utility in addressing pressing societal issues.

To operationalize the, often theoretical, OI paradigm, living labs (LLs) have been emerging as a way to transform theory to practice, combining with principles from Open Innovation and User Innovation (Schuurman, 2015). This way, LLs provide a framework to guide decentralized innovation by fostering collaborative engagement between stakeholders, with end-users playing a central, co-creative role in real-world contexts (Schuurman, 2015). Over the years, various forms of LLs have been established, which share commonalities while also exhibiting distinctive characteristics. These include for example agroecosystem LLs (McPhee et al., 2021), campuses operating as LLs (Evans et al., 2015), and Living Labs serving as testbeds for emerging technologies (Følstad, 2008) in which new products and technologies are tested. Urban environments present another context for LLs, particularly in addressing "wicked problems", which often have an urban nature (Coyne, 2005; Peters, 2017). Such Living Labs are usually called "Urban Living Labs" (ULLs). ULLs are deeply integrated into urban environments, which means they are strategically implemented to facilitate transitions toward urban sustainability, and addressing complex societal challenges such as population growth, aging, climate change, and public transport (Coyne, 2005). Defined largely within the framework of LLs, ULLs are characterized as user-centered, Open Innovation ecosystems that conduct systematic citizen-oriented co-creation methods, merging research and innovation within real-life urban communities (ENoLL, 2006; Steen and van Bueren, 2017). Steen and van Bueren (2017) further refine this concept by introducing the notion of "place-based labs," emphasizing the physical delineation within urban areas to enhance the conceptualization of ULLs.

The interest in LLs and ULLs grew in the past decade among both practitioners and academics. This can be attributed to their demonstrated ability to foster value within (urban) innovation ecosystems and their supporting role in transforming cities to be more resilient. Moreover, ULLs are able to catalyze systemic impacts within these networks (von Wirth et al., 2019). Various sources of literature have examined these systemic effects from diverse perspectives. Beyond stimulating open innovation (OI) (Leminen and Westerlund, 2012), ULLs are seen as promising avenues for (1) bridging the gap between solution development, production, and market adoption for urban solutions, (2) engaging multiple stakeholders in the development of these solutions, (3) leveraging and disseminating knowledge distributed among stakeholders, and (4) fostering new

partnerships and transdisciplinary collaborations (Voytenko et al., 2016; Steen and van Bueren, 2017, Robaeyst et al., 2021). In addition, prior research also highlights the potential of ULLs to enhance the absorptive capacity (the ability to internalize external knowledge), dynamic capabilities (the firm's agility in adapting to changes) (Cohen and Levinthal, 1990; Schuurman, 2015; Carayannis and Grigoroudis, 2016), and connective capabilities (Robaeyst et al., 2021; Fenger et al., 2012; Ansell and Torfing, 2014) of the stakeholders involved in ULLs. These dimensions of value creation have bolstered the appeal of ULLs in urban policy making (Steen and van Bueren, 2017), fueling a greater tendency to embrace place-bound experimental initiatives in urban environments.

However, despite ULLs' transformative potential towards resilient cities (Voytenko, 2016; Steen & Van Bueren, 2017), several challenges still persist. Hossain et al. (2019) identify, for example, limitations regarding the temporal nature of LLs, stakeholder governance issues, knowledge transfer efficiency, user engagement, and a lack of sustainable funding. Gascó (2017) categorizes these challenges as 'sustainability' and 'scalability, challenges,' with a lack of long-term funding, challenging the short LL life spans and temporal nature. Furthermore, the multi-stakeholder nature poses challenges due to divergent stakeholder expectations (Ersoy & Van Bueren, 2020).

This ambiguity regarding the Urban Living Lab concept creates challenges for practitioners addressing urban issues amid dwindling sources of decreasing funding (Voytenko, 2016) and academics seeking to further disentangling deeper insights in LLs (von Wirth et al., 2019). We argue that, to enhance comprehension regarding the nature of the added value of LLs, there is a crucial need for improved impact assessments and a better understanding of value creation processes in ULLs. However, rigorous impact assessment for ULLs effectiveness remains challenging (Steen & Van Bueren, 2017; Paskaleva & Cooper, 2021). Similarly, Ahn et al. (2019) note a limited understanding of the concrete societal impact of open innovation LLs due to the main focus on anecdotal evidence for LLs value validation. In addition, because of the local character of LLs, current literature on Living Labs (LLs) focuses mainly on impact assessments through anecdotal comparative case studies. This allows to gain insights into the specific LL contexts but fails in the development of a universal assessment framework (Bronson et al. 2021).

Considering this existing need to better understand the LL concept and its contribution to future resilient cities, and the need for a context specific, yet

generalizable assessment method, this research aims to develop a generalizable methodology for ULL value assessments that simultaneously takes local LL contexts in consideration.

2. Theoretical background

To support this methodological development, this study will integrate features and components drawn from established assessment methodologies and paradigms. This section provides a concise outline of the main foundational elements. First, we tap into the Theory of Change framework, and second we will concisely describe a participatory approach for impact assessment. Finally, we will link this research with an earlier developed framework for LL value creation formalized by Robaeyst et al. (2023).

Theory of Change

When it comes to assessment paradigms and methodologies, especially in the context of social innovation, the TOC (Theory of Change) paradigm offers a widespread and commonly applied framework for assessing impact of for example social ventures and NGO's when applying interventions in real life environments. This paradigm or approach is used to design, implement, and evaluate social interventions or programs (Weiss, 1995, Connel & Kubisch 1998). It provides a framework for understanding how and why interventions are expected to lead to desired outcomes (or not) by mapping out the causal pathways and assumptions underlying the intervention's logic. This way, this framework helps in breaking down complex initiatives or projects into necessary steps and conditions, enabling a clear comprehension on how and why they generate impact (Weiss, 1995, Connel & Kubisch 1998). Accordingly, this framework breaks down projects/initiatives into the following components

- **Inputs:** The facilities, materials, artifacts and resources that are developed or created by the initiative.
- **Activities:** The key-activities that are being executed making use of the created inputs and resources that are aimed at creating the impact of the initiative.
- **Outputs:** Assumptions on how the initiative will create improvement in the short term (0-6 months).
- **Outcomes:** Assumptions on how the project will create improvement in the mid-long term (12-18 months).

According to the TOC, these components form a sequential process which generates value within the context of the project intervention. Connell and Kubisch (1998) state that a good TOC must be plausible, feasible, and testable. Plausibility requires that the proposed activities, based on evidence and common sense, can lead to the desired outcomes. Feasibility demands that the initiative can be executed on the economic, technical, political, institutional, and social level. Thus, assumption testing can be conducted by applying a variety of measurement methods, both quantitative and qualitative. The interesting thing about ToC is its capacity to approach impact assessments in a structural, but still open-ended way, in a participatory manner, involving different stakeholders (or 'voices').

A participatory assessment approach

At the same time, scholars have been increasingly embracing principles of participatory research (Park, 2001), in which knowledge development takes place with communities and stakeholders, not just by academics standing at the side line. Similarly, Community-Based Participatory Research (CBPR) and Participatory Action Research (PAR) are emerging as methodologies to put this participatory approach into practice (and action!) (MacDonald 2012). This method has been elucidated across various contexts and disciplines. For instance, in philosophy, it emphasizes the imperative of involving the individuals studied in any research potentially impacting them (Vollman, Anderson & McFarlane, 2004). Sociology, on the other hand, underscores the incorporation of local contexts to better ("truly") comprehend issues and promotes action for change or improvement (MacDonald, 2012). Additionally, from a feminist perspective, PAR advocates for an integrated collective process of social investigation, education, and action (MacDonald, 2012; Maguire, 1987).

When it comes to the assessment of value, Hisschemöller & Cuppen (2015) delineate participatory approaches into "participatory methods," denoting procedures, and "participatory tools," representing steps within these procedures. The common thread among these distinctions is their aim to convene people in a specific setting and facilitate collaborative assessments. Through dialogue with and among local stakeholders, a deeper understanding of complex and unstructured problems or interventions emerges, supplementing scientific expertise. Central to this approach is the engagement of stakeholders in assessing complex interventions. By involving stakeholders and carefully considering the intervention's intricate environment, a more comprehensive understanding of its impact can be cultivated. This inclusive process fosters a holistic perspective, contributing to a nuanced evaluation of the intervention's value (Vaidya & Mayer 2014).

Building upon these perspectives, we develop a collaborative process that involves active participation from all stakeholders, emphasizing empowerment, contextual understanding, and ethical considerations throughout the research endeavor.

Value creation in (U)LLs

When it comes to the structure of this methodological endeavor, this paper extends upon research conducted by Robaeyst et al. (2023), particularly their investigation into Urban Living Lab (ULL) value creation. Prior to formulating the framework detailed in this paper, a qualitative assessment of ULL value creation was undertaken. Robaeyst et al. (2023) conducted interviews with stakeholders (N=20), originating from all of the helices from the quadruple helix innovation framework (Carayannis et al. 2018), involved in an urban living lab project called Comon, situated and conducted within the city of Ghent. The interviews aimed to gauge the extent to which participants perceived value creation through their engagement, resulting in an overview of processes towards value creation triggered by the conduction of the ULL. This gave insights into how different participating stakeholders in an LL perceive added value according to their own perspective.

The study's findings revealed that the implementation of an Urban Living Lab (ULL) aided in seven processes of value creation among participating stakeholders (both organizations and individuals, that can be categorized into two main themes. Firstly, the study demonstrated that capacity building was a significant form of value creation, encompassing the enhancement of entrepreneurial, knowledge, network, and instrumental capacities among stakeholders. Secondly, stakeholders perceived the ULL as fostering purpose-driven fulfillment by encouraging agenda setting on pertinent societal issues, fostering a hedonistic environment conducive to informal and experimental engagement, and facilitating a process and space dedicated to addressing pressing societal challenges. More concrete definitions regarding these dimensions are provided in Table 1.

Table 1 The processes of value creation within Urban Living Labs

<i>Process of ULL value creation</i>	<i>Description</i>
Capacity building	
Entrepreneurial capacity	The development of entrepreneurial skills (such as design thinking, prototyping, pitching,...)
Connective capacity	The extension of the network (networking, fostering collaboration, empowering groups, ...)
Knowledge capacity	Generation of knowledge (domain-specific insights, ideas and possibilities, methodological knowledge, ...)
Instrumental capacity	Instrumental value creation for the stakeholders (exposure, knowledge sharing, achieving KPIs, ...)
Purpose driven fulfillment	
Agenda setting	Putting topics on the agenda (political, societal, media, academic, ...)
Hedonism	Self-development of participants (informal, fun, learning, challenging, ...)
Altruism	Action-oriented contribution to improve society (creating tangible solutions, experimenting, ...)

Source: Robaeyst et al. 2023

3. Methodology

General approach

This study describes the development of a versatile impact assessment tool, blending key elements from diverse frameworks discussed earlier. This integrated approach aims to offer a comprehensive method for evaluating the value generated by applied Living Lab (LL) projects. At the core of this strategy lies the participatory creation of a Theory of Change (TOC) framework, wherein local stakeholders actively contribute to its formulation within the LL project's context.

The TOC framework serves as a practical and widely applicable tool, facilitating the systematic breakdown of LL interventions into essential components: inputs, activities, outputs, and outcomes. By delineating these outcomes and outputs, value assumptions can be pinpointed and translated into tangible quantitative or qualitative measures. Leveraging prior research

on LL value creation, the dimensions/processes outlined by Robaeyst et al. (2023) offer an inductive framework for establishing a holistic comprehension of LL value assumptions, ensuring the framework's general applicability.

This methodology entails a participatory approach, in which the framework provides the basic structure of the value analysis, but the core is to discuss the expected value creation and the effective value creation together with a wide variety of stakeholders. This allows for contextual flexibility and increases validity, enhancing the assessment's contextual relevance and depth.

Research methodology

To co-create and validate the robustness of these theoretical underpinnings, two focus groups (FG1 & FG2) were conducted, both involving LL practitioners actively engaged in projects in the city of Ghent, Belgium. Leveraging their firsthand experiences and deep understanding of LLs, these practitioners were considered expert stakeholders, capable of providing unique insights for this framework development. Several participants in these focus groups have been involved in various LL initiatives conducted in Ghent, each with its distinct focus and location. Table 2 offers an overview of the participants and their involvement in specific LLs, providing valuable insight into the diverse experiences and expertise contributing to the development and validation of the LL assessment framework.

Table 2 Overview of experts in the two focus groups

<i>ID</i>	<i>Name project</i>	<i>LL type</i>	<i>Location</i>	<i>Topic</i>	<i>FG1</i>	<i>FG2</i>
1	Comon	Urban Living Lab	City of Ghent	Healthcare	Yes	Yes
2	Comon	Urban Living lab	City of Ghent	Healthcare	Yes	Yes
3	CoGhent	Urban Living Lab	Three Ghentian neighborhoods	Cultural heritage	Yes	No
4	HoGentLL	Campus living lab	University campus	Urban planning	Yes	Yes
5	HoGentLL	Campus living lab	University campus	Urban planning	Yes	No
6	3IDLabs	Urban Living Lab	University campus	Education	Yes	Yes
7	LL development & diversity	Urban Living Lab	City of Ghent	Education	Yes	No
8	LL labor and activation	Living lab	City of Ghent	Labor & activation	No	Yes
9	LL coordination city of Ghent	Living Lab	City of Ghent	Living labs	Yes	Yes

The two focus groups were conducted sequentially, each contributing to the development and validation of the Living Lab (LL) assessment framework. In the initial focus group (N=8), participants engaged in a collaborative process to establish the foundational elements of the framework, utilizing the Theory of Change (TOC) approach. The first FG explored the goals and purposes of the assessment framework, which subsequently delineated the TOC components specific to their LL projects. Through a series of guided exercises, participants identified inputs, activities, and assumptions of value creation, drawing upon the theoretical framework proposed by Robaeyst et al. (2023). These elements were clustered to reveal overarching themes of value assumptions across all LLs, culminating in a first version of the LL value assessment framework. Next, specific measurements for value creation processes were defined, such as quantifying network capacity building. The outcomes were synthesized into a practical document addressing LL value creation.

To validate the initial framework, a second focus group was conducted with a reduced sample size (N=6), including a new participant representing a different LL project. Participants applied the framework to their respective LL projects, evaluating them based on previously identified dimensions. Feedback was provided for framework improvement, resulting in an iterative refinement process. The outcomes of the second focus group were analyzed and incorporated into the second version of the LL impact assessment method, enhancing its robustness and applicability.

4. Results

The results of this study are synthesized into a model, which we call the LLAM (Living Lab Assessment Method), a method designed for various purposes and to facilitate a comprehensive understanding of the value of a Living Lab. In this chapter, we offer a descriptive overview of the following elements of the LLAM. This is split up in two parts:

- *Goals and objectives:* Goals and objectives of the LLAM, as experienced by the respondents.
- *LLAM dimensions:* Descriptions of the dimensions of the LLAM, along with examples of how these dimensions can be measured.

Goals and objectives of the LL Assessment Framework

Both practitioners and academics confirmed the need for a structural assessment of Living Lab Value creation. During the focus groups, the articulation of the need for this framework closely mirrored the needs described in the introduction of this paper. Table 3 provides an overview of arguments that support the need for a value assessment framework.

Table 3 Overview of goals and purposes of the LL value assessment framework

<i>Goal</i>	<i>Description</i>
Assessment Identification of visible and invisible value creation of LL and its subsequent measurement metrics.	A framework needs to be designed to discern both apparent and latent value creation within the LL context. The framework provides a structure for delineating metrics essential for monitoring and tracking potential value creation within LL initiatives.
Formation The development of LL projects	A framework needs to be designed to serve as a formative tool enabling the development of strategic approaches for LL projects, encompassing processes, methods, and overarching goals, before the project starts (what do we want to achieve?)
Reflection A tool to reflect upon conducted LL projects	A framework should be a reflective instrument, supporting LL experts in cultivating more sustainable projects through introspection and refinement of their approaches.
Communication Communication of impact	The framework should support valid communication of the impact and generated value to diverse stakeholders, including funders, government entities, industry representatives, and the public.

Not surprisingly, the primary goal of the framework should be the assessment of the LL itself (post-intervention). Noteworthy here, is that participants expressed that it is important to capture both latent and explicit forms of value creation in this assessment. Respondents stressed that while LL projects generate various forms of value, many of these remain "invisible" or are overlooked at higher policy-making levels. The primary objective of the framework is to gain insights and visibility regarding these forms of value creation. Connected to this broader view of value creation is the operationalization or measurement aspect. A second objective of the LLAM is to gain a better understanding of how both visible and invisible value creation can be defined in terms of measurement and substantiation. Often, practitioners argue that existing KPIs (Key Performance Indicators), mostly quantitative in nature, are insufficient to assess the application of the LL in a holistic manner. Utilizing both quantitative and qualitative measurements is deemed more appropriate for assessing LL value creation.

Secondly, there is also a need for goal alignment instruments *ex ante*, before the start of the LL. In this context, the framework should proactively offer a set of value creation ‘dimensions’ that assist in shaping subsequent processes and methodologies aimed at generating specific forms of value creation, but also to discuss the weight & relevance of each goal. This would increase awareness of the process and methodological choices during the initiation of a project. This proactive approach enables stakeholders to strategically align their efforts with desired value creation outcomes from the outset.

Thirdly, the LLAM is able to enable a more holistic and abstract reflection on Living Labs. In more concrete terms, based on the value assessment of specific use cases and their corresponding processes and methodologies, the LLAM facilitates reflection on a broader and longer-term perspective. This enables policymakers to engage in strategic conversations and collaborations for future projects, leveraging insights gained from past experiences to inform future initiatives effectively.

Lastly, the LLAM should provide a clear, valid and more concrete framework to support stakeholder communication. Given the multi-stakeholder nature of a certain LL, focusing communication on specific forms of value creation allows for more targeted and effective communication. This approach aims to facilitate more concise and to-the-point communication, enhancing understanding and alignment among stakeholders involved in LL projects.

LLAM Dimensions

These objectives guided the creation of the LLAM, a first version of the framework was collaboratively developed with LL practitioners. For this analysis, the seven processes of value creation identified in the research of Robaeyst et al. (2023) were condensed into six key dimensions. The framework is designed to be adaptable to the context of the Living Lab, allowing each process to be measured using metrics or evidence tailored to that specific context.

To illustrate this adaptability within this paper, we will provide an example of measurement originating from one of the Living Labs discussed in the focus groups. While these measurements may be useful in various Living Lab scenarios, they are not universally applicable in all cases.

Skill capacity development

The living lab stimulates a wide range of growth, development, and improvement that an individual experiences in various aspects of their life and work. This development is supported and encouraged through participation in the (experimental) setting of a LL. With the experimental setting, efforts are made to stimulate "T-shaped skills" (Demirkan & Spohrer, 2018), which are situated along both a horizontal axis (general skills that can be applied in various contexts) and a vertical axis (domain-specific skills and knowledge).

Example of measurement

The campus-based LL 3IDLabs is aimed at improving VUCA-skills (skills that help recognizing and understanding the complexities of a rapidly changing world). As a set of Horizontal skills, these can be measured through the application of a [questionnaire] among participating students. Although the framework explicitly challenges a counterfactual approach, participants still fall back to quantitative or statistical measures. This might be due to bias towards mechanical objectivity (Daston & Galison, 1992).

Network capacity improvement

The living lab facilitates engaging encounters within the innovation ecosystem to enhance the network capacity of stakeholders involves initiating and organizing facilities and events with the goal of fostering inclusive environments where diverse audiences can interact meaningfully. Through this, the pilot project aims to cultivate a culture of diversity and engagement among various partners. This entails not only actively promoting inclusivity in activity organization but also creating physical spaces that encourage diversity among participants.

Example of measurement

The Urban Living Lab of Collections of Ghent aimed to establish new collaborations within the Ghentian ecosystem among a diverse set of stakeholders. This was evaluated through specific use cases resulting directly from the project, such as instigating [new project proposals] and the introduction of a [yearly master thesis collaboration] between Ghent University and a Ghentian museum institution. In this context, the assessment and impact evaluation were predominantly qualitative in nature and not conducive to quantitative measurement. The wide variety of examples that provide empirical evidence for this improvement require an open-ended assessment.

Knowledge capacity enhancement

The Living lab stimulates the development and sharing of new substantive as well as methodological knowledge, forming a dynamic process that offers innovative perspectives to participating stakeholders. This approach promotes mutual understanding and respect for multidisciplinary and expertise. The shared and developed knowledge is validated and illustrated in an interdisciplinary setting, involving academics, industry, government, and citizens.

In the "Diversity in Labour" project, a subproject was organized aimed at identifying and engaging isolated youth, also known as "Hikikomori" in Japanese, in the labour market. During the project, a new method was developed [generation of new knowledg] utilizing Reddit and Discord, which was then taught in 3 workshops to social workers [events on which newly generated knowledge is shared] in the city of Ghent who work with youth to help integrate them into the labor market.

Instrumental capacity offer

The LL supports local ecosystem partners in executing and communicating their own mission and tasks. This involves providing facilitative assistance to organizations and stakeholders within the ecosystem. This assistance may include offering resources, advice, networking opportunities, or other forms of support. The overarching goal is to empower these partners to achieve their own objectives. For instance, a civil organization focusing on foreign-speaking newcomers may aim to reach as many people as possible within this category. In this scenario, the LL acts as a facilitator by organizing new events and helping to achieve these objectives.

Example of measurement

The project Comon measured the instrumental capacity by conducting [20 interviews] with participating stakeholders. During these interviews, members of various participating organizations shared how the LL contributed to their own mission. These contributions were then documented in concrete ["impact stories"], serving as evidence for the added instrumental value of the project.

Societal agenda-setting

The Living lab contributes to communicating and mapping out socially relevant issues or complex problems (wicked problems) and aims to place them on the societal agenda. This process ensures that the central issue

receives the necessary attention, resulting in increased understanding among other stakeholders who may not typically engage with these themes.

Example of measurement

*The Living Lab Comon measured this dimension by tracking the **[number of public events]** organized around the theme of "understandability in healthcare." Additionally, they considered the number of **[attendees reached]** through these events and the frequency of **[project mentions]** on public radio, television, or in newspapers.*

Real solutions generation

The Living Lab embraces a proactive approach to urban challenges within the local city context. In this dimension, the focus lies on finding concrete solutions for the complex societal issues related to the central theme of the Living Lab. These solutions are then applied and tested within a real-life environment to determine their added value within the realm of the central theme.

Example of measurement

*The CoGhent Living Lab created a series of artifacts that supported reuse and reinvention. In a funded program called the cocreation fund, small initiatives **[got funding]** to make use of this infrastructure. The LL also developed **[first demonstrators]** of several cutting edge data technologies and data standards. Furthermore, several **[technology and artifact spin-offs & spin-outs]** sprouted out of the living lab.*

5. Conclusion and discussion

This study aimed at the development of a methodology for Living Lab Value assessments. This was realized through the adoption of existing paradigms such as the TOC paradigm, participatory assessment approaches and by building upon the existing framework of Robaeyst et al. (2023). Through the application of these theoretical foundations in two formative focus groups, a comprehensive LL value assessment method was developed (LLAM). With this methodology, which exists out of various frameworks, this paper offers a significant contribution to both academia and practice.

The primary academic contribution of this study lies in the participatory formulation of the LLAM (Living Lab Assessment Method) tailored specifically for Living Labs (LLs). This novel approach expands the theoretical understanding of LLs and offers an alternative framework for comparative case studies. Unlike conventional approaches, our

methodology incorporates both contextual factors and a generalized impact assessment, providing a more holistic view of LL initiatives.

From the perspective of practitioners engaged in Living Labs (LLs), our framework offers various functionalities to support their work. Firstly, the framework can be used in a summative manner, providing a comprehensive overview and assessment of the value creation within a LL. Its open design allows for the incorporation of both qualitative and quantitative value indicators, facilitating a thorough value assessment. Secondly, in the initial stages of a LL project, the LLAM serves as a formative tool, aiding practitioners in formulating goals and determining concrete actions regarding methodology and processes. Thirdly, by offering a broad and abstract view of conducted LLs, practitioners also find a reflective tool for future LL projects, enabling them to learn from past experiences and improve their approach in subsequent projects. These reflections and concrete assessments allow practitioners to communicate the sense and nonsense of LLs more aware.

From the perspective of policy makers, this framework emerges as a valuable instrument for collaborative efforts in co-creating and assessing LL initiatives. By fostering a unified vision among stakeholders, it promotes effective decision-making and resource allocation. This collaborative approach not only enhances the sustainability of LL projects but also strengthens community engagement and ownership.

One limitation of the framework is its context sensitivity, which necessitates collaboration with local practitioners for refinement. Additionally, its formulation within the city of Ghent limits its generalizability to other contexts. Further validation through real-life testing and a more diverse participant pool is recommended to strengthen its reliability and effectiveness.

To advance the field of Living Lab research, future research should focus on concrete real-life testing in various cities worldwide to validate the framework's effectiveness and identify areas for refinement. By addressing these challenges and embracing future research directions, we can enhance the understanding and implementation of lead user initiatives across diverse contexts.

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