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Harmonizing the evaluation of living labs: a standardized evaluation framework

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Abstract:

Candidate LLs joining LL associations and networks (ENoLL, Forum LLSA...) undergo quality-assessment processes based on specific criteria and evaluation frameworks to guarantee members meet their LL standards. Currently, limited attention is paid on how such evaluation methods can contribute to future LL-performance. The need to deeper understand the architectural aspects of LLs and further study effective management-approaches has been raised by other authors. Schuurman (2015) proposed a macro-meso-micro-level approach for classifying LLs. Despite its potential value, this three-level analysis approach has not yet been fully recognized in existing LL evaluation frameworks. The adoption of a harmonized macro-meso-micro evaluation approach, with a clear focus on the macro-level could support the development of LL towards sustainability, impact and efficacy. This paper aims to define a set of harmonized weighted criteria for a comprehensive LL evaluation framework to be used for assessing LLs on all three levels based on multi-method research approaches.

Keywords: Evaluation framework, Living lab evaluation; Living Lab assessment; Living lab criteria; Maturity of living labs;

1. Problem

European Network of Living Labs (ENoLL) is an international non-profit membership-based association promoting and enhancing the Living Labs (LL) concept globally. ENoLL can be considered as the leading LL authority due to having the world's largest membership network. All new candidate LLs must undergo quality assessment processes to make sure that all members meet their LL standard, based on an existing ENoLL evaluation framework. Similarly, members of other living lab networks (e.g. Forum LLSA) collaborating with ENoLL go through similar, but not identical, evaluation processes.

Although the evaluation processes are very thorough, Mastelic et al. (Mastelic, Sahakian and Bonazzi, 2015) argued that limited attention has been currently paid on how such an evaluation contributes to support living lab performances and sustainability, and proposed numerous improvement suggestions to ENoLL's evaluation framework. The need to better understand the architectural aspects of living labs and find effective management approaches has also been raised by other LL authors (Hossain, Leminen and Westerlund, 2019). Schuurman (Schuurman, 2015) has proposed a macro-meso-micro level approach for classifying living lab activities in which macro-level is referring to the LL constellation, meso to a LL innovation project and micro to different methodological research steps. This classification does support a more effective approach towards sustainability, by formalizing the creation of a LL self-standing structure.

Despite its potential value, the suggested three level analysis approach has not yet been fully reflected into the existing LL evaluation frameworks. Consequently, LL architects might be unaware on which level they are operating from and what effect this has on that specific level.

Considering that evaluation frameworks serve as well the purpose of giving deeper insights into quality assessment and most essential improvements, identify strengths and weaknesses, identify areas in which support and cooperation are needed, evaluate progress, when previous evaluation data is available and identify barriers and development needs (Forsström, Lilja and Ala-Mantila, 2020), LL evaluation frameworks should be considered an accelerator for deepening the understanding of the LL architectures and individual LL members.

Evaluation frameworks that are not adequately structured potentially constrain the development of a sustainable LL movement and hamper the possibility to work at the right architectural level for building a sustainable, impactful, and effective LL structure.

Within VITALISE¹, an European funded project focusing on the harmonization of living lab procedures, ENoLL is tackling the need for a harmonized evaluation framework across all living labs associations and projects, considering this revision as the basis for a strong and sustainable living lab community worldwide since emphasising the macro-level in evaluation frameworks ensures that living lab networks are better able to assess and support the sustainability of their members as the macro-level focuses on the long-term vision & approach of living labs.

¹ <https://vitalise-project.eu/>

2. Research question

The main aim of this paper is to define a harmonized set of weighted criteria for a comprehensive LL evaluation framework to be used for assessing LLs from macro-, meso- and micro levels.

Thus, the following research question (RQ) are defined:

What are and/or should be the main LL evaluation criteria at macro (RQ1), meso (RQ2) and micro (RQ3) levels?

How can we harmonize the existing evaluation frameworks to reflect the three levels architecture?

The premise is that creating an overall evaluation framework to harmonize the way the maturity of living labs is being evaluated will increase the sustainability of living labs in the long term by providing them a framework for improving the crucial elements of a living lab.

3. Current understanding

To work towards the harmonization of the evaluation framework of living labs, is based on the analysis and cooperation among different living lab networks - e.g., European Network of Living labs (ENoLL) and Le Forum des Living Labs en Santé et Autonomie (Forum LLSA) - and different European projects (e.g., oPEN Lab¹, SCORE², Rewaise³, Urbanome⁴) in which living labs are developed and evaluated. The first findings show that there is a lack of crucial elements of the macro-level aspects of a living lab, or it is not clearly identified.

Living Lab Definition

Forum LLSA⁵ describes living labs as actors of an open innovation policy, attached to the value potential of new markets. Living Labs are not a decision-making body but a democratic legitimacy body aiming to rebalancing public action in a logic of considering the generality of citizens' concerns, including those from minorities or actors with little economic weight.

ENoLL⁶ defines living labs as user-centered, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. They operate as intermediaries among citizens, research organisations, companies, cities and regions for joint value co-creation, rapid prototyping, or validation to scale up innovation and businesses. Living labs have common elements but multiple different implementations.

¹ <https://cordis.europa.eu/project/id/101037080>

² <https://cordis.europa.eu/project/id/101003534>

³ <https://cordis.europa.eu/project/id/869496>

⁴ <https://cordis.europa.eu/project/id/945391>

⁵ <https://www.forumllsa.org/>

⁶ <https://enoll.org/about-us/>

Figure 1 presents the six common elements as they are interpreted as the essential building blocks of a living lab by ENoLL.

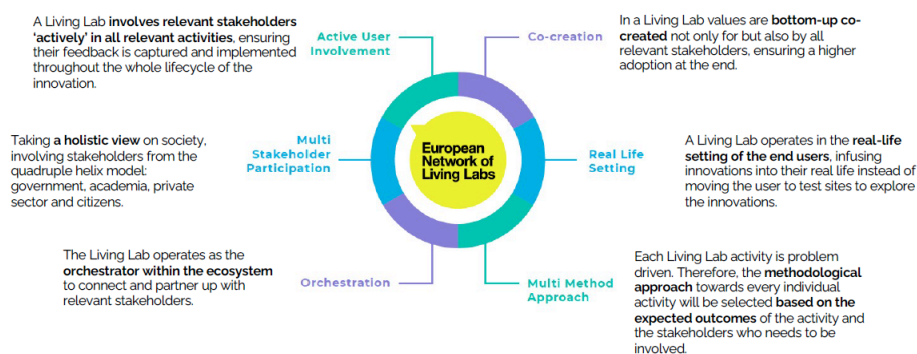


Figure 1 Six building blocks of a living lab according to ENoLL.

Over the years, to evaluate the maturity of applying living lab organisations to its network, ENoLL developed an evaluation framework based on these six building blocks, structured in six chapters and fifteen weighted criteria¹.

There are 3 different types of criteria:

- **A-criteria:** these criteria are essential in the definition of a living lab
- **B-criteria:** these criteria are important to assess the maturity of a living lab
- **C-criteria:** these criteria are a valuable add-on to the A & B criteria

Table 1 Current ENoLL Labelling & certification framework

LL building block	Criteria	Type of criterion
Organization	Organization, management & governance of the living lab	A
	Experience in living lab operations	B
	Interest & ability to participate in regional or (inter)national innovation system mechanisms	C
Users & reality	An iterative living lab process & real-life setting	A
	Users & people engagement approach	B
	Quality of methods & tools	C
Resources	Roles & responsibilities of qualified staff	A
	Access & availability of equipment & infrastructures	B
	Internal & external communication	C
Openness	Openness of innovation processes and partnerships	A
	Feedback protection & author's rights	C
Value	Co-created values for all involved stakeholders	A
	Coverage of the value chain	C
Business Model and Future Plans	Business Model & access/ability to funding	A
	SWOT analysis & strategic plans for the future	B

¹ <https://enoll.org/wp-content/uploads/2021/12/application-guidelines-wave-2022.pdf>

The LLSA Forum, since 2011, supports the actors of innovation in Health and Autonomy: professionals, institutions, academics, associations. Through an approach centered around the patient, the association federates the ecosystem of Living Labs by promoting the emergence of new projects through the establishment of working groups on key subjects in terms of health and innovation and by working on new concepts, methodologies, with the aim of advancing the health of tomorrow.

Forum LLSA uses a self-assessment framework based on following 10 dimensions of a living lab:

1. Governance (macro)
2. Operational outcomes (meso-micro)
3. Research (meso-micro)
4. Research outcomes (macro-meso-micro)
5. Processes & project management (meso-micro)
6. Human resources (outcomes) (macro-meso)
7. Financial & technical resources (macro-meso)
8. Clients/users outcomes (meso-micro)
9. Social outcomes (macro-meso)
10. Strategy (macro)

4. Approach

A multi-method research approach (Brewer, Hunter and others, 2006), composed of i) literature review, ii) experts workshop and iii) facilitated online workshop with experienced living lab actors, iv) creation of a pilot group representative of the relevant networks has been applied starting from June 2021 onwards.

1. Desk study/Literature review

First, a literature review on existing evaluation frameworks and wider definitions of living labs including criteria was conducted by searching academic literature as well as European funded LL projects and LL networks websites. The search terms included in the title the term “*living lab(s)*” and the term “*evaluation*” or “*criteria*” or “*assessment*”. The identified evaluation frameworks were studied to identify the criteria used by the research community for defining the living labs, defining “a preliminary set of criteria”.

Most of them highlighted the importance of openness (Leminen, Westerlund and Nyström, 2012) and transparency of research methods (Forsström, Lilja and Ala-Mantila, 2020) as well as developing competence, and committing to follow the principles of openness in research, development and innovation operations. Other studies presented their vision towards an evaluation framework by suggesting a harmonization approach for existing and emerging living labs (Mulder *et al.*, 2007; Mulder, Velthausz and Kriens, 2008). In these studies, i) user involvement is one of the key elements of a Living Lab while the full list is complemented by ii) service creation with relevance to the value added components that Living Labs can bring to innovation and validation, iii) infrastructure within this context, a simple definition of infrastructure can be given as the basic facilities, iv) governance structure of a Living Lab, describing the way it is organised and managed at different levels such as the operational or strategic ones, v) innovation outcomes according to which a living lab needs to be set up from an organisational point of view to guarantee specific Innovation Outcomes and finally vi) methods and tools a living lab applies for the user as co-creator approach such as Iterative living lab approach and real-life settings. Additional evaluation criteria are *policies for publication, copyright and proprietary rights, licensing, policies for research data and other research outputs as well as any sustainability plan including business models* (Hossain, Leminen and Westerlund, 2019b).

2. Experts workshop

Following the desk research, an online workshop with a group of LL research experts (N=15), with experience in (self)evaluation frameworks for living labs, introduced additional sources related to the (self)evaluation of living labs, based on their experience in different LL-projects (e.g., Provahealth¹).

During this workshop, the collected criteria along with those elicited from the literature review were consolidated and classified to macro-, meso- and micro layers following macro-, meso- and micro- definition of Schuurman (2015).

¹ <https://scanbalt.org/livinglabs/provahealth/>

- The **Macro-level** was described as the living lab's network consisting of different stakeholders that engage in knowledge transfers, mainly around an innovative infrastructure (material and/or immaterial).
- The **Meso-level** was referring to the innovation projects and activities carried out within a living lab
- The **Micro-level** focused more on the living lab methodological steps and the tools used. The discussion was continued until the researcher team reached consensus.

The workshop addressed different approaches on the chapters, criteria and KPI's used by different associations, projects and initiatives: ENoLL (European Network of Living Labs) labelling & certification framework, Three layered living lab model¹ (Schuurman, 2015), The living lab management system² introduced by VITALISE H2020 project (VITALISE H2020, no date).

A following interactive workshop in Autumn 2021 organised by Vitalise partners (N=32) and based on Forum LLSA self-assessment approach, Provahealth self-assessment toolbox³ and Relevant academic papers on collaboration and evaluation frameworks of living labs, as showed in Table 2, identified the missing criteria & KPIs.

¹ <https://biblio.ugent.be/publication/5931264/file/5931265.pdf>

² <https://wiki.livinglab-harmonization.com/xwiki/bin/view/Main/>

³ <https://scanbalt.org/livinglabs/toolbox/>

Table 2 Matching chapters & criteria

<i>3 layered model</i>	<i>ENoLL evaluation</i>	<i>Vitalise model</i>	<i>Forum LLSA</i>	<i>Provahealth</i>	<i>Missing items</i>
Macro	Organisation	Living Lab business model	Governance	Ideas	-
Macro	Organisation	Living Lab business model	Operational outcomes	Validation	-
Macro	Organisation	Research Process	Research	Ideas	Analysis of needs
Macro	Organisation	Innovation process	Processes & project management	Ideas	Process effectiveness
Macro	Organisation	R&D services	Research outcomes	Validation	-
Macro	Users & reality	Data collection approaches	-	Ideas	User centricity
Macro	Users & reality	Data collection approaches	-	Conceptualisation	User's implication
Macro	Resources	Living Lab research infrastructure	Human resources	Conceptualisation	Resource management
Macro	Resources	Living Lab research infrastructure	Financial & technical resources	Validation	Resource management
Macro	Openness	Innovation process	-	Conceptualisation	Agreements on IP
Macro	Value	Living Lab business model	Clients/users outcomes	Validation	-
Macro	Value	Living Lab business model	Social outcomes	Implementation	-
Macro	Business Models & plans for the future	Living Lab business model	Strategy	Implementation	-
Macro	-	-	HR outcomes	-	-
Meso	Users & reality	Research process	Research	Proof of concept	User engagement
Meso	Users & reality	Research process	Research	Proof of concept	User centricity
Meso	Users & reality	Research process	Research outcomes	Proof of concept	-
Meso	Users & reality	Data collection approaches	Processes & project management	Proof of concept	User's implication

Meso	Openness	Innovation process	Processes & project management	Proof of concept	-
Meso	Openness	Innovation process	Processes & project management	Validation	-
Meso	Value	R&D services	Research outcomes	-	-
Meso	Value	-	Client/users outcomes	Validation	-
Meso	Value	-	Social outcomes	Validation	-
Micro	Users & reality	Research process	Research	Proof of concept	User engagement
Micro	Users & reality	Research process	Research	Proof of concept	User centricity
Micro	Users & reality	Research process	Research outcomes	Proof of concept	-
Micro	Users & reality	Data collection approaches	Processes & project management	Proof of concept	User's implication
Micro	Openness	Innovation process	Processes & project management	Proof of concept	-
Micro	Openness	Innovation process	Processes & project management	Validation	-
Micro	Value	R&D services	Research outcomes	-	-
Micro	Value	-	Clients/user outcomes	Validation	-
Micro	Value	-	Social outcomes	Validation	-
-	-	Living lab lexicon & definitions	-	-	-
-	-	-	-	-	Harmonisation

3. *Facilitated online workshops*

Three facilitated online workshops were conducted to iterate the preliminary framework with a group of experienced living lab actors (N=8). The final proposed evaluation framework was evolving through each iteration of the online workshops. Within these workshops the participants discussed the importance of the different chapters and criteria, together with formulating missing criteria.

These workshops concluded to 1) shuffling and renaming chapters and criteria to reorganize them in a way that's more aligned with the three-layered model and 2) adding new criteria to fill the gaps in the current ENoLL evaluation framework.

4. *ENoLL labelling task force analysis*

Additionally, the ENoLL labelling task force analyzed the current evaluations received by applicants and identified the weak points to make sure these current criteria were improved. The result of these four steps is a new evaluation framework that will implement the harmonized approach under development.

5. *Pilot group*

To ensure the representativeness of the mayor LL networks, early in 2022, a pilot group composed of members from the VITALISE project¹, ENoLL and Forum LLSA was formed to further enhance the criteria and harmonize the process. The result was the drafting of new scoring tables for each of the criteria. The following step will be to use the evaluation framework and the scoring tables as a basis for the development of a self-assessment tools for living lab organizations to measure their maturity to be made globally available for LL and LL networks.

5. Findings

After combining the literature review for context, the comparison analysis for identifying the gaps, the iterative online workshops, and the analysis of current applications for scoping a new framework, the pilot group agreed to keep 6 chapters and 15 criteria supporting them while moving and/or renaming certain chapters and criteria to ensure the harmonization and make them more transparent. In addition, a classification for each of the (sub)criteria as macro-, meso- and micro-level was added.

The correspondence of the current and the new evaluation chapters and criteria is presented in Table 3 while an analysis on the context for each chapter follows.

¹ <https://vitalise-project.eu/>

Table 3 Comparison current and new evaluation chapters and criteria

<i>Current</i>	<i>New</i>
Organisation	Strategy (macro)
<i>Organisation, management & governance (macro)</i>	<i>Governance</i>
<i>Experience in living lab operations (all)</i>	<i>Business model</i>
<i>Interest & ability to participate in innovation system mechanisms (all)</i>	<i>Culture</i>
Users & reality	Operations (all levels)
<i>Iterative living lab process & real-life settings (meso-micro)</i>	<i>Operations</i>
<i>Users & people engagement approach (all)</i>	<i>Human Resources</i>
<i>Quality of methods and tools(meso-micro)</i>	<i>Equipment & infrastructure</i>
Resources	Openness (all levels)
<i>Roles & responsibilities of qualified staff (macro)</i>	<i>Innovation processes & partnerships</i>
<i>Access & availability of equipment & infrastructures (all)</i>	<i>Ownership of results</i>
<i>Internal & external communication (macro – meso)</i>	Users & reality (all levels)
Openness	<i>Quality of the iterative LL processes in real-life settings</i>
<i>Openness of innovation processes and partnerships (macro)</i>	<i>User-centricity of the user & stakeholder engagement approach</i>
<i>Feedback protection & author's rights (macro-meso)</i>	<i>Quality of participatory tools & methods</i>
Value	Impact & value creation (all levels)
<i>Co-created values for all involved stakeholders (all)</i>	<i>Co-created values</i>
<i>Coverage of the value chain (all)</i>	<i>Impacts of the living lab</i>
Business model & future plans	Stability & harmonisation (macro)
<i>Business model & access/ability to funding (macro)</i>	<i>Stability of the living lab (macro)</i>
<i>SWOT analysis & strategic plans for the future (macro)</i>	<i>Harmonization & scale up</i>

According to the new definitions, the chapters and criteria can be described as follows:

Strategy

This chapter focuses on the **macro-level** of a living lab, considering the *multi stakeholder participation* and the *orchestration* role of the living lab, looking at their *collaboration* strategies, while investigating the *business model* of the living lab as well. Within this chapter the LL is evaluated against 3 criteria:

i) **Governance**, in terms of a well-defined and shared vision & mission for the living lab, based on real identified needs of the quadruple helix which is reviewed on a regular and flexible basis (macro), involvement of all actors of the quadruple helix (on a strategic level) within a well described and flexible partner network (macro), team design (clearly defined

roles and responsibilities within the living lab management & coordination team) (macro) and finally a clear description about the expected impacts of the LL strategy and the LL projects (macro)

ii) **Business Model**, in terms of financial engineering (sustainable finances) (macro), and a well-defined and described service portfolio (for various types of innovation and collaboration processes)(macro)

iii) **Culture**, in terms of proof of connections/interest to connect with external (regional/national/ international) innovation ecosystems (macro), smart and adaptive cooperation/collaboration within the living lab design to build trust (macro-meso) and quality of the internal communication processes, channels & tools within the living lab to build trust (macro-meso-micro)

Operations

This chapter is covering **all levels** of a living lab, looking at the way the living lab manages its operations, considering the necessary equipment & infrastructure and human resources of the living lab. Within this chapter of the evaluation 3 criteria are defined:

i) **Operations**, in term of proof of experience in running living lab projects and activities, including described examples (meso-micro), installed monitoring processes for operational aspects of the living lab (research, innovation funnel, project management) (macro-meso), installed monitoring processes for measuring the impact of LL activities, LL projects and the LL strategy overall (macro-meso-micro), implemented partner agreements within the living lab (macro-meso) as well as branding and positioning of the living lab (macro-meso)

ii) **Human resources**, in terms of availability & assignment of qualified staff in different roles & responsibilities (labor division) (macro) and role fluidity (clear role distribution adapted in the basis of needs) (macro-meso)

iii) **Equipment & infrastructure**, in terms of access to necessary living lab equipment & infrastructures (e.g., software, hardware, spaces) (macro-meso-micro) and availability of necessary living lab equipment & infrastructures (e.g., software, hardware, spaces) indicated in time (macro-meso-micro)

Openness

This chapter investigates the openness of the living lab from a **macro-, meso- and micro-level** perspective, by focusing on the *processes*, the *partnerships*, the *feedback & IP protection*. Within this chapter of the evaluation 2 criteria are defined:

i) **Innovation processes & partnerships**, in terms of presence of agreements covering legal aspects of the living lab (insurances, mutual responsibilities) (macro-meso), presence of the necessary transparent data agreements between the living lab and its partners, stakeholders & users (macro-meso), level of transparency of the living lab (macro) and openness towards new partners and investors (macro)

ii) **Ownership of results**, in terms of feedback protection (meso-micro), shared ownership vs. Formal ownership (macro-meso) as well as quality of the IP processes in place describing the living lab activities supporting capability and openness (meso-micro)

Users & reality

This chapter investigates the *ways of collaboration with users* and the levels of engagement & participation, by focusing on the implementation of an *iterative living lab process in real-life settings* and investigating the quality of used *tools & methods* Therefore, it relates

to the **macro-, meso- and micro-level** of a living lab. Within this chapter of the evaluation 3 criteria are defined:

i) Quality of the iterative living lab processes in real-life settings, in terms of adoption of an iterative living lab process based on the lifecycle approach and/or the living lab integrative process (meso) and involvement of users in real life settings (e.g., at home, work, in the public space) (meso-micro)

ii) User-centricity of the user & stakeholder engagement approach, in terms of description and intensity of the user participation & user impact on the innovation process (macro-meso), representativity of the user panel in relation to the amount of actively involved users in the living lab activities (meso-micro), level of permanence of the user panel (beyond project scale) (macro) and amount of actively involved users in the living lab activities (micro)

iii) Quality of the participatory tools & methods, in terms of engagement strategies (e.g., via partners) to match evolving needs of users (macro-meso), range of used tools & methods (meso-micro), quality and innovativeness of tools & methods to involve (groups of) people in the different steps of the iterative living lab process (meso-micro) as well as quality of the external communication processes, channels & tools to attract new partners, stakeholders, and users (macro-meso).

Impact & Value creation

This chapter assess the *co-created values* (e.g., knowledge sharing, capacity building, network building) by whom but even more importantly for whom. Furthermore, it investigates different *impact aspects* of the living lab (e.g., societal, economic, environmental...). Therefore, this chapter is related to **all levels** of a living lab. Within this chapter of the evaluation 2 criteria are defined:

i) Co-created values, in terms of user and stakeholder satisfaction (e.g., influence on the process & products, shared values, purpose) (macro-meso-micro), degree of knowledge exchange among living lab actors (macro-meso-micro), academic validation for researchers (e.g., publications, real case studies, cross-sectoral & cross-border "authorship", conference (participation/invitation...)) (macro-meso), knowledge sharing among network actors (e.g., presence of a community platform/knowledge platform, shareable results, tech transfer) (macro-meso), capacity building for/by network actors (e.g., developed training materials for/by stakeholders, experts created by the living lab, study credits, academic courses) (macro-meso), TRL level of developed technologies (e.g., adoptability in operational environments, replicability in other settings) (meso), value chain entities covering (macro-meso) and degree of value capture strategies (macro-meso-micro)

ii) Impact of the living lab, in terms of internal impact corresponding to what degree did the different levels of the living lab learned from each other (macro-meso-micro), societal impact (e.g., behavioral change, inclusion, diversity, digital gap) (macro-meso), economic impact (e.g., patents, market disruption, speed of market penetration, decrease of cost, increase of profit, improved value proposition of the living lab) (macro-meso), environmental impact (e.g., reduction of pollution, decrease of weather events, increase of air quality) (macro-meso) and regulatory impact (e.g., public policies, standardization of regulatory requirements, marketing authorization) (macro-meso).

Stability & harmonisation

The final chapter focuses on the (financial) *stability* of the living lab from a **macro-level** perspective, considering different needed aspects like business model, service offerings

(e.g., processes, procedures, policies, methodologies, tools & methods...) and strategy plans. Aligned with this, this chapter looks at the level of harmonisation of these strategical and operational building blocks beyond the living lab (in relationship to other LLs, RIs and open innovation orchestrators) since this will increase the sustainability of the living lab. Consequently, it mainly deals with the macro level. Within this chapter of the evaluation 2 criteria are defined:

i) Stability of the living lab, in terms of degree of achieved funding (macro), degree of new partnerships (macro), degree of network collaboration (local to international) (macro-meso), SWOT analysis (e.g., risk assessment, self-reflection, unique selling points) (macro) as well as business plan for the future (e.g., financial balance projects vs. Service offering) (macro).

ii) Harmonisation & scaling-up, in terms of adoption of standardized living lab procedures (ethics, IP approach, quadruple helix involvement) (macro-meso), adoption of standardized project management processes (living lab integrative (macro-meso), adoption of standardize tools, methods & technologies (e.g., access to other living labs services, knowledge and technologies while learning from them to further develop own living lab services) (macro), replicability of the service offering/value proposition (scaling-up) (macro), quality of cross-sectoral and geographical collaboration (macro), quality of knowledge sharing in comparison with other LLs & RIs (macro) and quality of capacity building in comparison with other LLs & RIs (macro)

6. Conclusions

This new evaluation structure proposes a harmonized approach that will identify the macro-meso – micro level, with a focus on the macro level that will support a long-term vision towards sustainability, as shown in Table 4.

Table 4 Comparison macro-level criteria

<i>New</i>	<i>Current ENoLL framework</i>
<i>Governance</i>	<i>Organisation, management & governance</i>
<i>Business Model</i>	<i>Business model & access/ability to funding</i>
<i>Culture</i>	---
<i>Human resources</i>	<i>Roles & responsibilities of qualified staff</i>
<i>Equipment & infrastructure</i>	<i>Access & availability of equipment & infrastructures</i>
<i>Innovation processes & partnerships</i>	<i>Openness of innovation processes and partnerships</i>
<i>Ownership of results</i>	---
<i>User-centricity of the user & stakeholder engagement approach</i>	<i>Users & people engagement approach</i>
<i>Quality of participatory tools & methods</i>	<i>Quality of tools & methods</i>
<i>Co-created values</i>	<i>Co-created values for all involved stakeholders</i>
<i>Impact of the living lab</i>	---

Stability of the living lab ---
Harmonisation & scale-up ---

The proposed evaluation structure can help on the one hand the evaluators of living labs and the living lab networks in general to understand the potentiality of the LLs to operate at the three levels, and on the other hand to support individual living labs to regularly self-evaluate assessing their living lab performance according to the six key building blocks. This approach will support the transformation towards more professional LLs, by adopting a maturity model (Santonen *et al.*, 2020), which in the long run can help supporting a sustainable LL architecture. This is one of the challenges addressed to the living lab's community by Paskaleva et al. (Paskaleva and Cooper, 2021), according to which, evidence base for the living labs' performance has yet to be placed in public domain.

This study contributes to 1) the theoretical underpinning of LL evaluation frameworks in the macro-meso-micro level approach and the existing literature, 2) the practical multi-layered (macro-meso-micro) and multidimensional LL evaluation framework and 3) the refined evaluation structure that supports future research by providing a harmonized approach to compare, benchmark and detect strengths, weaknesses and maturity of LL related to each criterion.

The more in-depth understanding of the strengths and weakness of the LL will also help developing ad hoc LL training and capacity building programs by identifying barriers and development needs (Forsström, Lilja and Ala-Mantila, 2020).

Equally important, the framework presented in this paper, will be set the ground for the development of a self-assessment tool for living lab organisations, together with further focused capacity building activities in the wider ENoLL-network and beyond. According to ENoLL long experience, self-assessment remains a challenge for the living labs and would be a key to corrective actions and improvement.

The implementation of the improved evaluation structure proposed in this paper as the standard for ENoLL certification process will help increasing the quality of the LL organizations both during the certification and by a long-life iterative self-evaluation framework, supporting the sustainability, effectiveness, and impact of the LLs and of the LL methodology.

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