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# Towards Living Lab Value Proposition: Living lab Experts' Perceptions of Living Lab Value

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## Abstract

Prior studies have argued that the value that living labs are providing is blurry. Grounded on the living lab experts' opinions, the study defines the key value proposition elements for living Labs. An online workshop was arranged in which 22 experts provided a total of 208 value proposition suggestions for the researcher, policy maker and public authority, and SME/company customer segments and for the different Technology Readiness Level (TRL) phases. As a result, the following seven main value categories including a total of 31 different value items were identified: 1) Enhanced collaboration and networking possibilities, 2) Validity and reliability, 3) Improved innovation, 4) Financial and process benefits, 5) Benefits for the users and society, 6) Safe environment for RDI and 7) Increased skills and capabilities. The results also suggest that living lab value argumentation is partially context-dependent. Value proposition suggestions are proposed for companies, researchers, policymakers, and public authorities.

**Keywords:** living lab, value proposition, expert opinion, living lab benefits.

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## 1 Introduction

Living labs are collaborative and user-centered environments that enable the co-creation and testing of new technologies, services, and systems in real-life contexts. According to the literature, a key characteristic of living labs is that they promote and facilitate research and innovation through the collaboration and interaction between various stakeholders, such as universities and researchers, businesses, policymakers, and citizens/users, by using a participatory approach (Leminen, Westerlund and Nyström, 2012; Schuurman, De Marez and Ballon, 2015; Sangiorgi, D., & Prendiville, 2018) . According to the European Network of Living Lab's members' catalog (ENoLL, 2023), living labs operate in over 20 different areas the most common being social

innovation and inclusion (Edwards-Schachter et al., 2012)", health & wellbeing (Santonen et al., 2022), smart cities & regions (Cardone et al., 2014), education and/or vocational training (O'Brien et al., 2021) and environmental and climate change (Santonen et al., 2017).

Customer value proposition (CVP) defines how an organization aims to provide value to customers (Payne, Frow and Eggert, 2017). From a customer-enterprise perspective, "value proposition" is a dynamic statement that explains and summarizes the benefits that a service, product, or solution offers to its customers or users and why this product or service should be chosen over other similar, competitive options (Johnson, Christensen and Kagermann, 2008; Osterwalder and Pigneur, 2010). In the context of living labs, although the value proposition is not yet clearly defined, in this study it refers to the unique value or benefits that the living lab approach offers to its stakeholders.

Living lab stakeholders are either the living lab customers (a person or organization who purchases or uses living lab research infrastructure services to conduct specific contract-based research) or end-users who are study participants who voluntarily participate in research after giving informed consent to be the subject of the research. However, in this study we focus only on the following living lab customer segments: "*Researchers*", "*Policy makers and public authorities*", and "*SMEs/companies*".

The present study aims to identify and rank the key elements of living lab value propositions from a living lab expert's point of view, having as a starting point the living labs in the Health & Wellbeing domain.

## 2 Living lab customer, value and challenges

### 2.1 Living lab customers

Multi-stakeholder participation is one of the key elements of living labs, which engage all the actors of the Quadruple Helix innovation framework in their studies (Carayannis and Campbell, 2009). Grounded on Business Model Canvas (Osterwalder and Pigneur, 2010), a study by (Santonen et al., 2020) identified key customer segments of the quadruple helix for health and wellbeing living labs. Companies were represented by device manufacturers, digital service providers, and preventive health/well-being service providers. The academic group included educational and research organizations. Public sector organizations cover municipalities and cities, state-level organizations, regional public authorities as well as primary, secondary, and tertiary care health organizations which depending on the country can also be private. For civic society, non-governmental organizations were referred to. Networks and clusters were also mentioned, which can belong to multiple quadruple helix groups depending on their mission.

The aforementioned customer segments can be considered as Business-to-Business Customers (B2B) who purchase or use living lab research infrastructure services to conduct a specific contract-based research and/or development activity. To clarify, in this study, we are mainly interested in identifying and clarifying living lab value propositions to help the research infrastructure managers of the living lab and not for the study participants representing the end-users.

### 2.2 Living lab value

Existing literature and references discuss a plethora of benefits of the living lab approach, including increased user involvement and collaboration between multiple stakeholders and, consequently, better alignment with user needs and preferences (Følstad, A., & Kvale, 2018), more effective innovation processes and outcomes (Dell'Era and Landoni, 2014; Schuurman, De Marez and Ballon, 2015), faster time-to-market (European Commission, 2016), as well as improved product and

service quality along with reduced risk of failure (Leminen, Westerlund and Nyström, 2012; Dell'Era and Landoni, 2014; Schuurman, De Marez and Ballon, 2015). Living labs as open innovation ecosystems are noted for their ability to bridge the gap between research and development (Følstad, A., & Kvale, 2018) and, also, stimulate economic growth by providing a safe space for collaboration and experimentation (European Commission., 2016; Følstad, A., & Kvale, 2018). A study by (Santonen and Julin, 2019) evaluated what kind of needs and expectations SMEs have for using transnational living lab services. The main findings include 1) testing, 2) marketing/sales support, 3) R&D for new ideas, 4) networking and collaboration, 5) access to end-users, 6) market knowledge, and 7) support for innovation management, localization/landing, and funding.

### 2.3 Living lab challenges to prove the delivered value

The living lab benefits claims are not without criticism. After an extensive literature review, Paskaleva and Cooper (2021) listed the most frequently mentioned 'benefits' of using an LL approach but concluded that the actual living lab performance and benefits remain blurry due to limited empirical evidence. Authors also argue that the published evidence so far leans on inadequate research design and circular reasoning derived from the living lab definition is often utilized to argue the benefits. Also, a systematic review by Schuurman et al. (2015) concluded that empirical evidence on living lab performance is lacking. Furthermore, another systematic review by Hossain et al (2019) argued that quantifying and expressing the value of living labs lacks clear measurable values while also identifying various challenges associated with living labs.

As a result, it is concluded that there is first a need to clarify the living lab value proposition, which can later be empirically validated. According to Anderson et al. (2006), there are three different types of value propositions: (1) all benefits, grounded on listing all the benefits the customer receives from the service provider, (2) favorable points of difference, highlighting the key benefits compared to competitors, and (3) resonating focus, focusing on only a few key benefits that are most valued by customers. In this study, the "all benefits" approach is adopted to gain an overall understanding of living lab experts' perception of the value, while leaving empirical validation to further studies.

This approach has also drawbacks (Anderson et al. 2006). Experts can suggest values that do not provide any benefits to customers or many of the benefits may be points of parity with rival approaches, thus diluting the value. However, at the current stage favorable points of difference and resonating focus approaches are problematic since little is known about who are living lab competitors and what different types of customers value.

## 3 Methodology

### 3.1 Overall research framework: Expert opinion as a research method and formation of an expert panel

According to Payne and Frow (2005), there are three elements of the value creation process: determining what value the company provides to its customers; determining what value the company receives from its customers; and successfully engaging in this co-creation. The value proposition is a crucial element in communicating the living lab value to customers through sales force messages, sales promotions, and various other advertising, PR, or similar communication and marketing activities (Ballantyne et al., 2011). Therefore, there is a need to clarify what kind of value arguments living lab experts including living lab managers, service providers, and researchers using living lab services themselves are using when arguing, regardless of whether the suggested values are accepted, rejected, or preferred by the buyers (Baumann et al., 2017).

This study utilizes an expert opinion (also sometimes referred to as expert judgment or expert knowledge) research method (Kruger et al., 2012) in an online nominal group brainstorming setting (McMillan et al., 2016; Boddy, 2012). The utilization of expert knowledge is grounded on the assumption that using experts will lead to better results than using laypersons (Goodman, 1987). Nevertheless, expert opinions cannot be regarded as absolute truths, as even experts can make inaccurate or even false conclusions (Sackman, 1975; Baker, Lovell, and Harris, 2006). The expert opinion research approach has been applied in various scientific fields and is considered especially useful in topics with limited empirical evidence (Kangas and Leskinen, 2005), therefore, it is also considered suitable for our research purposes. The overall research methodology is presented in Figure 1.

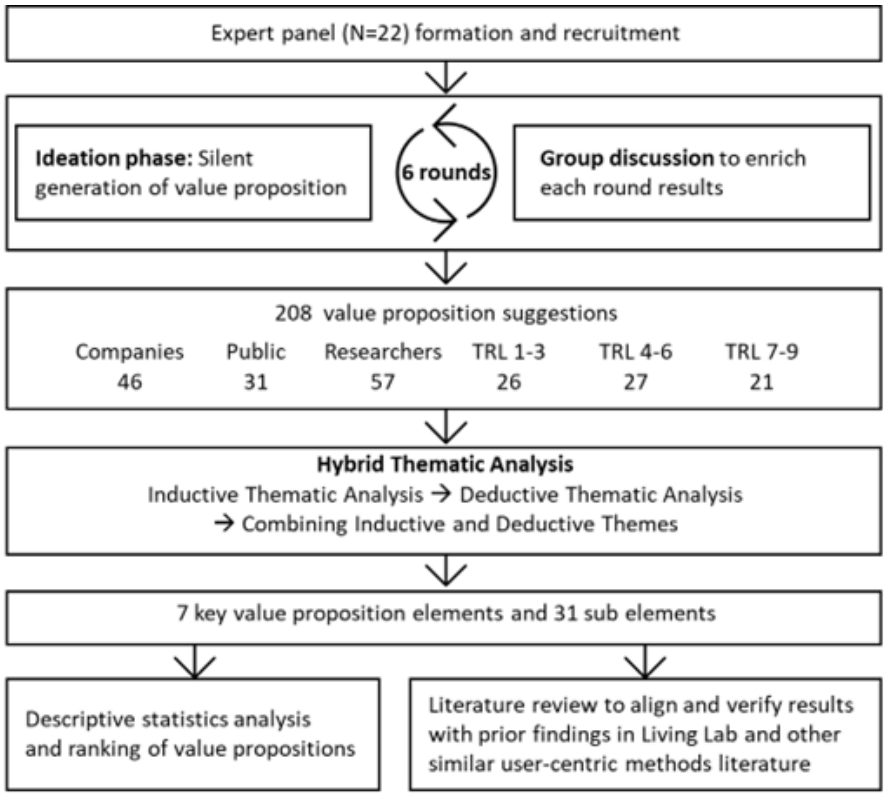


**Figure 1.** Overall research framework

## 3.2 Expert panel formation and recruitment

In this study, an expert is defined as a person with special knowledge and skills regarding living lab projects, research, and/or management, acquired through practice, study, or experience (Kangas and Leskinen, 2005). The expert panel (N=22) included 7 living lab (project) managers, 6 researchers focusing on living lab research, and 9 researchers who were using the living lab approach for their research purposes. Experts were recruited from the Horizon 2020-funded Virtual Health and Wellbeing Living Lab Infrastructure (VITALISE) project's Harmonization Body. The VITALISE project aims to open up living lab research infrastructures to facilitate and promote research activities in the Health and Wellbeing domain in Europe and beyond, as well as harmonize processes and common tools commonly utilized by living labs. Therefore, it is argued to be a suitable recruitment channel for our study.

### 3.3 Online brainstorming in a nominal group setting

Brainstorming (Osborn, 2012) in an online nominal group setting (McMillan et al., 2016) took place on the 17th of January 2023. The facilitators explained the objectives of the brainstorming session and provided practical information regarding the tasks. Six consecutive rounds were executed, with each round including approximately a 5-minute anonymous and independent task to write as many value proposition suggestions as possible via Mentimeter, an online audience response system. After submitting their suggestions, they became visible to other experts to stimulate ideation and discuss the relevance of the proposed value propositions.

The brainstorming phase was regarded as an aided top-of-mind (TOM) awareness evaluation for a brand association and awareness, where the living lab concept is defined as a 'brand' (Stepchenkova and Li, 2014; Chakraborty, 2019). In this context, top-of-mind awareness refers to whatever customer value experts can recognize or recall for a specific customer group or innovation process phase, regardless of the order in which they were mentioned. Therefore, the more often a certain value proposition element is mentioned, the more important it is interpreted to be (Stemler, 2001). After the independent task, the results were shown to the expert panel members, and they had the opportunity to collectively comment on and enrich the outcomes.

To stimulate and focus the brainstorming, the following predefined living lab customer segments derived from prior research were established for rounds 1 to 3 (Santonen et al., 2020): R1) Researchers (RESEARCH), R2) Policy makers and public authorities (PUBLIC), and R3) SMEs/companies (COMPANY). In each round, the aim was to ideate on the value living labs provide for each of these customer segments.

The brainstorming rounds 4 to 6 focused on ideating living lab value for different innovation process phases. The Technology Readiness Level (TRL) scales are commonly used and a widely accepted framework for assessing the maturity of technologies and describing the current innovation process stage (Héder, 2017; KTH Innovation Readiness Level, 2020). Due to time limitations, the nine individual TRLs were grouped into three main phases to represent exploration (TRL 1-3), experimentation (TRL 4-6), and evaluation (TRL 7-9) phases in the living lab process (Coorevits et al., 2018).

### 3.4 Inductive and Deductive Hybrid Thematic Analysis

A Hybrid Inductive (Bottom-Up) and Deductive (Top-Down) Thematic Analysis approach was applied (Fereday and Muir-Cochrane, 2006). The well-established six-stage approach by Braun & Clarke (2006) was used to conduct inductive analysis: 1) familiarizing with data, 2) generating initial codes, 3) searching themes, 4) reviewing themes, 5) defining and naming themes, and 6) final analysis. First, two independent researchers familiarized themselves with the data, generated initial codes, and searched for themes. Second, a consensus workshop among the core research group was used to agree on the coding, review themes, and define and name the themes.

Next, method triangulation was applied by conducting deductive analysis suggested by Boyatzis (1998). First, a set of deductive codes was formulated based on the SMEs' need typology by Santonen and Julin (2019) and the living lab business model value proposition elements by Santonen et al. (2020). Second, value proposition suggestions were recoded and agreed upon using the defined deductive codes. In the follow-up phase, the separate inductive and deductive analysis results were aligned together, and the final seven names for the themes and 31 benefits for each theme were defined, as described in Appendix 1.

### 3.5 Descriptive statistics and literature review

A literature review was conducted using Google Scholar, which has become a powerful database of scholarly literature and beyond (Halevi et al., 2017). In addition to using keywords such as '*value*,' '*value proposition*,' and '*benefit*' in conjunction with '*living lab*,' searches with keyword combinations derived from expert value arguments were also carried out (e.g., funding, investment, capacity building, co-creation) to investigate the body of knowledge regarding the value of living labs. Snowballing sampling was also utilized by examining the reference lists of identified publications. The main purpose of the literature search was to complement and verify the results rather than conducting a systematic literature review. A non-parametric Wilcoxon Signed Ranks Test was utilized to identify whether value proposition prioritization differed between the customer segments and TRL phases (Woolson, 2007).

## 4 Results

### 4.1 Categorization of the results and mapping with prior literature

Table 1 presents the mapping results along with living lab expert arguments based on the final classification results. The main value proposition elements were as follows: 1) economic benefits, 2) improved innovation, 3) validity and reliability, 4) benefits for users and society, 5) enhanced collaboration and networking opportunities, 6) a safe environment for RDI, and 7) increased skills and capabilities.

**Table 1.** Living lab experts value argument mapping and generalized benefits from existing literature

| Living lab expert arguments | Benefits derived from literature relating arguments |
|---|---|
| Financial and process benefits | |
| 1) Living lab can provide funding (e.g., via open calls), 2) Support to gain investments, 3) Faster development time, 4) Fail fast, 5) Risk reduction | 1) Cost savings, 2) Reduced development costs, 3) Increased Efficiency, 4) Shorter time-to-market, 5) Funding |
| Improved innovation | |
| 1) Better solutions, 2) Prioritization, 3) State of the art / current status, 4) Local and Internationalization market knowledge/ marketing, 5) Marketing support | 1) Better product design, 2) Improved quality, 3) Better problem solving, 4) Better decision making, 5) Competitive advantage, 6) Increased creativity and innovation, 7) Access to new markets |
| Validity and reliability | |
| 1) Living labs have extensive methodological expertise, 2) Real-life, 3) Test, Validation/ impact analysis (Iterative validation), 4) Proof of concept | 1) Enhanced ecological validity, 2) Improved external validity, 3) Better generalizability, 4) Increased validity, 5) Richer data, 6) Complementary insights |
| Benefits for the users and society | |

| Living lab expert arguments | Benefits derived from literature relating arguments |
|---|---|
| 1) Verified user acceptance, 2) Needs and wants, 3) Identification and definition of relevant target groups for your study purposes, 4) Needs and requirements | 1) Enhanced User Experience, 2) Improved User/Customer Satisfaction, 3) Enhanced Social and Environmental Impact |
| Enhanced collaboration and networking possibilities | |
| 1) Providing access to users and engaging them across different innovation process phases, 2) Networking and collaboration opportunities, 3) Multi/Interdisciplinary, 4) Innovation network orchestration, 5) Panel management, 6) Co-creation, 7) Engagement/Involvement/ feedback, 8) Publications | 1) Increased Opportunities for Collaboration, 2) Improved Communication and Collaboration, 3) Enhanced Collaboration, 4) Strengthened Partnerships and Networks, 5) Increased Stakeholder Engagement and Ownership, 6) Greater Access to Participants, 7) Increased Efficiency, 8) Improved Resource Allocation |
| Safe environment for RDI | |
| 1) Ethics, 2) Risk reduction | 1) Protecting Human Participants, 2) Upholding Public Trust, 3) Ensuring Fairness, 4) Promoting Integrity, 5) Preventing Research Misconduct, 6) Meeting Legal Requirements, 7) Regulatory Compliance |
| Increased skills and capabilities | |
| 1) Capacity building, 2) Skills to do user-centric innovations, 3) Understanding agile/iterative/ innovation process | 1) For a person, group, organization, or system, 2) University campus and courses, 3) Community capacity building, 4) Informed and evidence-based decisions, 5) Developing skills, knowledge, and networks for intersectoral cooperation |

## 4.2 Ranking of the value proposition main elements

The distribution of main value categories is presented for customer segments in Figure 2 and for different TRL phases in Figure 3. Figure 4 compares the distribution of main value categories between customer segments and TRL phases. The Wilcoxon Signed Ranks Test ($z = -2.907$, $p = 0.04$) revealed a statistically significant difference in the number of value proposition suggestions between customer segment and TRL phase viewpoints when evaluating data at the sub-item level. It appeared that, for experts, it was easier to make value arguments for different types of customer segments than for TRL phases.

Furthermore, when comparing the different customer segments, it was found that it was easier to make value arguments for '*Researchers*' ($z = -2.721$, $p = 0.007$) and '*SMEs/companies*' ($z = -2.179$, $p = 0.029$) than for '*Policy makers and public authorities*'. Interestingly, TRL 7-9 phase gained fewer arguments than TRL 1-3 ($z = -2.009$, $p = 0.045$) phase and TRL 4-6 phase ($z = -2.018$, $p = 0.044$), even though the living lab literature highlights the benefits of testing in real-life environments. However, it is remarked that the order of brainstorming tasks might have influenced the results: RESEARCH → POLICY → COMPANY → TRL 1-3 → TRL 4-6 → TRL 7-9.

A Kendall's $\tau_b$ correlation was run to determine the relationship between different customer segments and TRL phases. There was a weak correlation between '*Researchers*' and '*Policy makers and public authorities*' ($\tau_b$ = .396**, $p$ = .007) and a moderate correlation between TRL 1-3 and TRL 7-9 ($\tau_b$ = .620**, $p$ = .001). As a result, value argumentation appears to be partially context-dependent.

In an overall view, '*Enhanced collaboration and networking possibilities*,' '*Validity and reliability*,' and '*Improved innovation*' were the three highest-ranking value categories. The fourth and fifth categories were '*Financial and process benefits*' and '*Benefits for the users and society*.' '*Safe environment for RDI*' and '*Increased skills and capabilities*' were the two bottom-ranking categories.

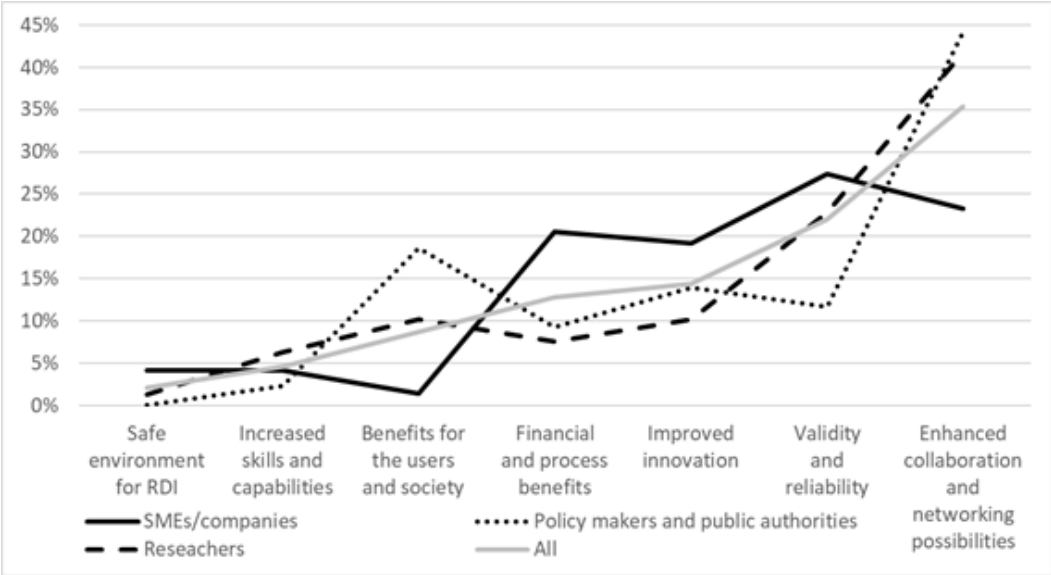


**Figure 2.** Distribution of main value categories within customer segments

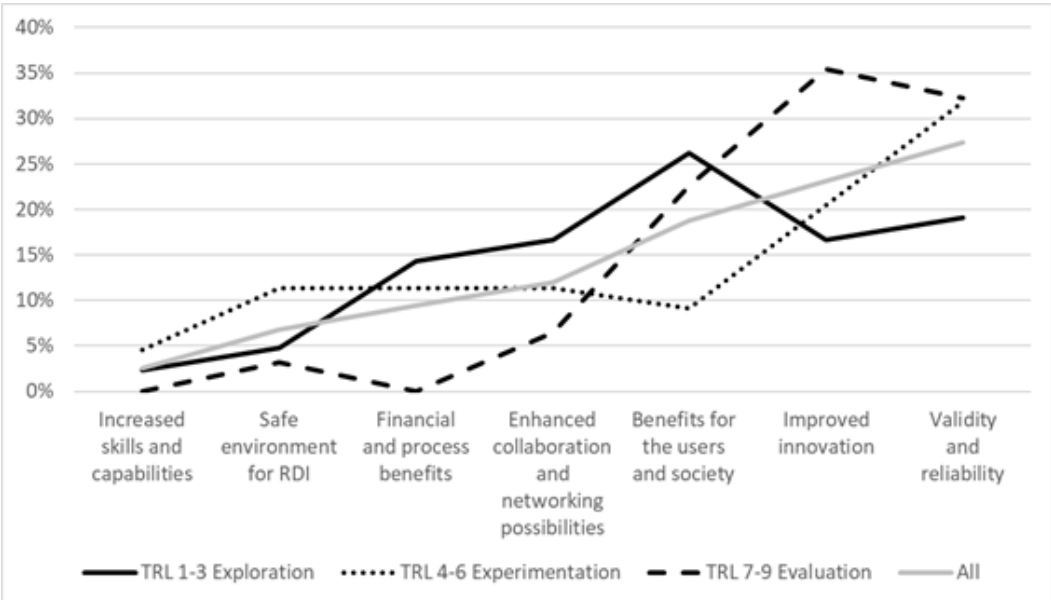


**Figure 3.** Distribution of main value categories within TRL phases

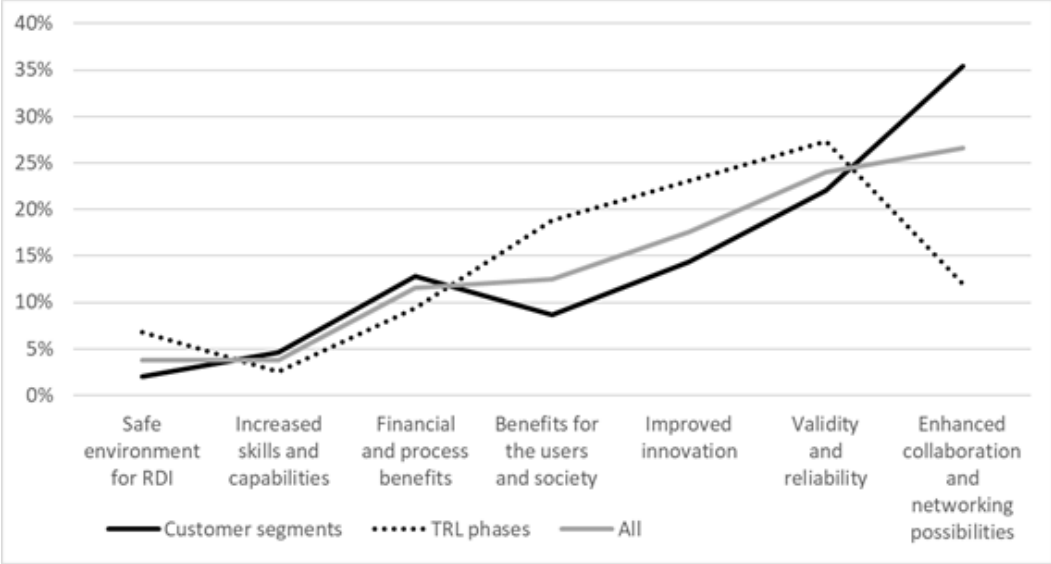


**Figure 4.** Distribution comparison of main value categories between customer segments and TRL phases

## 5 Discussion

The following attempts to provide a more in-depth explanation and description of the value categories while considering the existing findings in the literature.

### 5.1 Enhanced collaboration and networking possibilities

The main values that living labs, as a collaborative innovation approach (Santonen, 2021), offer include enhanced collaboration and networking possibilities (Puerari et al., 2018). Orchestrating innovation activities among innovation network actors plays a central role in living labs. The orchestrator guides and supports the network's activities while establishing trust within the network to boost goal-oriented collaboration (Nyström et al., 2014). To facilitate and enhance collaboration and co-creation, living labs also offer a wide range of services, tools, and methodologies (Santonen et al., 2020; Huang and Thomas, 2021).

To ensure a constant inflow of users with up-to-date profiles, some living labs have adopted a panel-based approach grounded in a yearly recruitment activity of users willing to cooperate in Living Lab research (Schuurman et al., 2012). Gaining access to potential users is one of the most wanted services requested by SMEs from living labs (Santonen and Julin, 2019). Thus, living labs with an extensive user base have better possibilities to attract customers for their services.

Another advantage of living labs is that they enable more diverse, multidisciplinary, and multilevel governance collaborations, bringing together stakeholders from different industries and fields (Hakkarainen and Hyysalo, 2013; Giannouli et al., 2018). Furthermore, the iterative nature of the living lab approach enables a quick reaction to user feedback, fostering a genuine bottom-up data collection process (Veeckman and Van Der Graaf, 2015). This fosters cross-sectoral and interdisciplinary collaboration, opening up new and sometimes unexplored opportunities for cooperation and novel innovations.

### 5.2 Validity and reliability

Validity and reliability are the second most important factors of the living lab value proposition, with reliability referring to the stability of findings and validity to the truthfulness of findings (Altheide & Johnson, 1994). Living lab research, driven by design thinking, combines laboratory-based

and field-based approaches as they complement each other's strengths and weaknesses. Pure lab research often lacks in its generalizability to the real world (Peeters et al., 2013). Therefore, the living lab approach, when utilized in real-life settings and/or real-life simulation settings (Coorevits and Jacobs, 2017; Jamrozik et al., 2018), promises higher generalizability, ecological, and external validity (Cronbach, 1957; Albers et al., 2018; Gopakumar, 2014).

Furthermore, living lab projects conduct method triangulation, as they, by definition, apply a multimethod approach and have expertise in various tools (Boyatzis, 1998; Malmberg et al., 2017; Huang and Thomas, 2021). Living lab research designs follow a multistakeholder approach, which increases the likelihood of producing a greater quantity and variety of user feedback, ensuring that all relevant development issues are properly identified (Santonen, 2016).

## 5.3 Improved innovation

Improved innovation refers to all the different aspects in which the developed solution, whether it be a product, service, process, decision, policy, etc., could be better than competing solutions. The key idea of the living lab process is to enhance the design and user experience quality of the developed solution (De Moor et al., 2010). A better user experience typically includes factors such as usability, accessibility, functionality, desirability, credibility, and efficiency (Hassenzahl and Tractinsky, 2006; Sauer et al., 2020; Barnum and Palmer, 2010).

Living lab studies have referred to better design in terms of functionality, usability, sustainability, and cost-effectiveness (Brankaert and Den Ouden, 2017; Liedtke et al., 2012; Fleet, 2020). Living labs are also argued to broaden the scope of innovation, stimulate creativity, and facilitate better decision-making and policymaking, especially when dealing with complex societal challenges and problems (Barata et al., 2017; Sörvik et al., 2015; Liedtke et al., 2012; Gatta et al., 2017). Furthermore, by providing local and international market knowledge, living labs can help companies enter new markets or enable the localization of products to specific regions (Santonen and Julin, 2019; Feurstein et al., 2008; Lievens et al., 2011).

As a result, improved innovation should eventually lead to a competitive advantage if proper competitor analysis and high user acceptance have been achieved during the living lab process.

## 5.4 Financial and Process Benefits

Economic benefits refer to gains that can be expressed in financial terms resulting from the living lab innovation process or the improvement of the developed solution (modified from Oxford Reference, 2023). Various living lab projects have been offering competitive open-call funding to companies and researchers to conduct living lab research (Health Innovation Center of Southern Denmark, 2017).

Additionally, startup companies and entrepreneurs often struggle to find their first customers, which is needed to convince investors. Therefore, a living lab study verifying customer acceptance and other solution benefits can help assure venture capital funding (Katzy, 2012; Le Dinh et al., 2018). 'Fail fast' refers to an iterative innovation process that involves co-creation and quick testing to identify and address potential problems as early as possible (Müller and Thoring, 2012) and is a common approach used in living lab, design thinking, and lean startup methodologies (Leminen et al., 2017; Schuurman, 2019).

As a result, this can lead to a faster development process and therefore reduce the time to market (Frow et al., 2015). Additionally, the risk of solution failure is greatly reduced since many problems and genuine market demand can be detected at the beginning of the development process, where making changes is cheaper (Almirall and Wareham, 2009). Early intervention

enables cost savings due to project termination or investment reallocation to more promising development activities (Ballon et al., 2018).

## 5.5 Benefits for users and society

Benefits for users and society refer to the impact of living lab studies on these groups. User-centricity is at the heart of the living lab approach, where research and innovation activities prioritize the needs, behaviors, and preferences of users (Eriksson et al., 2005). Various methods have been developed for living labs to uncover users' explicit, observable, tacit, and latent needs, as well as to provide a holistic view of user experience (Dell'Era and Landoni, 2014; Pallot and Pawar, 2012).

By involving users as active participants in the living lab process, the developed solutions are more likely to meet their needs, leading to higher user adoption and retention rates. In addition, the Public-Private-People Partnership (4P) approach of living labs provides a way to legitimize the results across society, ensuring that the solutions developed are not only effective but also socially acceptable and sustainable (Molinari, 2011). Living labs also promote user empowerment, transparency, and social capital, making innovation outputs more democratic and socially approved (Nesti, 2018). For users, participation in living lab activities is primarily driven by intrinsic motivations, with material and financial rewards holding lesser importance (Logghe et al., 2014).

## 5.6 Increased skills and capabilities

One of the key aspects of living labs is capacity building and the enhancement of innovation skills (Hooli et al., 2016; Herselman et al., 2010). Capacity building, as a concept, has various meanings, models, modalities, and methods (Simmons et al., 2011). In the living lab context, we define capacity building as a process that improves the ability of a person, group, organization, or system to meet its objectives or perform better (Brown et al., 2001). There are two main strands in living labs as capacity-building arenas.

The first strand utilizes the university campus and courses as a living lab and learning platform (Favaloro et al., 2019; Konstantinidis et al., 2021; Rukspollmuang et al., 2022; Rogers et al., 2023; Davidson et al., 2022). It is argued that living lab enables students to engage with complex problems, identify actionable opportunities, and address real-world issues collaboratively in multistakeholder settings, thus acting as a modern-day experiential learning platform (Favaloro et al., 2019).

The second strand focuses on community capacity building, especially in the context of urban and rural Living Labs. These studies promote living labs as learning and knowledge-sharing platforms among local actors, helping to make more informed and evidence-based decisions, as well as developing skills, knowledge, and networks for intersectoral cooperation (Dvarionienė et al., 2023; Hansen and Fuglsang, 2020). By acquiring new knowledge and skills, various stakeholders can initiate or undertake their living lab projects or become proficient actors within the innovation ecosystem. The successful and continuous knowledge and experience transfer between stakeholders should eventually lead to organization and system-level improvements."

## 5.7 Safe Environment for RDI

A safe environment for RDI refers to the provision of mechanisms for ensuring regulatory and legal compliance, as well as a risk-free area for experimentation, where innovations can be developed and tested (Almirall and Wareham, 2009). As an innovation network orchestrator, living labs can help mitigate or remove legal, financial, or social barriers encountered by partners by mediating

discussions between different stakeholders (Voorwinden et al., 2023). The living lab approach can also be used for exploring, experiencing, and refining new policies and regulations in tandem with technology development before their implementation (Ma, 2023; Engels et al., 2019).

The living lab approach provides mechanisms to ensure stakeholders' rights are protected, and ethical considerations are integrated into the research process (Callari et al., 2020). Conducting research in various real-life environments, such as homes, and public and social places, arouses numerous concerns regarding ethics, security, and privacy, which must be very carefully considered (Sainz, 2012). Furthermore, collaborating with multiple stakeholders with varying backgrounds, including vulnerable groups, emphasizes the importance of mastering ethical knowledge and tools, as well as the ability to mediate conflicts and facilitate negotiation and co-creation processes, which are crucial skills for living labs (Sainz, 2012). A study by Geenhuizen (2019) also suggests that the living lab approach is well-aligned with Responsible Research and Innovation (RRI) principles. With the emergence of various regulations, such as safety, ethics, sustainability, and privacy, living labs have expertise and frameworks to manage these issues in multistakeholder settings, enabling a solid ground for co-creation and testing activities (De Witte, 2021; Galič, 2019; Kioskli et al., 2022; Racine et al., 2023).

## 5.8 Consolidated value proposition for companies, researchers, and public authorities

By using the frequency of mention as a starting point, the following value proposition suggestions are proposed for companies, researchers, policymakers, and public authorities.

The value proposition suggestion of living labs for companies:

> Living labs provide a compelling opportunity for companies to connect with users and actively involve them throughout various phases of the innovation process. This inclusive approach enables companies to effectively test, validate, and analyze the impact of their solutions iteratively. Moreover, by participating in living labs, companies gain access to enhanced networking and collaboration opportunities, fostering a dynamic ecosystem for innovation and growth.

The value proposition suggestion of living labs for policymakers and public authorities:

> Living labs present an effective platform for policymakers and public authorities to identify, engage, and involve users and diverse stakeholders throughout various phases of the innovation process. Through this collaborative approach, Living labs facilitate the gathering of reliable feedback, needs, and requirements from the real end-users. Additionally, the process allows for the verification of user acceptance, ensuring that policies and public initiatives are designed and implemented with a strong focus on meeting the genuine needs of the community they serve.

The value proposition suggestion of living labs for researchers:

> Living labs provide researchers with unparalleled networking and collaboration opportunities in multistakeholder settings, fostering a rich environment for academic and practical exchange. Beyond this, living labs serve as a powerful platform for researchers to create and demonstrate proof of concept, enabling them to test and validate their research results iteratively. By aligning with the cutting edge of innovation, living labs offer researchers a unique space to refine and fine-tune their work, ensuring that

it remains at the forefront of advancements in the field. Through these invaluable resources, researchers can drive their projects and publications toward real-world impact and contribute meaningfully to societal progress.

# 6 Conclusions, Limitations, and Future Research Avenues

## 6.1 Conclusions

Living labs have been criticized for the lack of clarity regarding the value they provide. To address this, value perceptions were collected from living lab experts in an online workshop setting. While prior studies have also investigated and listed the values and benefits of living labs, this study makes a novel contribution by proposing and ranking a clear and understandable value categorization grounded in seven main values, including a total of 31 different value items.

It was easier for the experts to generate value arguments for different types of customer segments than for different innovation process phases. Furthermore, it was also easier to make value arguments for 'Researchers' and 'SMEs/companies' than for 'Policy makers and public authorities'. Value arguments between different customer segments and TRL phases also differed. These results suggest that living lab value argumentation appears to be partially context-dependent. Relating to this Schaffers and Turkama (2012) argued that there is a risk that the living lab value proposition might become impossible to communicate because the term "living lab" can mean different things in different contexts and for different target groups. Our findings support their suggestions.

The proposed framework grounded on the “all benefits” approach (Anderson et al. 2006), can later be utilized to define value proposition via “favorable points of difference” or “resonating focus” approaches which address not only the customer but also the competition point of view. Based on our findings, preliminary value propositions were formulated for the three investigated customer segments to emphasize value for each particular target group. It is argued that these can be especially helpful for novice living lab practitioners when acquiring new customers and/or when formulating marketing and communication messages. Furthermore, the proposed framework can be used in further studies to systematically investigate which of the value items the different stakeholder groups recognize.

From a theoretical contribution perspective, our results suggest that the value of a living lab is not the same for all stakeholders or the same in different innovation process phases. Thus, future living lab studies should pay more attention to different stakeholder groups' motivation and value expectations to reveal and validate holistic cross-cutting and customer segment-specific values.

## 6.2 Limitations and Future Research Avenues

The defined values in this study are perceptions instead of empirically verified impacts. Therefore, the outcomes of this study cannot be taken as absolute final truths due to the inherent uncertainty regarding expert opinions (Kangas and Leskinen, 2005). In this study, the frequency of mention was defined as an importance metric, assuming that living lab experts would highlight the words and statements they consider most important when describing the living lab value. Thus, high frequency in our case only indicates that certain words and terms are higher in experts' top of mind, not that the value exists.

Therefore, it is suggested that the outcomes of this study, in conjunction with the living lab evaluation framework (Vervoort et al., 2022), could be used as a roadmap to define quantifiable measures to verify the proposed values in empirical settings. However, defining quantifiable measures for each of the value categories would require a careful examination of literature beyond

the current living lab publications. Theoretical frameworks focusing on costs of collaborative innovation (Vivona et al., 2023), new product performance (Najafi-Tavani et al., 2018), community capacity building (An et al., 2014; Liberato et al., 2011), or user experience (Laugwitz et al., 2008) could provide a good starting point to develop robust empirical tools to quantify living lab value.

The number of panel members (N=22) was relatively limited, although in line with studies grounded in expert panels (Hsu and Sandford, 2019). The panel members included living lab managers and researchers, many of whom were operating in the health and well-being domain, which is only one of the domains where living labs operate (ENoLL, 2023). Furthermore, the selected experts were managing, providing, selling, and also using living lab services themselves and having different occupations. Therefore, they might tend to oversell and exaggerate the value of living lab on purpose or unintentionally or have different viewpoints on value due to different occupations or roles (Phythian et al. 2011). The service quality model proposed by Parasuraman et al. (1985) is suggested to evaluate gaps between service providers' and customers' perceptions of living lab value through a quality viewpoint. However, the advantage of employing experts with somewhat diverse backgrounds is beneficial for generating diversity, thus a justified methodological choice.

Additionally, there are different types of living labs (Alavi et al., 2020), various other stakeholders beyond our expert group (Nyström et al., 2014; Ståhlbröst et al., 2015; Mbatha and Musango, 2022), and various underlying factors influencing the business models that living labs follow (Santonen et al., 2020). As a result, the value provided by different types of living labs might significantly vary, as well as the value gained by different stakeholders. Sample size and heterogeneity limitations restrict our ability to generalize the findings. Therefore, future studies with larger sample sizes and more heterogeneous coverage should be executed to encompass the richness of living labs and their related innovation ecosystems. Finally, the perceived disadvantages – the opposite of benefits and value – should also be evaluated similarly, as it would provide an excellent opportunity to make comparisons between living lab advantages and disadvantages.

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## 8 Appendix 1.

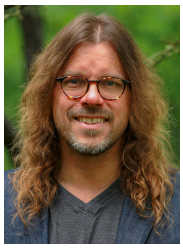
**Table 1.** Living lab experts value argument mapping and generalized benefits from existing literature

| Sub Element | Company | Public | Research | TRL 1-3 | TRL 4-6 | TRL 7-9 |
|---|---|---|---|---|---|---|
| Economic benefits | | | | | | |
| Living lab providing funding | 3 | 1 | 1 | 0 | 0 | 0 |
| Support to gain investments | 3 | 2 | 0 | 1 | 0 | 0 |
| Faster development time | 4 | 0 | 2 | 3 | 1 | 0 |
| Fail fast | 2 | 0 | 2 | 1 | 1 | 0 |
| Risk reduction | 3 | 1 | 1 | 1 | 3 | 0 |
| Improved innovation | | | | | | |
| Better solutions | 3 | 1 | 2 | 0 | 2 | 0 |
| Prioritization | 2 | 3 | 0 | 1 | 2 | 1 |
| State of the art/current status | 6 | 2 | 3 | 3 | 2 | 1 |
| Local and Internationalization market knowledge/marketing | 3 | 0 | 2 | 1 | 0 | 6 |

| Sub Element | Company | Public | Research | TRL 1-3 | TRL 4-6 | TRL 7-9 |
|---|---|---|---|---|---|---|
| Marketing support | 0 | 0 | 1 | 2 | 3 | 3 |
| Validity and reliability | | | | | | |
| Living labs have extensive methodological expertise | 1 | 1 | 2 | 0 | 3 | 0 |
| Real-life | 3 | 0 | 2 | 1 | 1 | 1 |
| Test, Validation/impact analysis (Iterative validation) | 10 | 3 | 9 | 4 | 6 | 7 |
| Proof of concept | 3 | 1 | 4 | 3 | 2 | 2 |
| Risk reduction | 3 | 0 | 1 | 0 | 2 | 0 |
| Benefits for the users and society | | | | | | |
| Verified user acceptance | 0 | 2 | 2 | 3 | 2 | 3 |
| Needs and wants | 0 | 1 | 1 | 2 | 0 | 1 |
| Identification and definition of relevant target groups for your study purposes | 1 | 2 | 3 | 4 | 0 | 2 |
| Needs and requirements | 0 | 3 | 2 | 2 | 2 | 1 |
| Enhanced collaboration and networking possibilities | | | | | | |
| Providing access to users and engaging them across different innovation process phases | 5 | 4 | 4 | 1 | 1 | 0 |
| Networking and collaboration opportunities | 4 | 3 | 10 | 1 | 1 | 1 |
| Multi/ Interdisciplinary | 0 | 3 | 6 | 1 | 1 | 0 |
| Innovation network orchestration | 2 | 0 | 0 | 2 | 1 | 0 |
| Panel management | 1 | 0 | 0 | 0 | 0 | 0 |
| Co-creation | 2 | 2 | 4 | 0 | 0 | 0 |
| Engagement/Involvement/ Feedback | 3 | 7 | 5 | 2 | 1 | 1 |
| Publications | 0 | 0 | 4 | 0 | 0 | 0 |
| Safe environment for RDI | | | | | | |
| Ethics | 1 | 0 | 0 | 2 | 4 | 1 |
| Risk reduction | 2 | 0 | 1 | 0 | 1 | 0 |
| Increased skills and capabilities | | | | | | |
| Skills to do user-centric innovations | 1 | 1 | 2 | 0 | 1 | 0 |

| Sub Element | Company | Public | Research | TRL 1-3 | TRL 4-6 | TRL 7-9 |
|---|---|---|---|---|---|---|
| Understanding agile/iterative/ innovation process | 2 | 0 | 3 | 1 | 1 | 0 |

## Biographies



**Teemu Santonen.** Dr Teemu Santonen holds a DSc (Econ.) degree in Information Systems Science. Since 2006 he has been acting as a principal lecturer at the Laurea University of Applied Sciences in Finland focusing on open innovation research. He has published over 80 scientific articles including 15 publications covering living lab methods, services, business models, innovation network orchestration and case studies. Santonen has coordinated and participated in numerous international/national living labs and open innovation projects in various domains including "health and wellbeing", "creative industries", "circular economy/sustainability" and "pedagogical development". He is a European Network of Living Labs (ENoLL) council member and co-leading ENoLL Harmonization working group to reconcile differences and promote coherence in living lab practices. Before his academic career, Santonen worked for over a decade as a development manager in leading Finnish financial, media and ICT sector organizations. Santonen also co-founded Finland's first neuromarketing research company and holds a patent. The Finnish Inventor Support Association have honored Santonen's crowdsourcing project as the best school related innovation in Finland.
*ORCID: https://orcid.org/0000-0003-1273-6472*
*CRediT Statement: Conceptualization; Formal analysis; Funding acquisition; Investigation; Methodology; Writing – original draft;*

**Vasileia Petronikolou.** Vasileia Petronikolou has completed her bachelor studies in the Department of Psychology of Aristotle University of Thessaloniki (AUTH) in 2018 and since then she is a licensed psychologist. She has completed her theoretical seminar training in Cognitive Analytic Psychotherapy and now she is finishing her training in Cognitive Behavioral Psychotherapy. Since January 2020, she collaborates as a research associate with the Lab of Medical Physics and Digital Innovation, of the School of Medicine at AUTH at several Greek and European projects. She is experienced in project management, especially in Living Lab related projects in Health and Well-being domain. Her research interests focus mostly on the development and exploitation of Assistive Technologies for supporting vulnerable populations. She has contributions in interdisciplinary conferences, as well as she is author of scientific papers.
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*CRediT Statement: Conceptualization; Data curation; Methodology; Writing – original draft*

**Despoina Petsani.** Having a background in computer engineering, Despoina Petsani pursued her passion to support people health and social wellbeing, by becoming a Living Lab researcher, with experience in assistive technologies and decision support systems for the continuum of care. She is currently PhD Candidate and Research Associate in the Assistive Technologies and Silver Science Research Group in the Lab of Medical Physics and Digital Innovation, School of Medicine of Aristotle University of Thessaloniki. She is also the Harmonization Body Coordinator of the VITALISE H2020 project where her tasks are to synchronise the goals and the objectives of the specific Harmonization Body, ensuring the openness to the global Living Lab and the research community. Currently, she is co-chairing the ENoLL Living Lab Harmonization Working Group. She has been trainer in the "Virtual Learning Lab" programme powered by the European Network of Living Labs since 2020. She was the Living Lab coordinator of CAPTAIN project (H2020) where she managed the co-creation activities in 5 living labs across 5 European countries.
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*CRediT Statement: Conceptualization; Data curation; Funding acquisition; Methodology; Project administration; Writing – original draft; Writing – review & editing*

**Sarantis Dimitriadis.** Sarantis Dimitriadis is a graduate of the Physics department of the Faculty of Science of the Aristotle University of Thessaloniki. He received his Master's degree in Materials Physics and Technology of the Physics department of the Faculty of Science of the Aristotle University of Thessaloniki and working as a Research Associate with active contribution to various projects, at Medical Physics Laboratory and Digital Innovation of Medical School, Aristotle University of Thessaloniki.
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*CRediT Statement: Data curation; Formal analysis; Investigation; Methodology; Writing – original draft*


**Panagiotis D. Bamidis.** Panagiotis Bamidis is a Professor and Director of the Lab of Medical Physics and Digital Innovation in the School of Medicine at the Aristotle University of Thessaloniki, Greece. He designs, implements, and evaluates IT and Assistive Technologies systems that improve everyday activities of elderly or other vulnerable groups and improves their health or life quality or improves the education and training of health professionals. He is the co-ordinator of several large European projects, and the PI for many national and international funded projects. He is the President of the Hellenic Biomedical Technology Society (ELEBIT), HL7 Hellas, the international Society of Applied Neuroscience (SAN), a member of the Administration Boards of other societies and patient associations. He is/has been the Chairman/Organiser of >20 international conferences and several national Biomedical Technology conferences. Since 2020, he leads the Medical Education Innovation & Research Unit (MEIRU) of the Special Unit for Biomedical Research and Education (BRESU) of the School of Medicine. He has founded a Living Lab and 2 spin-offs.
*ORCID:* https://orcid.org/0000-0002-9936-5805
*CRediT Statement: Conceptualization; Funding acquisition; Project administration; Resources; Supervision; Writing – review & editing*

**Evdokimos I. Konstantinidis.** Dr. Evdokimos I. Konstantinidis is Postdoc Researcher at the Lab of Medical Physics and Digital Innovation in the Aristotle University of Thessaloniki and the Chairperson of the European Network of Living Labs (ENoLL). He is currently coordinating the Research Infrastructure H2020 project, VITALISE - aiming to harmonize the procedures and ICT tools of the Health and Wellbeing Living Labs, towards creating an open ecosystem for the European researchers. He received the Diploma in electronic engineering from the Technological Educational Institute of Thessaloniki, in 2004, and the Ph.D. degree in the Laboratory of Medical Physics of Medicine in 2015. He is currently the coordinator of the RAISE HE funded project on services for the European Open Science Cloud, towards a crowdsource network for data processing, and the Evolve2CARE HE project as a response to the call for innovation experimentation frameworks. In 2020, as a result of the H2020 funded project named CAPTAIN H2020, he co-founded one of the first 10 spin-offs of AUTH. His research interests lie predominately in the area of living labs methodologies as well as design of technology for health and wellbeing. (Scopus h-index: 19, 1562 citations).
*ORCID:* https://orcid.org/0000-0002-5522-9553
*CRediT Statement: Conceptualization, Funding acquisition, Writing – review & editing, Methodology*