

Review

Living Labs for Rural Areas: Contextualization of Living Lab Frameworks, Concepts and Practices

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Received: 28 May 2019; Accepted: 9 July 2019; Published: 11 July 2019



Abstract: Living Labs are spaces for innovative and participative research, development and activities that use multidisciplinary approaches and promote the co-creation paradigm. Our specific interest lies in exploring the value of the Living Lab concept for creating environments that enable equal opportunities for people living in rural and urban areas, and for making rural areas attractive places to live. Moreover, through the existing practices and research results available, Living Labs are seen as one of the important building blocks of smart rural development and an important step towards establishing a Smart Village environment. Living Labs are a valuable player in enhancing circular economy, digital transformation, local self-sufficiency and other elements of sustainable living. The main aim of this paper is therefore to put Living Labs in the context of rural areas and evaluate their possible contributions for sustainable rural development. This paper argues that the element of community and social change should be considered as a key element in enabling sustainable living.

Keywords: Living Lab; rural areas; rural development; (social) innovation; Smart Villages

1. Introduction

At the beginning of 2019, as demands for more sustainability-driven policies are becoming louder and more numerous, tendencies towards environmentally-responsible politics are stepping to the fore. It is definitely time to rethink our behaviors, visions and economies, and this is coming into focus on many levels. For example, on a global level in 2015, the Sustainable Development Goals (SDGs) were placed at the forefront of the vision for the future of Humankind and the Planet [1]. The Goals are defined very broadly and they address various areas of human lives, therefore to achieve them is one of the greatest challenges of our time.

Stemming from these general orientations, there are some necessary changes related to many aspects of the future of our everyday lives including eating, cleaning, hygiene, washing, preparing food, and also many other fields. These expected changes act as motivators to think about different ways to maintain the quality of life while lessening the environmental impacts. Drawing from this, a twofold awareness is on the rise: firstly, to achieve the SDGs new approaches to economic, technological and social development are required. Secondly, there is a need to reconsider what quality of life actually means in the context of contemporary societies. Namely, in order for societies to thrive in the future, the quality of living should be based less upon goods and services that cause high environmental footprints and more on activities with lower environmental impacts [2] (p. 6). In this regard, one of the promising concepts/approaches that emerged in recent years is (sustainable) Living Labs. Living Labs are “spaces for innovative and participative research, development and activity deployment” that are “using multi-disciplinary methods and approaches and bringing people together in social contexts around a range of themes” [3] (p. 12).

There are various understandings and definitions of what a Living Lab specifically is, which indicates the importance of the further elaboration of the concept/approach in different contexts. The specific interest of this paper lies in exploring the value of the concept for creating environments that enable equal opportunities for people living in rural and urban areas, and for making rural areas attractive places to live. In this context, Living Labs are understood as integral in the processes of using local assets and strengths for the future development of rural areas and for enhancing the implementation of the Smart Villages concept. Smart Villages is a model of sustainable villages, enhancing local circular economy by using bottom-up approaches and integrating information and communication technology (ICT) solutions into services (like e-health, e-mobility, e-government, e-education, etc.) with the aim to improve living conditions for rural inhabitants [4]. Moreover, as will be elaborated through the existing practices and research results available, Living Labs are seen as one of the important building blocks of smart rural development. They are therefore a valuable step towards enhancing circular economy, digital transformation, local self-sufficiency and other elements of sustainable living that lie at the core of Smart Village environment. Even more importantly, at the core of both Smart Villages and Living Labs, the same focus is to be found: people. It has been shown many times how bottom-up approaches and collaborations with communities lie at the center of the Smart Village concept [4], and how involving people forms a core of Living Lab approaches [5] (p. 8). Another common component to both concepts is ICTs and their importance for contemporary living, whereas people's needs, aspirations and daily routines are at the center of attention [6] (p. 60). The main aim of this paper is therefore to put Living Labs in the context of rural areas and evaluate their possible contributions to sustainable people-led rural development. It is argued that the element of community and social change should be considered as one of the key elements in addressing and enabling sustainable living for the future.

In order to put the concept in a more specific context, this paper has made a qualitative review of initiatives and practices that are especially important for the context of the European Union (EU). Moreover, Living Labs are put in the context of rural areas in the EU and their relevance for addressing environmental, social as well as rural-specific challenges is examined. Some of the major contributions Living Lab projects can bring forward are: focus on the research of (ecological) sustainability, development of SMEs' innovation potential, and greater participation in the public sector [3] (p. 16). This paper acknowledges the rising popularity of Living Labs as they create a space for collaboration of multiple stakeholders and bring forward real-life contexts [7] (p. 15). It also acknowledges that not every Living Lab contributes to the achievement of the SGDs or to sustainable development [8] (p. 392). The main focus of this paper is therefore moved from the review of academic readings of Living Lab approaches and practices towards understanding the evolution of the concept per se and towards more practical applications of the concept. This paper draws the findings from existing reviews of papers, examples and practices on the role of Living Labs in the field of sustainable development and open innovation and extends them in the light of the proposed focus, e.g., social and digital innovation for the development of rural areas.

1.1. What Is a Living Lab?

The field of research focusing on Living Labs is far from a static entity. Quite the opposite, it is a very processual and dynamic field, changing its focus dependent on specific contexts and areas of work. Being a distinctively practice-based phenomenon, Living Labs have gained their academic and scientific attention only in the last decade and a half [9]. They are a thriving domain of research [10] (p. 4) focusing on many different arenas of human life. The path of development has been long and is important for understanding how the domain is placed within academic communities. Even further, there is not one commonly accepted definition of the Living Lab [7] (p. 51). In order to find a definition that conveys what a specific Living Lab actually is, it is important to analyze the specific examples and individual experiences to grasp the essence of it [9]. For example, Bergvall-Kåreborn, Ihilström Eriksson, Ståhlbröst and Svensson [11] have analyzed more than thirty projects that were

carried out in two Swedish Living Labs—Botnia Living Lab and Halmstad Living Lab. On the basis of this analysis they have identified key components (ICT and infrastructure; management; partners and users; research; approach) and key principles (openness; influence; realism; value; sustainability) of Living Labs. Given the focus on specific practices, their indication of components and principles is adapted to the specific European, even Swedish, context and there are more definitions bringing forward other important aspects.

Going back to the roots, one of the first researchers to use the term was William Mitchell, a professor at the MIT, who used the term Living Lab to describe the process for conducting user research in the context of so called smart homes or homes of the future [11], [12] (p. 63). In general, since the late nineties, Living Labs have been present at a number of research institutions dealing with ever more present computing [13]. Although the concept itself first emerged in North America, it soon started to thrive in Europe with many dispersed initiatives emerging all over the continent, where Living Labs are still gaining attention. For the European, but also wider, global community of Living Labs, one of the most crucial moments happened in 2006 when the European Network of Living Labs (ENoLL) was formed [12] (p. 63), [14] (p. 7). Due to its implicit connection with a wider framework of EU policies, the network and its foundation will be discussed in more detail further in the text, but it is necessary to highlight its implications for the rise of the Living Labs movement even here.

Throughout previous periods, the focus of Living Labs as a research method/approach has changed. The beginnings were much focused on the sphere of ICT, the ways and processes that could enhance the use of ICT in the lay society [11]. In more contemporary uses, Living Labs can be found in many different spheres focusing on enhancing the participation of people (e.g., user participation) in innovation processes [9]. Stemming from this, there is a broad variety of definitions emphasizing the different spheres of the social and digital worlds—the inconsistency of information in the literature on Living Labs that has already been noted by others [15]. Another difficulty encountered with understanding the scope of Living Labs research and methodology is the abundance of descriptive papers addressing examples and practices, but a lack of more detailed, empirical analysis of those practices. This is especially the case in the sense of the critical evaluation of reasons for the foundation, sources of financing, business models, research findings, and longevity of the specific projects, etc. [15].

Living Labs are therefore conceived very broadly and can be defined as many different things: a place of creativity where collaboration between different people happens, a (multi stakeholder) organization [5] (p. 10), an innovation milieu, (research) methodology [11], an approach for involving users [12] (p. 64), a public private partnerships concept [16], an open innovation ecosystem based on open innovation, an experimentation platform [17], and a user-centered approach [18]. One of the latest definitions was suggested by Westerlund et al. [7] and is based on the qualitative analysis of Living Lab examples and practices. They define a Living Lab as “a sociotechnical platform with shared resources, a collaboration framework, and real-life context, which organizes its stakeholders into an innovation ecosystem that relies on representative governance, open standards, and diverse activities and methods to gather, create, communicate, and deliver new knowledge, validated solutions, professional development and social impact” [7] (pp. 56–57).

Despite the differences in focuses, perspectives, and definitions, there are some common points contributing to understanding the Living Lab concept that underpin its interdisciplinary nature [11]. One of the main characteristics is their openness in the sense of inviting different collaborators, addressing different themes, and including citizens and the public [7] (p. 55), [16]. Two other features often ascribed to Living Labs are innovation and co-creation. Each of them is important in their own way, but especially when they contextualize one another. Innovation in one of the main ingredients, the aim and the principle of Living Labs [12–15,17,19]. In some definitions, the Living Lab can be an innovation system in itself [12] (p. 64). In others, (open) innovation is seen as either a process that takes place in a Living Lab [13] (p. 116) or that is implicitly integrated in the Living Lab environments [15]. Another important ingredient common to Living Labs is the co-creation paradigm [5] (p. 12), [20]. It is often associated with user innovation, but in general, in the context of Living Labs, it refers to

involving users in product and service development [12] (pp. 75–79). Involvement of users at all stages of developing new solutions for socio-economic or technological challenges has been detected as a common practice [5] (p. 12), [19] (p. 15) and an essential prerequisite for effective co-creative practices. Basically, co-creation brings together different policy and practice stakeholders with the aim to develop an outcome that will be valued by all the parties involved in the process [21] (p. 4). Therefore, in order to improve innovative solutions, the co-creation paradigm recognizes the importance of collaboration between different stakeholders: researchers, companies, users, members of interested civil society, but also policy makers [5] (p. 12). The co-creation paradigm is consistent with the rising awareness of how innovations occur not in an isolated, laboratory context, but mostly where technology and people/humans intersect [3] (p. 15). Thus, combined together, innovation and the co-creation paradigm enhance the possibility of new (digital) solutions to successfully address emerging social, economic and environmental challenges. Finally, another very important segment of Living Lab (research) methodologies is also connected with everything listed above—a real-life setting [5] (p. 12). In Living Labs evolving around digital technologies and ICT, the real-life setting is connected with laboratory settings that resemble the atmosphere of real homes/houses [22]. On the other hand, Living Labs focused on social innovations and sustainable solutions are taking into consideration specific local contexts, values and economies to develop products or services most valuable in certain social and cultural environments.

1.2. Living Labs within the EU Framework

The idea of Living Labs first started to flourish in the United States, but Europe and the EU in particular rapidly adopted the idea. It has already been indicated how the European Network of Living Labs (ENoLL) plays an important role in the establishment of Living Labs as a research method and a well-rooted business model. The foundation of the Network is interconnected with a wider EU policy framework.

In the year 2000, when the Lisbon Strategy was delineated with the aim to boost social cohesion and sustainable economic growth [23], the EU started to actively address the issue of underutilized innovation potential. To further enhance and bring the goals of the Strategy closer to realization, the Helsinki Manifesto [24] was released in 2006. Besides focusing on the aims outlined in the previous documents, the Manifesto also built upon focus on enhancing ways in innovation that are more people-centered. Awareness of a need for a “new open, user-centric and networked innovation environment” gave the initiative for the establishment of ENoLL [24] (pp. 1–4). From merely 20 members from 15 EU member states at the time of establishment, the number already exceeded one hundred in 2008 [14], and in 2010 the number of members exceeded two hundred (including 24 non-EU Living Lab members) [18]. This indicates the importance of, and the need for, the Network. The number of active Living Labs varies, and today the Network connects more than 150 affiliated members from Europe and five other continents, as shown in Figure 1. The Network is organized as a platform that gives support, enhances learning and enables the exchange of good practices for the development of new projects [18].

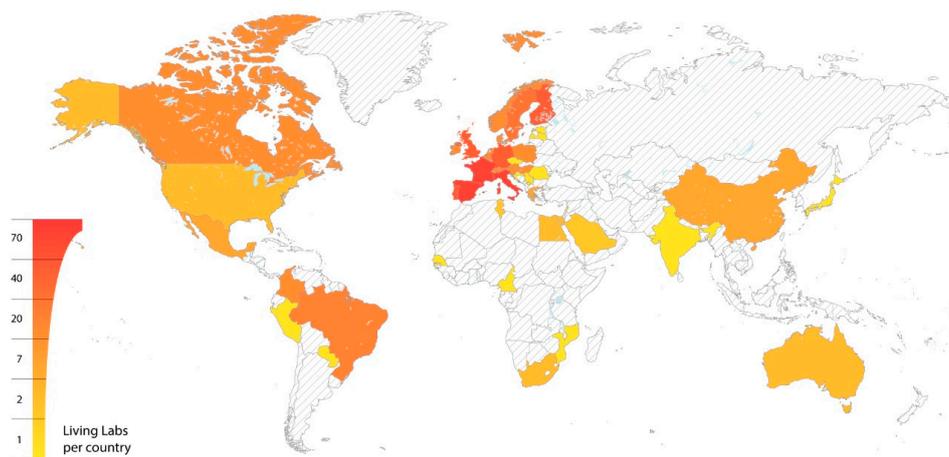


Figure 1. Map of Living Labs accredited by European Network of Living Labs (ENoLL) per country between 2006 and 2015. Reproduced with permission from ENoLL, published on the ENoLL website [25].

By strengthening the innovation potential, Living Labs and ENoLL were closely linked first to i2010 and later to the ICT Policy Support Programme of the Competitiveness and Innovation Programme (CIP PSP) [26] (p. 31), and to the EU policy for media and information society [14] (p. 5). They were deemed as an important part of the regional innovation ecosystems and Smart Specialization Strategy [27]. The importance of the Living Lab approach has also been acknowledged by the European Commission’s Directorate for Information Society and Media by publishing a collection and an overview of projects and activities carried out within the EU framework [14]. A number of projects have also been financed with the support of the European Regional Development Fund (ERDF) and the European Agricultural Fund for Rural Development (EARDF) in line with the view of boosting the innovation potential especially in EU rural areas [26] (pp. 32–33). Firstly, the initiatives on Living Labs influenced the Horizon 2020 programs and Smart Specialization Strategies. And secondly, they also affected Cohesion Policies and Territorial Cooperation programs [27]. A general impression is that even if present under the current Horizon 2020 scheme, Living Labs were more present in the previous (financing) periods [28].

The first projects under these initiatives were aimed at developing collaboration tools and promoting the establishment of partnerships to provide the environment for the further development of Living Lab initiatives. Besides other areas of focus, some of the first initiatives concentrated also on rural areas. For example, the project Collaboration and Rural (C@R), which started already in 2006 and ran for the next three years, aimed to include inhabitants of remote rural areas to participate as equal members of society [14] (pp. 37–40), [29]. Five main goals of the project were to provide a collaborative platform, put the platform into use, promote open collaboration, develop common methodology for the development of Rural Living Labs and provide support for EU policy makers with regard to rural development [29]. Findings of this and other projects addressing this matter will be discussed in more detail later on as they are of vital importance for understanding the importance of the sustainable rural development concept. In the following years, there were many more projects and networks established addressing the topic of either innovation or Living Labs.

The EU framework was supportive of Living Labs initiatives also on other levels. In 2008, a thematic network Community-Based Living Labs to Enhance SMEs Innovation in Europe (CO-LLABS) was established to enhance the use of ICT services and the concept of Living Labs, and to actively involve/activate SMEs [14] (pp. 19–22). Three Coordination and Support Actions were issued in 2006: CoreLabs (Co-Creative Living Labs) aiming to establish Living Labs as the foundation of the European Innovation System [14] (pp. 25–28); Clock (Challenges of Collaborative Working Environment) as a coordination action focusing on the methodology and user-centeredness of Living Labs; and OpenFutures (Future Centres as Collaborative Working Environments) [14] (pp. 31–33). In addition

to accelerating innovation potentials and development of rural areas, the EU framework has also considered Living Labs in the context of (Smart) Cities and (their) sustainable development [30], and cross-border cooperation and local development [31].

Throughout the years, Living Labs have therefore been intensively integrated in some vital EU policy, financial, and research frameworks. A very recent example that points to the topicality of the Living Lab concept is the 2018 event of the European Week of Regions and Cities. It included a session explicitly addressing the role of the Living Labs in the EU framework—Cross-border Co-Creation Living Laboratories for Local Development [31]. As will be shown in more detail on the examples of the Living Lab projects, the workshop portrayed co-creation as immanent to the Living Labs concept and showed how bottom-up approaches are an efficient way to address the challenges of local development [31].

One of the earliest EU explanations (from 2008) of what Living Labs are clearly addressed all of the above-mentioned components and stated that a Living Lab “is a user-driven open innovation ecosystem based on a business–citizens–government partnership, which enables users to take an active part in the research, development and innovation process” [14] (p. 7). The definition serves as a good springboard towards understanding the concept within the projects financed by the EU frameworks, and for addressing different sectors and areas of life.

2. Tackling Innovation Challenges

2.1. Rural Challenges

By being formulated very broadly, Living Labs offer the opportunity to address a wide array of working and research fields. Some of the most active and prospective areas of work are e-wellbeing, e-services, e-government, e-democracy, energy efficiency and interconnecting of different ICT sectors [14] (pp. 9–10). These dimensions play a very important part in addressing the issues of rural areas and increasing the sustainable use of the potential of the EU countryside.

Besides global environmental challenges discussed above, rural areas in the EU are also facing some more specific problems, such as depopulation, youth and brain drain, low diversification of job opportunities or limited access to (health, educational, governmental) services [32] (pp. 125–127). In order to address these challenges, it is necessary to approach them properly and through different but coinciding interdisciplinary perspectives. At the time of emergence, Living Labs were primarily connected with the domains of technological development and ICT, but nowadays projects focused on Living Labs are broadly aiming to make contemporary ways of life more sustainable, comfortable and efficient in the social sphere as well as in economy and technology—as shown in Table 1. One of their main objectives is to find sustainable alternatives for living and arranging our living environments while encouraging innovation, creativity, improvisation and collaboration [2] (p. 4), [33] (p. 10). Living Labs therefore address challenges on the crossroads of various aspects: social dimensions, economic aspects and environmental issues. In such a way, they emphasize the role of communities, social change and digitalization as vital elements in making the living more sustainable and increasing the potential for (social) innovations. As has been briefly mentioned earlier, when discussing the potential of Living Labs in rural areas, it is important to note the difference between an “ordinary” Living Lab and a Rural Living Lab. Rural Living Labs have to take into consideration the complexities of demographic challenges, consequences of emigration/immigration, ageing of the rural population, climate change and its implications for the livelihoods of the rural population, etc. Therefore, for their longevity and sustainability, the need for multidisciplinary approaches is even more emphasized [34] (pp. 243–245).

In general, when aiming to achieve greater sustainability of the systems, it is necessary to address not only technical aspects and (static) individual practices, but also take into consideration the fluidity and dynamics of everyday lives where technologies and people actually ‘live’. Also, innovation has more than only a technological aspect: it extends to socio-economic-environmental

and political scopes [35] (p. 1). Even further, the needs created by the technologies themselves and social practices surrounding them should be taken into account or the outcomes of new sustainable approaches, practices, technologies can turn out very unsustainable [36] (p. 24). Living Labs projects can help establish an ecosystem for research and actions on innovative practices that promote open and collaborative innovation processes by engaging all relevant stakeholders and people in different relevant contexts [2] (p. 7). This particularly refers to rural areas, where creating favorable conditions for entrepreneurship and innovation is foreseen as one of the main drivers for economic and social development. Building upon practices and research on everyday topics and setting an environment where collaborative innovation is implicitly integrated leads towards strengthening the sustainable values that are promoted within the Living Lab contexts [11].

Consequently, the research agenda of the Horizon 2020 project Living Lab Research Concept in Rural Area (LiveRUR) aims at developing long-term collaboration practices between different stakeholders, expanding innovative business models and increasing innovation potential through establishing rural Living Labs in rural areas [37]. The project emphasizes the role of the territorial context and increases the role of local circular economies for successful Living Lab environments. Some of the findings listed in this paper derive from segments of an ongoing research, but the findings will primarily be a starting point for our further activities and actions.

2.2. Living Laboratories, Projects and Research

In the past two decades, since the field of research has been actively involved in the development processes, the number of Living Labs rose, directing their activities towards thematic domains. Many of them emerged from projects financed from the EU programs, others have been explicitly connected with the economy, public sectors, industry, and universities. There are a large number of cases, but only a few have carefully been selected according to the impacts, areas of focus and relevance for our own interest in sustainable and smart development of rural areas.

Apart from Collaboration and Rural (C@R) in 2006, soon after the EU directed its attention towards the enhancement of the innovation potential, another project started. Mediterranean Living Lab for Territorial Innovation (MedLab) was co-funded by the European Regional Development Fund (ERDF). It promoted a Living Lab approach to increase territorial innovation [38,39]. Six Mediterranean countries collaborated (Greece, Cyprus, Italy, France, Spain, and Slovenia) and advocated approaches towards better inclusion of Living Lab approaches in regional innovation policies. It is important to note that the project focused on accelerating the innovation potential but included a broader regional level as it aimed to develop a transnational Mediterranean Living Lab [26]. The pilot activities focused on rural development, spatial planning, tourism, SME networks, and included several Living Labs and initiatives. The project also made some important policy recommendations prompting the harmonization of EU, national and regional policies; the inclusion of Living Lab approach in the policy frameworks; providing conditions for self-sustainability of Living Labs) [26] (pp. 43–45). However, it lacked concrete results, i.e., services or products.

Another project addressing the international networking dimension of the Living Labs started in 2009 and lasted for three years—Advanced Pilots of Living Labs operating in networks (APOLLON). It acknowledged the role of ENoLL and connected partners from ten EU countries (Belgium, Finland, France, Hungary, Italy, Netherlands, Portugal, Sweden, United Kingdom, and Slovenia) [40]. APOLLON aimed at developing a common approach for Living Labs projects but also at establishing thematic Living Lab networks across the continent, i.e., (i) Network for Health; (ii) Network for Energy; (iii) Network for Manufacturing; iv) Network for Media [41]. The main objective of the project was to accelerate the role of SMEs and offer them the opportunity to scale up their activities to the international level [41] (p. 3). An important project in terms of Living Labs networking was also the Interreg Italy-France strategic Alcotra Innovation project 2010–2012 (funded by the Alcotra Italy-France co-operation programme) [42] (pp. 50–51). The project developed the LEADER methodology (Fr.: Liason Entre Actions de Développement de l'Économie Rurale; Eng. Links between the rural

economy and development actions) for participatory development, which is now extended and used widely for the establishment and operation of Living Labs [43].

The approach developed in MedLab, the conclusions of the APOLLON project and the methodology developed within Alcotra Innovation were later transferred to another project and adopted for the needs of Central Europe. The project Central European Living Lab for Territorial Innovation (CentraLab) was co-funded by the EU and lasted from 2011 to 2014 [44]. By using the results of previous projects, CentraLab built upon the concept of a Living Lab to increase the innovation potential of the region and to address some of the shared concerns related to eco-tourism, energy, SME networks, mobility, climate change, waste management, e-health, environment, media and creativity, and also rural development. With its pilot project, CentraLab demonstrated how citizens' involvement in the innovation processes can bring an added value to the development of the region (and broader) [42] (p. 8). One of the important achievements of the project was the "Budapest Manifesto," advocating a Europe-wide partnership of Living Labs addressing three important global issues at the time: financial crisis, climate change and lack of active representation [42] (pp. 44–47). Another important aspect of CentraLab is the refinement of the approach and methodology developed in the previous projects, and the concretization of the results.

Within the Interreg North-West Europe program, another collaborative project was approved in 2012. Sustainable Labs North West Europe (SusLabNWE, 2012–2015) focused on Living Lab's infrastructure for enabling and supporting sustainable living practices at home/home practices [45]. The project included the Netherlands, Germany, the United Kingdom and Sweden. The methodology, the infrastructure and the toolkit developed in the project were the results of collaboration between Living Labs, industry and academia. In general, the project is important as it explicitly addressed the issue of ecological sustainability for the future and the importance of collaboration between different spheres of society. In addition to research in laboratory environment and houses, the research also included separate modern energy self-sufficient houses/living facilities equipped with sensors for measurements of different parameters in order to develop systematic methodologies that could be widely used and transferred to different EU countries [45].

Outside of the Interreg programs, a set of projects was approved on a regional level in the Baltics. The Nordic-Baltic Research and Innovation Programme on Living Labs (LILAN) was started with the cooperation of Norway, Sweden, Denmark, Iceland and Lithuania. LILAN co-funded several projects focusing on Living Labs and the importance of networks. One of them is the SmartIES project (Transnational Nordic Smart City Living Lab Pilot, 2010–2012) [46], which focused on sustainable practices of energy saving in urban contexts. An active part in the research process was played by the Swedish Botnia Living Lab [35,47]. Botnia Living Lab is also a founding and effective member of ENoLL and is focusing specifically on the challenges posed in the Smart Cities ecosystems. Botnia has also developed their own FormIT methodology, which has been widely acknowledged and used. FormIT is a human-centered approach to innovation and development of digital solutions for Smart Cities [35] (pp. 18–19) accelerating the iterative nature of the innovation process and strong engagement of the relevant stakeholders [47] (pp. 23–24). One of the valuable outputs of the SmartIES project was a publication *The Living Lab Methodology Handbook*, written by Anna Ståhlbröst and Marita Holst [35].

Another Living Lab handbook was written more recently, in 2017, by the partners of another EU-funded project: User Engagement for Large Scale Pilots in the Internet of Things (U4IoT). The project started in 2017. It will last until the beginning of 2020 and produced *Living Lab Methodology: Handbook* [48]. The project is providing research pilots for large-scale projects, applying participative methodologies and co-creation workshops, offering a digital tool for the engagement of users, and enabling direct support for user-engagement [49]. The overall objective is to support the partners to successfully engage with the end users throughout the whole process of development. U4IoT is still ongoing, but partial results of the research include the End-User Engagement Toolkit, Survey & Crowdsourcing Tools, Co-Creative Workshop Methodology and the aforementioned Handbook [49].

Some of the latest projects addressing the EU territory were funded within the Horizon 2020 Programme. For example, the project Rural–Urban Outlooks: Unlocking Synergies (ROBUST) 2017–2021 is addressing a very important aspect of connections between urban and rural areas [50]. It builds upon two building blocks of the project—Communities of Practice (CoP) that are organized around five themes connected with rural–urban challenges (new business models and labor markets; public infrastructure and social services; sustainable food systems; cultural connections; ecosystem services), and (eleven) Living Labs that are conceptualized as a form of place for participative collaboration in a real-life setting. The main objectives are to contribute to the understanding of the dynamics of interactions between rural and urban areas, and to the understanding of the dynamics of interactions between rural and urban areas.

Further, there is the project Using Living Labs to Roll out Sustainable Strategies for Energy Poor Individuals (STEP-IN) [51] and our own current project, Living Lab Research Concept in Rural Areas (LiveRUR) [37]. The main objective of the STEP IN project is to develop a global methodological approach to effectively address the challenges of energy poverty. The partnership of the project consists of Living Labs and other partners with high expertise in the research field concerned. Three chosen geographical areas are in the focus (a mountainous region of Greece, an area in rural Hungary, and a British urban area with low housing quality). In each of them a Living Lab has been established in order to tackle energy poverty. As the project is still in the first third of duration, more tangible results are yet to come [52]. The LiveRUR project (2018–2021) is focused on Living Labs as innovative business models and their adaptation for rural areas in Europe. It builds upon the principles of sustainable development of local resources and economies and works towards enhancing the diversification of local economies [37]. Within the project a list of existing business models has been made, and their weaknesses and challenges have been analyzed. In the analysis, special attention was put on the following agricultural and farming sectors: fruits and vegetable products, dairy products, cultivation of arid land, agritourism, organic farming, livestock, agribusiness providing social services, and smart rural sector. One of the main aims of the project is also to conceptualize a new business model: Regional Circular Living Lab business model concept (RAIN).

For several years now, MIT Media Lab has been working in Andorra, collaborating with the country in the project, The Andorra Living Lab. The Living Lab focuses on different aspects of urban challenges, including energy and environment, mobility, technological innovation, tourism, etc. [53,54]. The Andorra Living Lab project commenced in 2014. It includes approximately 77,000 people and has proved to be a very successful example of an Urban Living Lab, as a “place” for conducting research and testing new approaches and technological solutions in a real-life, large-scale environment. Another large-scale example of a Living Lab was set in 2012 in Turkey, in the Başakşehir district in Istanbul [55,56]. At the Başakşehir Innovation and Technology Center, which is the center of a Living Lab, three parts of the Living Lab run simultaneously: A User Experience Center, an Incubator Center, and Social Space. The main areas of research concentrate on smart urban life, robotics, wearable technologies, e-health, ICT, smart and renewable energy systems, and similar [56]. To this day, almost twenty projects have been carried out under the auspices of the Living Lab, involving partners/collaborators from economy, industry, education and research, non-governmental organizations (NGOs), and also municipality [56]. Its wide involvement in different spheres of local community is very indicative of how active the Living Lab is.

It has already been mentioned in connection with the EU framework and existing initiatives and examples that one of the main reasons for establishing a Living Lab lies in increasing the innovation potential in communities, regions, or in a specific domain. Since in 2006 the innovation paradigm was put at the center of most EU development programs and policies, the role of Living Labs has increased. As shown in Table 1, one of the important evolution processes to note within this is how (ecological) sustainability and the circular economy paradigm are slowly stepping forward into the focus of the Living Lab movement, resulting even in a newly established term: Sustainable Living Labs. However, this is not a complete and exhaustive list of research and projects or of Living Labs; it

is only a selective list of examples to show how the Living Lab (research) approach gained attention and credibility within the EU framework and how its approaches and methodologies are becoming harmonized with the SDGs. There are/were a number of other projects and Living Labs on the complete list of approximately 400 Living Labs in the records of ENoLL, as for example LivingLabs^{ict} addressing the ICT sector in Apulia, Italy [57]; Turku Archipelago LL in Finland [58], and others. Although the first examples and analysis of Living Labs were shown in the north of Europe, today the whole EU is fairly well represented in the Network.

Table 1. Evolution of the Living Lab concept/approach, its focuses and challenges.

	Emergence	Focus	Challenges
Living Lab	1990s	Involvement of end users in the development of new technologies and ICT solutions in real-life environments.	Conducting user testing outside of laboratory environments; issues of trust and data protection; developing products and services required by people.
Rural Living Lab	2000s	Development of rural areas through involvement of local communities, relevant local stakeholders and stakeholders from different sectors.	Great sensibility to local environments and its complexities: working with communities, small and sparsely populated areas, specific local challenges; poor digital literacy.
Sustainable Living Lab	after 2010	Sustainable approaches to rural development while focusing on behaviors and experiences of daily practices.	Encompassing different components of sustainability: ecological, social and economic, circular economy and following the Sustainable Development Goals (SDGs); sustainable digital tools.

Slovenian institutions have been involved in partnerships of many EU-funded projects listed above, and one of the results of these activities are also the existing Living Labs. For example, E-Zavod (Eng. e-Institute)—Institute for Comprehensive Development Solutions has been active for more than fifteen years now. The overall aim is to improve the quality of lives for everybody and to act in line with the SDGs. Some of the most represented areas of their research are environment protection, innovative economy, social welfare, moral values, and smart cities and communities. E-Institute has also been a leading partner in the CentraLab project described above and has consolidated the role of the institution in the field of Open Innovation [59]. E-Institute is also a member of ENoLL. Living Lab Ljubljana was established by a public institution Regional Development Agency of Ljubljana in 2017 and as a part of the ROBUST project, in which the Agency is involved as a partner. The aim of the LL Ljubljana is to shorten the food supply chain in the only Slovenian urban region—Ljubljana. One of the main challenges for the LL is to address rural–urban connections that are playing a major role in the context of food supply in the region. The Living Lab will extend the existing cooperation between different stakeholders to the scope of the whole region, thus connecting approximately half a million of people [60]. The most recent example of a Living Lab is AV Living Lab (Autonomous Vehicles Living Lab), established as a profit institution in Ljubljana in 2018, with the main focus on autonomous driving. AV Living Lab provides an ecosystem, with a testbed consisting of eleven kilometers of road networks and a laboratory for rapid prototyping [61].

A promising example of a Slovenian Living Lab with international outreach is the Living Lab InnoReNew. LL InnoReNew operates within the InnoRenew CoE Renewable Materials and Healthy Environments Research and Innovation Center of Excellence (InnoRenew CoE), an independent research institute founded in 2017 through the H2020 Teaming instrument by Fraunhofer WKI, University of Primorska, the Slovenian National Building and Civil Engineering Institute and the Institute for the Protection of Cultural Heritage of Slovenia. LL InnoRenew was established in August 2015 (in the InnoRenew CoE Teaming project preparatory phase) as a hub bringing together different stakeholders to discuss the development, testing and implementation of creative and innovative ideas, concepts and policies that the new CoE could address [62]. With the establishment of InnoRenew CoE, LL InnoReNew evolved into an ecosystem that connects different stakeholders, promoting open innovation in addressing sustainable development, renewable materials, and a human- and nature-friendly living environment. The partnership between public and private institutions connects research and innovation processes and provides an environment for co-creation, testing and valorisation of ideas, concepts and

scenarios using real-life examples. InnoRenew has more than 110 members from over 25 countries, including SMEs, higher or secondary education institutions, research organizations, municipalities, regional development agencies, ministries, business and research associations, technology platforms and clusters, as well as some interested individuals. As part of its public engagement activities, LL InnoRenew also plays an active role in its community, for example by organizing events to explore wood and its properties at local elementary schools, thus encouraging students to find fascination for wood as a material and science in general. InnoReNew CoE and LL are growing together, performing ground-breaking research and creating an actual space for open and user-led innovation.

2.3. Existing Rural Living Laboratories and Research

Even though an extensive review of existing and operating Rural Living Labs has been made, only some of them are presented below either because of their connection with the aforementioned projects or because of their relevance for establishing an argument on the importance of the concept for rural areas.

Most of the earliest initiatives on Living Lab approaches were focused on the challenges of urban areas, but the evolution of the concept has, amongst others, brought forward focus on the modification of the approach for applicability in rural areas. For example, already in 2006, Tünde Kállai [63] exposed plans to have a Rural Living Lab in the town of Gödöllő, Hungary. The paper built upon the results of the C@R project (Collaboration@Rural, 2006–2009). It enhanced the role of online communities and the positive effect that an application for enabling online product exchange would have for Hungarian rural communities. This Rural Living Lab was one of the seven labs established during the course of the project. There are some important insights that the whole C@R project offered. One of them is the awareness of a Rural Living Lab as an ecosystem where all activities are directed by the needs of the local rural community that is part of the Living Lab [34] (p. 206). Another important dimension was to determine the framework for evaluating the socio-economic impact of the Rural Living Labs in the research areas under consideration. In the final report of the project [34], there is a comprehensive description of context-dependent factors that need to be taken into consideration: local context (infrastructure, resources, funds, etc.), local interests and needs, external drivers and developments (funding available, strategic partners, rural policies, presence of companies, etc.) [34] (pp. 207–210). C@R also identified the main pillars needed for the successful implementation of Living Lab activities: societal communities, industry and market actors, research community, infrastructures for research and innovation, and political support [34] (pp. 220–221). In this paper, the understandings of Rural Living Labs derive from/build upon the components defined within this framework.

The MedLab project (2007–2013) also recognized the importance of the Living Lab approach for rural areas. One of the five fields under consideration was rural development, the project focused on Abla, region Andalusia, Spain, where the Rio Nacimiento Living Lab (RioNLL) was established. Its aim was to enhance the potential of social innovation and contribute to the development of rural areas [39,64]. Whilst the Living Lab was an active part of the project, the official website and all the activities dried up after the end of the project. Also, ENoLL does not recognize it as an effective member anymore.

Smart Rural Living Lab in Panela, Portugal, emerged as a part of wider plans of the Panela municipality. A program for improving regional competitiveness and enhancing rural development was issued already in 2007. The Smart Rural Living Lab is founded upon the results of the successful initiative and is focusing on four main areas of work: natural resources, social development and welfare, tourism and identity, citizenship and entrepreneurship [65,66]. At the center of the Living Lab is the sustainable development of all dimensions of society: human, economic and political dimension, resources and environment, science and technology. The Smart Rural Living Lab includes business offices for smaller companies (Mini-Habitat), House of Creative Industries (smARTES), a fabrication laboratory (FabLab Panela), and Habitat for Business Innovation in Strategic Sectors (HIESE) [66]. The main objective of the Smart Rural Living Lab and the Panela Municipality is to reverse the perception

of rural area's weak points and make them the main ingredient of a successful smart rural development plan. The Living Lab is an active player in regional development processes.

The STEP-IN project (2018–2020) has also taken a multi-centric approach to the application of the Living Lab approach. With the main focus put on the energy sector, STEP-IN is also directing attention to European rural areas, more specifically to the Hungarian countryside, the Nyírbátor district. The Rural Area Living Lab's objective is to reach low-income households, gather the necessary information and accelerate the shift towards a positive change, to more efficient energy consumption [52]. The Living Lab is in action and fully operating, but the first tangible results are yet to come.

Also, the LiveRUR project put the concept of the Living Lab at the forefront of (smart) rural development by establishing thirteen Living Lab initiatives in chosen pilot areas in eleven countries (Portugal (Azores), Czech Republic, Slovenia, Spain, Malta, Turkey, Italy, Latvia, Austria, France, and Tunisia). LiveRUR aims to enhance the application of the Living Lab research/development approach for rural areas. The project has made a review of existing business models of rural areas under consideration, reviewed the perception of Living Labs and Rural Living Labs, made a benchmark study for the implementation of the Living Lab approach for the pilot areas, etc. [67] (pp. 12–15). Specifically, in Slovenia, three sites have been chosen for the implementation of the Living Lab approach, Kungota, Solčavsko, and Padna-Šmarje [37], each of them aiming to achieve its own goals. Within the scope of the project the main focus in Kungota is professionalization of activities in the intergenerational center named House of all generations and towards revitalization of sustainable touristic program. Solčavsko aims to give more support to existing local initiatives, professionalize them with new approaches and enhance the role of community in the governance of Nature Park Logarska dolina. In addition, Padna-Šmarje, small Istrian villages, aim to foster the development of innovative (organic) products and sustainable tourism. In general, two of the most important results of the project will be the continued existence of thirteen new Living Lab in rural areas, an important step for the popularization of the concept in the field of (smart) rural development, and an incentive for transition to circular economy through Rural Living Labs.

3. Discussion: Living Labs for Rural Areas

Globally, favorable conditions for living and sustainable orientation for the future development of rural areas are becoming increasingly important. Depopulation, poor accessibility of services and low innovation potential are some of the greatest challenges to be addressed. In this view, Living Labs as ecosystems that are built around local/regional needs, new technologies and participation approaches are gaining attention. In order to follow the ambitions of sustainable development set in the SDGs, it is important to put in use multidisciplinary knowledge and keep in mind the local contexts of the developmental processes.

In this paper, Rural Living Labs are understood as a concept for establishing a holistic ecosystem that enables synergies among various stakeholders in rural areas: inhabitants, entrepreneurs, decision and policy makers, educators, farmers and aspiring (young) leaders, and builds upon the values of circular economy. Living Labs in rural areas therefore do not aim to only improve the economic welfare of the local and/or regional communities, but above all the social and environmental welfare of those communities. At the forefront of the Rural Living Lab ecosystem is a mission to increase the innovation potential in rural areas by enhancing sensibility for local communities, economic structures and resources. In this view, an important part is played by ambitions to enhance circular economy in the EU and beyond as it is proposed in the recent report Global Resources Outlook [68] (pp. 138–140). Integration of the circular economy logic in local and regional processes causes changed conditions for local communities, entrepreneurs, makers, farmers, educators and others. This requires some fundamental changes in the value chain: from the production of a product/service to the patterns of consumption. It therefore calls for the development of new models of operation [67] (p. 16), but these changes require (social) innovation.

In line with the celebration of cultural heritage, which was expressed in the European Year of Cultural heritage in 2018, Rural Living Labs can also contribute to the conservation and promotion of material and immaterial cultural heritage. Local cultural heritage is of great importance for rural areas, as it is one of the main foundations for the development of tourist activities which play an important part in rural economies. On one side, the preservation of heritage can be accomplished with projects such as innovative eco museums based on the principles of the Living Lab ecosystem but with special focus on the preservation of local heritage. On the other hand, there are great opportunities for the preservation of abandoned and slowly decaying buildings that are common in rural areas. By opening new opportunities for local economies and enhancing the potential for social innovations, new lives could be envisioned for those old buildings. For example, buildings can be used as the social and innovation hubs of the Living Lab ecosystem. New functions can be given to them, such as becoming a local FabLab or a small shop that is part of the platform connecting local food producers. There are many yet undiscovered opportunities in this field that can be born within the innovative local environments and built around local challenges.

In their paper on the importance of social innovation for rural areas, Tirziu and Vrabie [69] discussed some crucial areas of social innovation in rural areas. They exposed five fields of social innovation that can contribute the most: new services in rural areas; new education courses; ecological farming; formation of local action groups; and electronic and social innovations [69]. While they expose the importance of information technologies for the developmental processes in rural areas, their main focus is on the importance of the community and human resources. From this point of view, how the Living Lab approach has been developing in the EU is very important. Since 2006, top-down EU initiatives and founding mechanisms have been enabling the development of the Living Lab approach, Living Labs and ENoLL. At the same time, these initiatives were appropriated, led by and adapted to the needs of local, regional and national communities. Similar to what Tirziu and Vrabie suggest, in order to facilitate bottom-up activities and processes connected to the Living Labs movement, the EU has launched several top-down initiatives. The innovation paradigm has been at the forefront of the EU Living Lab initiatives, but projects are becoming more and more oriented towards (ecological) sustainability and the sustainable use of resources. Despite all this, rural areas still lack a more thorough report on the connections and impacts of EU initiatives for the sustainable and circular development of rural areas—as was done for urban areas in 2017 in the case of EU cities [30].

The analysis of operating Rural Living Labs around the Globe [67] (pp. 12–15) showed how the concept of the Rural Living Lab is prevailing in Europe compared to other continents. This demonstrates the success of the EU's top-down coordination of initiatives. Even though there are many examples of Living Labs that have dried up after the funding of the project stopped, the value of the approach has persisted and developed further. There are some successful examples of how one initiative has been upgraded by another, as was the case with the CentraLab project building upon the insights of former projects—MedLab and APOLLON. The main value of sometimes short-lived Living Labs established within these initiatives is therefore not in the Living Lab as a place per se, but in lessons learned and the popularization of the approach.

Another important aspect in the processes of rural development has to be exposed: rural development is primarily about achieving the expectations of rural citizens and improving their social and cultural environment, and only then about economic and technological development [70] (p. 570). Namely, outside of academia and laboratory settings, it is hard to isolate the vision of our future development from the vision of what kind of people we are going to become, what kind of lifestyles and relationships we are going to form within the communities and with our built and natural environment. Therefore, the latter should always guide the formulation of the former. In this sense, the Living Lab ecosystem and an actual/real-life environment of the community play a great role in this process.

4. Conclusions

How we live in and handle our living environments is drastically changing, as are the ways we understand and adapt it to our needs [2] (p. 3). If we are to achieve the Sustainable Development Goals and preserve our Planet, new more sensible developmental approaches are required. These approaches have to build upon social, cultural and natural diversity and its preservation. In particular, great care is needed for the future wellbeing of rural areas. By applying a Living Lab approach to socially and environmentally sensitive smaller communities, many issues are addressed. A Living Lab establishes a circular rural environment built upon local (social, natural, economic) resources. By connecting stakeholders from various local spheres, it enhances the potential for (social and technological) innovations and social change. By establishing a vibrant ecosystem built around the sustainable use of local resources, it also creates a springboard for the diversification of local economies and creates a space for new innovative services and products. By upgrading local economies, promoting digital technologies, circular economy and enhancing community building, the Living Lab approach is also an essential component in establishing a Smart Village environment, which plays an important part in the future view of rural areas.

Author Contributions: V.Z. designed the research. E.S.D. supervised the research. All three authors, V.Z., A.S., and E.S.D., performed the research and analyzed the data. V.Z. wrote the paper.

Funding: This research was co-funded by the European Union via the Horizon 2020 Programme (LIVERUR Project (Grant Agreement number—773757), and the Slovenian Research Agency (research core funding No. R544).

Acknowledgments: This paper has been produced within the project Living Lab Research Concept in Rural Areas (LiveRUR), which was co-funded by the Horizon 2020 Programme (2018–2021). The authors acknowledge the financial support from the Slovenian Research Agency (research core funding No. R544).

Conflicts of Interest: The authors declare no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results. All authors read and approved the final manuscript.

References

1. Sustainable Development Goals. Available online: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/> (accessed on 31 January 2019).
2. Van Timmeren, A.; Keyson, D.V. Towards Sustainable Living. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 3–7.
3. Mastelic, J.; Sahakian, M.; Bonazzi, R. How to keep a living lab alive? *Digit. Policy Regul. Gov.* **2015**, *17*, 12–25. Available online: <https://www.emeraldinsight.com/doi/pdfplus/10.1108/info-01-2015-0012> (accessed on 24 February 2019). [CrossRef]
4. Zavrtnik, V.; Kos, A.; Stojemnova Duh, E. Smart Villages: Comprehensive Review of Initiatives and Practices. *Sustainability* **2018**, *10*, 7. Available online: <https://www.mdpi.com/2071-1050/10/7/2559/htm> (accessed on 21 July 2018). [CrossRef]
5. U4IoT Consortium. Living Lab Methodology: Handbook; U4IoT Consortium. 2017. Available online: https://u4iot.eu/pdf/U4IoT_LivingLabMethodology_Handbook.pdf (accessed on 24 January 2019).
6. Keyson, D.V.; Morrison, G.M.; Baedeker, C.; Liedtke, C. Living Labs to Accelerate Innovation. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 55–61.
7. Westerlund, M.; Leminen, S.; Habib, C. Key Constructs and a Definition of Living Labs as Innovation Platforms. *Technol. Innov. Manag. Rev.* **2018**, *8*, 51–62. Available online: <https://timreview.ca/article/1205> (accessed on 24 February 2019). [CrossRef]
8. Burbridge, M.; Morrison, G.M.; van Rijn, M.; Silvester, S.; Keyson, D.V.; L Virdee, C.B.; Liedtke, C. Business Model for Sustainability in Living Labs. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 391–403.

9. Ballon, P.; Schuurman, D. Living Labs: Concepts, Tools and Cases. 2015, Volume 17. No. 4. Available online: <https://www.emeraldinsight.com/doi/full/10.1108/info-04-2015-0024> (accessed on 24 February 2019).
10. McPhee, C.; Leminen, S.; Westerlund, M.; Schuurman, D.; Ballon, P. Editorial: Innovation in Living Labs. *Technol. Innov. Manag. Rev.* **2017**, *7*, 3–6. Available online: https://timreview.ca/sites/default/files/article_PDF/Editorial_TIMReview_January2017.pdf (accessed on 15 January 2019).
11. Bergvall-Kåreborn, B.; Eriksson, C.I.; Ståhlbröst, A.; Svensson, J. A Milieu for Innovation—Defining Living Labs. In Proceedings of the 2nd ISPIM Innovation Symposium: Stimulating Recovery—The Role of Innovation Management, New York, NY, USA, 6–9 December 2009; Available online: <https://pdfs.semanticscholar.org/a210/711d9b9bc0a28daa8bb03cfa0f9813a01210.pdf> (accessed on 24 February 2019).
12. Dutilleul, B.; Birrer, F.A.J.; Mensink, W. Unpacking European Living Labs: Analysing Innovation’s Social Dimensions. *Central Eur. J. Public Policy* **2010**, *4*, 60–85. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2533251 (accessed on 25 January 2019).
13. Følstad, A. Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. *Electron. J. Virtual Organ. Netw.* **2008**, *8*, 99–131. Available online: https://www.researchgate.net/publication/272566802_LIVING_LABS_FOR_INNOVATION_AND_DEVELOPMENT_OF_INFORMATION_AND_COMMUNICATION_TECHNOLOGY_A_LITERATURE_REVIEW (accessed on 21 January 2019).
14. European Commission. *Living Labs for User-driven Open Innovation: An Overview of the Living Labs Methodology, Activities and Achievements*; Office for Official Publications of the European Communities: Luxembourg, 2009; Available online: https://www.eurospordello.eu/sites/default/files/Living%20Lab%20brochure_jan09_en_0.pdf (accessed on 15 January 2019).
15. Schuurman, D.; de Marez, L.; Ballon, P. Living Labs: A Systematic Literature Review. In Open Living Lab Days, Proceedings, Istanbul, Turkey. 2015. Available online: <https://biblio.ugent.be/publication/7026155/file/7026171.pdf> (accessed on 24 February 2019).
16. Niitamo, V.P.; Kulkki, S.; Eriksson, M.; Hribernik, K.A. State-of-the-Art and Good Practices in the Field of Living Labs. In Proceedings of the 2006 IEEE International Technology Management Conference (ICE), Milan, Italy, 26–28 June 2006; Available online: <https://ieeexplore.ieee.org/document/7477081> (accessed on 26 February 2019).
17. Pierson, J.; Lievins, B. Configurig Living Labs for a ‘Thick’ Understanding of Innovation. Available online: <https://anthrosource.onlinelibrary.wiley.com/doi/epdf/10.1111/j.1559-8918.2005.tb00012.x> (accessed on 24 March 2019).
18. What are Living Labs. Available online: <https://enoll.org/about-us/what-are-living-labs/> (accessed on 1 March 2019).
19. Almirall, E.; Lee, M.; Wareham, J. Mapping Living Labs in the Landscape of Innovation Methodologies. *Technol. Innov. Manag. Rev.* **2012**, *2*, 12–18. Available online: <https://timreview.ca/article/603> (accessed on 21 March 2019). [CrossRef]
20. Hagy, S.; Morrison, G.M.; Elfstrand, P. Co-Creation in Living Labs. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 169–178.
21. Korošak, T.S.; Zavrtnik, V.; Kos, A.; Duh, E.S. Report of Participatory Tools, Methods and Techniques. In *Deliverable DT3.1.1 of the project Smart Villages*; University of Ljubljana: Ljubljana, Slovenia, 2018.
22. Markopoulos, P.; Rauterberg, G.W.M. LivingLab: A White Paper. *IPO Annu. Prog. Rep.* **2000**, *35*, 53–65. Available online: https://www.researchgate.net/publication/2406991_Livinglab_A_White_Paper (accessed on 21 March 2019).
23. The Lisbon Strategy in Short. Available online: <https://portal.cor.europa.eu/europe2020/Profiles/Pages/TheLisbonStrategyinshort.aspx> (accessed on 15 March 2019).
24. The Helsinki Manifesto. Available online: http://elivinglab.org/files/Helsinki_Manifesto_201106.pdf (accessed on 25 March 2019).
25. The 10th Wave for ENoLL Membership is now Open! Available online: <https://openlivinglabdays16.wordpress.com/2015/12/10/the-10th-wave-for-enoll-membership-is-now-open/> (accessed on 20 June 2019).
26. MedLab Consortium. MedLab: Final Publication. Available online: https://www.programmemed.eu/uploads/tx_ausybibliomed/Medlab_1_FINAL_PUBLICATION_EN.pdf (accessed on 5 May 2019).

27. Living Labs for Regional Innovation Ecosystems. Available online: <http://s3platform.jrc.ec.europa.eu/living-labs> (accessed on April 2019).
28. European Commission. LIVING LABS. Available online: http://s3platform.jrc.ec.europa.eu/documents/20182/117542/S2E_Fiche_Living_Labs.pdf/994eafb3-4393-415b-a36d-d8cf6f33d44c (accessed on 20 April 2019).
29. Collaboration at Rural. Available online: <http://www.c-rural.eu/index.php> (accessed on 21 March 2019).
30. Santonen, T.; Creazzo, L.; Griffon, A.; Bódi, Z.; Aversano, P. Cities as Living Labs—Increasing the Impact of Investment in the Circular Economy for Sustainable Cities. Available online: https://ec.europa.eu/info/sites/info/files/research_and_innovation/rise/cities_as_living_labs.pdf (accessed on 20 April 2019).
31. Cross-Border Co-Creation Living Laboratories for Local Development. Available online: https://europa.eu/regions-and-cities/programme/sessions/24_en (accessed on 20 April 2019).
32. Zavrtnik, V.; Kos, A.; Duh, E.S. Smart Villages in Slovenia: Examples of Good Pilot Practices. In *Smart Villages in the EU and Beyond*; Visvizi, A., Lytras, M.D., Mudri, G., Eds.; Emerald Publishing Limited: Bingley, UK; pp. 125–138, GB, In Press.
33. Herrera, N.R. The Emergence of Living Lab Method. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 9–22.
34. Pérez-Trejo, F.; Pereira, L.D.; Guzmán, J.G.; de la Cruz, M.N. Living Labs and Rural Development: Towards a Policy Agenda. In *Living Labs for Rural Development: Results from the C@R Integrated Project*; Schaffers, H., Guzmán, J.G., de la Cruz, M.N., Merz, C., Eds.; TRAGSA: Madrid, Spain; FAO: Roma, Italy, 2010; pp. 227–246. Available online: <http://www.c-rural.eu/dmdocuments/C@RBook.pdf> (accessed on 21 March 2019).
35. Ståhlbröst, A.; Holst, M. *Botnia Living Lab—For Sustainable Smart Cities and Regions*; Luleå University of Technology: Luleå, Sweden, 2016; Available online: https://www.ltu.se/cms_fs/1.157454/file/LTU%20Broschyr%20Botnian%20Living%20Lab%202010x148_lowres.pdf (accessed on 5 May 2019).
36. Hasselkuß, M.; Baedeker, C.; Liedtke, C. Social Practices as a Main Focus in Living Lab Research. In *Living Labs: Design and Assessment of Sustainable Living*; Keyson, D.V., Guerra-Santin, O., Lockton, D., Eds.; Springer International Publishing: Delft, The Netherlands; London, UK, 2017; pp. 23–34.
37. LiveRUR. Available online: <https://liverur.eu/project/> (accessed on 21 February 2019).
38. Project—Mediterranean Living Lab for Territorial Innovation. Available online: <https://www.keep.eu/project/1642/mediterranean-living-lab-for-territorial-innovation> (accessed on 21 February 2019).
39. MedLab consortium. MedLab—Mediterranean Living Lab for Territorial Innovation. Available online: <http://www.ins-med.org/wp-content/uploads/2010/11/BROCHURE-MedLab.pdf> (accessed on 21 February 2019).
40. European Commission. Advanced Pilots of Living Labs Operating in Networks. Available online: <https://cordis.europa.eu/project/rcn/191724/factsheet/en> (accessed on 3 May 2019).
41. Ballon, P. Open Innovation by Living Labs Across Borders: The APOLLON Project. Available online: <http://livinglabs-ghent.fi-week.eu/files/2010/12/1110-Ballon-01.pdf> (accessed on 3 May 2019).
42. CentraLab Consortium. CentraLab: User Driven Innovation for Regional Development. Available online: <http://centralivinglab.eu/index.php/en/documents/finish/130-promotion/734-centralab-user-driven-innovation-for-regional-development-final-publication> (accessed on 3 May 2019).
43. LEADERS. Approach for Establishment and Operating of Living Labs. Available online: <https://www.user-participation.eu/planning-the-process/step-5-participatory-methods/development-of-services-or-products/leaders> (accessed on 3 May 2019).
44. CentraLab: Central European Living Lab for Territorial Innovation. Available online: <http://centralivinglab.eu/index.php/en/> (accessed on 3 May 2019).
45. SusLabNWE Consortium. Sustainable Labs North West Europe. 2014. Available online: http://suslab.eu/fileadmin/suslab/Images/SusLab_brochure_2014_1.0.pdf (accessed on 3 May 2019).
46. NordForsk. A Transnational Nordic Smart City Living Lab Pilot. Available online: <https://www.nordforsk.org/en/programmes-and-projects/projects/a-transnational-nordic-smart-city-living-lab-pilot> (accessed on 3 May 2019).
47. Ståhlbröst, A.; Holst, M. *The Living Lab Methodology Handbook*; Social Informatics at Luleå University of Technology and CDT: Luleå, Sweden, 2012.
48. Evans, P.; Schuurman, D.; Ståhlbröst, A.; Vervoort, K. Living Lab Methodology: Handbook, U4IoT Consortium. 2017. Available online: <https://zenodo.org/record/1146321#.XSaO2qQRXIU> (accessed on 10 July 2019).

49. User Engagement for Large Scale Pilots in the Internet of Things. Available online: <https://u4iot.eu/> (accessed on 21 February 2019).
50. ROBUST: Rural-Urban Europe. Available online: <https://rural-urban.eu/> (accessed on 3 May 2019).
51. European Commission. Using Living Labs to Roll out Sustainable Strategies for Energy Poor Individuals. 2018. Available online: <https://cordis.europa.eu/project/rcn/214803/factsheet/en> (accessed on 3 May 2019).
52. Step-In Project. Available online: <https://www.step-in-project.eu/> (accessed on 3 May 2019).
53. Matheson, R. Small European Nation Becomes a “Living Lab” for Urban Innovation Researchers. MIT News, 2017. Available online: <http://news.mit.edu/2017/european-nation-andorra-living-lab-media-lab-urban-innovation-1013> (accessed on 14 April 2019).
54. Andorra Living Lab. Available online: <https://www.media.mit.edu/projects/andorra-living-lab/overview/> (accessed on 21 February 2019).
55. Rahal, M. What I Know About Building a Living Lab: Ersin Pamuksüzer. Wamda, 1 August 2017. Available online: <https://www.wamda.com/memakersge/2017/08/building-living-lab-ersin-pamuksuzer%C3%BCzer> (accessed on 21 February 2019).
56. Başakşehir Living Lab, Istanbul. Available online: <http://basaksehir-livinglab.com/BLL/home/> (accessed on 21 February 2019).
57. LivigLabs ict: Apulia Innovation in Progress. Available online: <http://livinglabs.regione.puglia.it/web/guest> (accessed on 3 May 2019).
58. Turku. Available online: <https://civitas.eu/eccentric/turku> (accessed on 3 May 2019).
59. E-Institute. Available online: <https://www.ezavod.si/en> (accessed on 3 May 2019).
60. ROBUST, Ljubljana. Available online: <https://rural-urban.eu/living-lab/ljubljana> (accessed on 3 May 2019).
61. AV Living Lab: BTC City Ljubljana. Available online: <https://avlivinglab.com/> (accessed on 3 May 2019).
62. Turk Mehes, K.; Living Lab InnoRenew, Izola, Slovenia. Personal Communication, May 2019.
63. Kállai, T. State-of-the-Art in Utilizing Living Labs Approach to User Centric ICT Innovation—Automotive, Rural, eEngineering and Renewable Energy LLs in Hungary. In Proceedings of the 4th International Conference on Management, Enterprise and Benchmarking, MEB 2006, Budapest, Hungary, 2006. Available online: https://s3.amazonaws.com/academia.edu.documents/4111799/kallai_0.pdf?response-content-disposition=inline%3B%20filename%3DState-of-the-art_in_utilizing_Living_Lab.pdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWOWYYGZ2Y53UL3A%2F20190711%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20190711T055440Z&X-Amz-Expires=3600&X-Amz-SignedHeaders=host&X-Amz-Signature=6fa88e044a3aaacca69ce75de61bc95b326ec8c10a911bc37519c34dbe839e95 (accessed on 3 May 2019).
64. Rio Nascimento Living Lab. Available online: <http://staging.enoll.org/node/115> (accessed on 3 May 2019).
65. Smart Rural Living Lab. Available online: <http://staging.enoll.org/livinglab/smart-rural-living-lab> (accessed on 3 May 2019).
66. Matias, L. New Innovation Concept Smart Rural: Inspiring Innovation in the Rural World. 2018. Available online: http://www.reseau-pwdr.be/sites/default/files/SmartRural-apresent18_ENG_wallon.compressed.pdf (accessed on 3 May 2019).
67. Kallai, T. Deliverable 3.1: Report of Case Studies on Rural Living Lab’s Definitions, November 2018. Available online: <https://liverur.eu/wp-content/uploads/2018/12/D-3.1-Report-of-Case-studies-on-rural-living-labs-definitions.pdf> (accessed on 10 May 2019).
68. IRP. *Global Resources Report 2019: Natural Resources for the Future We Want*; United Nations Environment Programme: Nairobi, Kenya, 2019; Available online: https://www.resourcepanel.org/sites/default/files/documents/document/media/unep_252_global_resource_outlook_2019_web.pdf (accessed on 16 May 2019).
69. Tirziu, A.-M.; Vrabie, C. Living Labs Instruments of Social Innovation in Rural Areas. MPRA, 2017. Available online: https://mpra.ub.uni-muenchen.de/79868/1/MPra_paper_79868.pdf (accessed on 21 March 2019).
70. Zurita, L.; Kallai, T. Rural Living Labs—User Based Innovation for the Rural Areas. In Proceedings of the EFITA Conference, Wageningen, The Netherlands, 6–8 July 2009. Available online: https://www.academia.edu/36856923/Rural_living_labs-user_based_innovation_for_the_rural_areas (accessed on 21 February 2019).

