sustainability

MDPI

Article

Living Labs—A Concept for Co-Designing Nature-Base Solutions

Gerd Lupp [1,*], Aude Zingraff-Hamed [1], Josh J. Huang [1], Amy Oen [2] and Stephan Pauleit [1]

[1] Chair for Strategic Landscape Planning and Management, Technical University of Munich, 85354 Freising, Germany; aude.zingraff-hamed@tum.de (A.Z.-H.); Josh.J.Huang@gmail.com (J.J.H.); pauleit@tum.de (S.P.)
[2] Norwegian Geotechnical Institute, 0855 Oslo, Norway; amy.oen@ngi.no
* Correspondence: gerd.lupp@tum.de; Tel.: +49-8161-71-4664

Abstract: Living Labs are recognized as a progressive form to foster innovation and the strengthening of collaborative planning. The concept has received strong attention by the European Union (EU) research and innovation agendas recently. This contribution investigates how a Living Lab approach could be used for the design and implementation of Nature-Based Solutions (NBS). NBS are gaining acceptance as a more sustainable solution for reducing the exposure to natural hazards and vulnerability to events, such as increased flooding in changing climate. However, a lack of collaborative approaches hinders their broader implementation. A literature review on the theoretical aspects of the Living Labs concept in the context of NBS is conducted, and we compare the theoretical findings with practices that were observed by case studies implementing NBS in a collaborative manner. The Isar-Plan River Restoration in Munich, Germany, and the Mountain Forest Initiative (Bergwaldoffensive). Both of the case studies have already started well before the concept of Living Labs gained wider popularity. Both award-winning cases are recognized good practice for their exemplary in-depth stakeholder involvement. The paper discusses the concepts and approaches of Living Labs and reflects on how it can serve and support in-depth participatory stakeholder involvement.

Keywords: Nature-Based Solutions; Living Labs; hydro-meteorological risks; natural hazard mitigation; Blue Solutions; Green Solutions; cooperative planning; collaborative planning; innovation design

Citation: Lupp, G.; Zingraff-Hamed, A.; Huang, J.J.; Oen, A.; Pauleit, S. Living Labs—A Concept for Co-Designing Nature-Based Solutions. *Sustainability* **2021**, *13*, 188. https://dx.doi.org/10.3390/su13010188

Received: 1 December 2020
Accepted: 24 December 2020
Published: 28 December 2020

1. Introduction

Climate change is resulting in an increase of extreme hydro-meteorological events, which, in turn, results in more frequent and more severe floods and droughts [1]. Around the end of the 1980s, after decades of implementation of technical engineering solutions, planners and engineers started to look at nature as a source of inspiration for mitigating the increase of natural hazards that result from extreme hydro-meteorological events. In order to address the growing vulnerability, susceptibility, probability, risk, and vulnerability [2], new approaches, such as Nature-Based Solutions (NBS), are increasingly considered to be suitable to partially or fully replace conventional technical approaches, such as static flood protection infrastructures, or at least an increase their effectiveness [3]. NBS are identified as being sustainable, cost-effective, and viable solutions to make use of and optimize the properties of natural ecosystems [4]. NBS can be defined as "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits, and help to build resilience. Such solutions bring increasingly diverse nature and natural features and processes into cities, landscapes, and seascapes, through locally adapted, resource-efficient, and systemic interventions" [4].

A broad spectrum of ecosystem-based measures falls under the umbrella of NBS. In contrast to grey solutions that are mostly monofunctional, NBS are recognized for their co-benefits. Because of this characteristic, NBS address societal challenges and provide opportunities for implementing solutions that not only reduce risk, but also improve ecosystem function and social capacity, reduce economic vulnerability, and retain or develop a sense of place. Polycentric and collaborative planning have been recognized as an efficient model for addressing environmental issues and achieving multifunctionality [5]. This suggests that NBS planning, design, and implementation will achieve high efficiency when involving expert and stakeholder dialogues [6]. Collaborative planning can have many faces. Following citizen participation typologies [7], the inclusion of many stakeholders can differ between the projects, according to a gradient of participation intensity. Intense collaboration among different public and private actors, as well as citizens for the design and implementation of solutions, is recognized as an efficient tool in environmental governance [8]. In order to solve complex problems and to find innovative designs, recent studies identified that such partnerships and collaborative approaches are crucial in successfully implementing NBS [9–11]. In contrast, missing or non-institutionalized intersectoral collaboration cause bottlenecks when implementing measures, such as in the case of river restorations [12]. Formalized procedures for collaboration and participation are vital, can support the elaboration and implementation of solutions [13], and they are increasingly becoming mandatory in projects [6]. For example, a number of NBS projects funded under the European Horizon2020 program, which aims to address the risk of natural disasters, require the implementation of in-depth participatory processes (i.e., OPERANDUM, RECONECT and PHUSICOS). One concept to support such intensive institutionalized collaboration is the so-called "Living Lab" concept. For instance, PHUSICOS applies the Living Lab concept as a foundation for the selection, co-design, implementation, monitoring, and evaluation of its NBS [14,15].

The concept of "Living Labs" or "living laboratories" was first used in the early 1990s by Bajgier et al. in order to describe students' experimentation to solve problems in a Philadelphia neighborhood [16] (p. 701). William J. Mitchell, from the MIT Media Lab and School of Architecture, further developed the concept in 1995 to define an innovative research, which aimed to develop and test information and communications technology in homes, neighborhoods, and cities [17,18]. The concept was quickly picked up as an effective approach for many types of applications to provide a highly creative environment [6,19–21]. In Europe, the application of Living Labs in real-life settings and 'real' experimentation emerged around 2005 [22], when the concept started to receive strong attention from the European Union (EU) and it is recognized as a progressive form of experimental and inclusive mode of planning, project design, and implementation that fosters innovation [23].

In line with strengthening democratic processes in the EU, policies strongly encourage collaborative approaches in order to create innovation and the involvement of stakeholders by including them into the design and implementation of different fields of research and development. Programs, such as Horizon 2020, promote the use of the Living Lab approach [24], including its application in the field of landscape and environment related topics. This indicates that the Living Lab approach might be well suited for NBS measures and it may help to systematize and structure such bottom-up processes. However, in scientific literature, there is no uniform definition of Living Labs [25] and a lack of recipes or descriptions on Living Labs processes in the field of NBS.

In this contribution, we investigate how Living Labs and their approaches could serve in cooperative planning of NBS. For this purpose, we identify the characteristics of Living Labs, strengths and weaknesses, and in which ways the concept can be used in NBS co-design and implementation. We focus on mountain areas that are most vulnerable to climate change and already experience a greater number of extreme hydro-meteorological events, but have not yet received as much attention [26].

We use two collaborative NBS planning cases from the Bavarian Alps as the wider area of the PHUSICOS concept case area with in-depth participatory processes, which are widely recognized as "good practice" examples. These two cases are a result of the German State of Bavaria's initiation of governance innovations and polycentric governance in many areas of environmental policies in the early 2000s. These policy changes included in-depth stakeholder involvement right from the beginning through co-design, implementation, and monitoring as well as evaluation for this purpose [27]. The two selected asses represent one "blue" and one "green" NBS and intense in-depth participatory processes that had already started before the Living Lab concept had its breakthrough in Europe. Therefore, in this study, we compare and assess these cases in light of the theory of Living Labs in order to determine whether this concept can support a formalized approach for in-depth collaboration of stakeholders to co-design and implement NBS.

2. Materials and Methods

The methodological approach consists of three steps. First, a literature review established the theoretical foundation of the Living Lab concept and developed the analytical framework. Second, a case study analysis that was based on two cases illustrating a green and a blue solution investigated the application of the Living Lab approach in collaborative planning to co-design and implement NBS. Both case studies are from the Bavarian Alps and the PHUSICOS concept case area. In a third step, we discussed and compared the theoretical Living Lab concept with the two case studies for similarities and, finally, reflected how the concept can serve to organize and structure strong, deep participatory approaches co-designing and implementing NBS.

2.1. Literature Review

In order to collect sound data on the theoretical foundation of the Living Lab concept, we conducted a literature review while using peer-reviewed scientific papers that were collected from Web of Science (WoS) (Clarivate Analytics, Philadelphia, PA, USA) by searching for publications that are related to "Living Labs". Search terms and categories that were selected to extract relevant papers from the WoS database can be found in Appendix A. The resulting publications were then selected while using the PRISMA method [28]. In screening the abstracts of the articles for relevance, 126 articles were collected for a qualitative content analysis [29]. In order to collect more in-depth information where needed, starting from this set of identified papers, snowball sampling from the WoS papers and their key authors were taken if additional information was used. A key source for this task was the website of the European Network of Living Labs, which provided an additional 31 articles for the literature database (see Appendix A).

2.2. Case Study Analysis

For the analysis of the two case studies that were linked to the wider PHUSICOS concept case area, only a few scientific publications could be found using the search terms "Isar-Plan", "Isar River Restoration", the respective German terms, and "Mountain Forest Initiative" or "Bergwaldoffensive", even in the broader Google Scholar database. Therefore, the internet was more widely searched for additional project documentations by using the search terms in the search engines "Ecosia" and "DuckDuckGo" and knowledge of the authors on the two case studies. In addition, facilitators and selected project participants based on publications that were found in the free search were asked for recommendations for literature. They were from the city of Munich, the responsible ministries (State Ministry of the Environment and Consumer Protection, State Ministry of Food, Agriculture and Forestry), and their respective subordinate authorities, such as the water administrations, environmental agencies, departments for food, Agriculture, and forestry on materials. Books, reports in practice-oriented publications, and documentations of the processes were identified or confirmed to be useful with the help of these stakeholders.

2.2.1. Isar-Plan

The Isar River sources in the Austrian Karwendel Mountains flows 295 km north and it crosses Munich, Germany's third largest city and the capital of the Federal Free State of Bavaria (Figure 1). It is the fourth largest river of Bavaria and an important tributary of the Danube River [30,31].

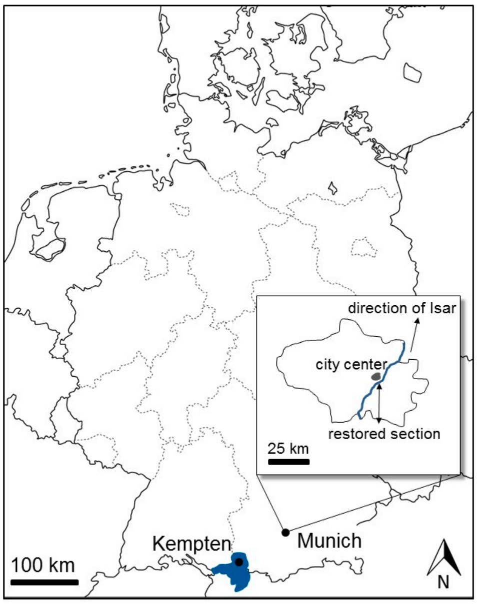

Figure 1. Isar River and restored river stretch in Munich by the Isar-Plan and the Mountain Forest Initiative area for projects of the Kempten Department for Food, Agriculture and Forestry.

The pristine Isar was a braided alpine river with large gravel bars, pioneer vegetation, and extreme water regimes that ranged from almost dry riverbeds to severe flood events [32]. In the 20th century, the Isar was forced into a concrete channel with many water diversions in order to produce hydropower and it resulted in an almost dry flowing main river in the southern part of the city. Within the inner city of Munich, the river was channelized in a double-trapezoid riverbed with fortified riverbanks. With the regulation measures and canalization in the early 20th century, both ecological qualities, such as biodiversity in and along the river, socio-cultural aspects, such as recreation opportunities for the citizens of Munich, and landscape qualities in the inner city were extremely poor [33]. Most ecological and social functions (e.g., recreation opportunities) were lost [34]. With regular major flooding events occurring throughout Munich´s history, even with massive river regulation measures, engineering and construction of infrastructure, such as dams and a reservoir upstream, this flood risk was not completely eliminated. Consequently, additional measures had to be taken [35,36]. A new direction in water resources governance and new policies to strengthen environmental governance in the 1990s catalyzed river restoration projects by addressing multiple purposes, such as enhancing flood protection and ecological and socio-economic systems, while, at the same time, aiming to improve all aspects of life along the river.

Between 2000 and 2011, an eight-kilometer-long river restoration project took place in the southern inner city of Munich, Germany (Figure 1). The Isar-Plan or the Isar river restoration project in Munich (Germany) is widely recognized as a model of good practice [37] and it achieved the first German award for river development ('Gewässerentwicklungspreis') in 2007. The ex-post-analysis of this concept case provides a good practice framework of a successfully implemented flood risk management plan combined with a river restoration. The formal work on the Isar-Plan process began as early as 1987. It was a forerunner in applying an intense collaborative planning approach with different interest groups, politicians, and authorities, as well as the civil society lobbying and advocating for changes. It took more than a decade to finally implement the results of the co-design process and give the Isar a more natural appearance. Therefore, the in-depth participative process was already at a progressive stage before the first attempts to capture and define the Living Lab concept and it displays many exemplary core characteristics of a Living Lab process and its application in the field of NBS implementation [5].

2.2.2. Mountain Forest Initiative—Bergwaldoffensive

The "Mountain Forest Initiative" ("Bergwaldoffensive") started with pioneering activities in Hinterstein in the Upper Allgäu. The activities started as early as 1989 in order to revitalize and re-establish rapidly disintegrating forest stands on steep mountain slopes above the village. The disintegrating forest led to an increased risk of rock fall, avalanches, and landslides. Forests have more retention capacity than agricultural land or open land, especially in moderate rain events [38,39]. Mixed forests have greater potential for interception, water retention, water storage [40], slope stabilization, and reduction of risks due to avalanches, debris flow, and rock fall [41]. Continuous, repetitive management practices are needed in order to achieve and maintain these protection forests with a variety of species and diverse forest structures [42]. Thus, multifunctional management practices [43] to strengthen the vitality of mountain forests in order to enhance their protective function have been implemented in Germany for decades in state-owned forests and many forests owned by public bodies, such as communities [44]. However, these management practices are often not the case in the 57% of the forest area that belong to private owners. Most of them own only a few hectares of forest, which is often dispersed over several plots. With changes in owner structures, forest management in Bavaria faces a challenge, with an increasing number of landowners with little or no knowledge and skills to manage mountain forests [45].

Based on research, mixed stands were planted and naturally regenerated using wood tripod constructions to protect the planted small trees in Hinterstein. Various stakeholders were involved and the process was finally mediated in 2002 [46]. Based on the success story of this case, the Bavarian Ministry of Food, Agriculture and Forestry launched the 7.5 Mio Euro "Mountain Forest Initiative" campaign in 2008. The aim was to secure and restore the protective function of vulnerable mountain forests under climate change and to work on this topic in a collaborative way with forest owners and various stakeholders [47].

Forest owners are not the only relevant stakeholders. Hunters play a crucial role in maintaining the vitality, regeneration ability, and protective functions of forests by managing roe and red deer as well as chamois population. These ungulates reduce the diversity of the tree species important for stability and structure in forests by browsing. Even in lower numbers, these ungulates can have detrimental impacts on forest ecosystems and hunting concepts can limit these damages [48–50]. Other uses can also impact forest development, for example, recreational activities, such as hiking, mountain biking, or climbing [51–54].

In the Mountain Forest Initiative, in-depth participation is the core feature of the development process. The purpose of this approach is to achieve a strong sense of ownership for the overall process and agree upon measures through the intense involvement and collaboration of different stakeholders at the local level, including local authorities, foresters, hunters, nature conservation and volunteering groups, the Alpine Club, and tourism associations [27,55]. The core aim is for those threatened by natural hazards and forest owners, who are able to reduce risks to be in the center of the processes. Activities strive to develop rich structured, healthy, and resilient mixed forests with a variety of tree species and replace spruce plantations (*Piea abies*), as these plantations are most vulnerable and affected by climate change [56]. Important core objectives are dissemination and outreach activities in order to raise awareness regarding the crucial role that mountain forests play through joint courses with schools, businesses, and companies [57].

The program is still ongoing at the time of writing the paper. It has been implemented in varying degrees throughout the entire Bavarian Alps [56]. The Department for Food, Agriculture, and Forestry, which is responsible for the Upper Allgäu in Kempten, has the most intensive documented activities in recent years (Figure 1). Their way of pioneering and implementing the Mountain Forest Initiative is widely recognized as a best practice example evidenced by its winning the International Alpine Prize for Protective Forests for 2009 [58].

3. Results

3.1. Living Lab Approach

The results of the systematic literature review indicated that the term "Living Lab" is also largely used in other contexts, such as "open air" or "field experiments". Approximately one-third of the papers that were initially found addressed these topics and not "Living Labs" in the sense of in-depth participatory processes and intense stakeholder involvement. The EU defines Living Labs as "user-centered, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings. In practice, Living Labs place the citizen at the center of innovation, and have thus shown the ability to better mold the opportunities offered by new ICT concepts and solutions to the specific needs and aspirations of local contexts, cultures, and creativity potentials" [23].

The earliest Living Lab literature mainly focused on the development of software and use of digital tools. Thus, Living Labs initially were seen as a kind of wired room, space, or city with a user-centric methodology, where researchers and end-users sense, innovate, validate, and refine complex home technologies in a real-life context [59]. With the concept receiving interest from many disciplines, and the idea of Living Labs expanding to other fields, such as sustainable energy, health care, and safety [60], it has been adapted to the different fields of applications. A broad spectrum of definitions has been formulated for this reason [25,61]. A wide variety of activities is carried out under the umbrella term "Living Labs". Therefore, they are described as a methodology, system, concept, and environment or "Ecosystem", with Table 1 giving an overview of the different approaches and contexts.

3.2. Goals and Characteristics of Living Labs

In assessing the WoS papers, the most prominent goals of the approach are (creation of) "knowledge", "collaboration", and "participation" of "users" or "stakeholders". Key topics are development of new "sustainable" solutions or "designs", mainly related new, "smart" technologies, architecture, or energy, but also the shaping of transition processes. The main settings of the analyzed Living Labs in the WoS papers take place in "cities" or "urban" environments. Key characteristics are seen in creating "innovation", "openness" and "spontaneity" of processes, which create "sustainable solutions" and "multiple benefits", while adding value, as well as producing "knowledge" (see Table 1).

Living Labs serve and frame an intensive form of participation and involvement of stakeholders [62–64]. Sometimes, a special dimension is highlighted as an important core feature of the concept, such as a virtual or real space, which could be a city or neighborhood [64,65]. This makes the concept more tangible for landscape related topics and NBS. Some authors refer to the monitoring and evaluation processes as a key feature of a Living Lab process (see Table 1). In recent years, Living Lab approaches also emerged in the context of landscape planning, NBS, and climate change. However, in the search for respective papers, only a few papers explicitly deal with green space or the development of natural areas. These papers mainly describe Living Labs in the context of the exchange/creation of knowledge in order to stimulate sustainable economic growth based on natural resources [66–68]. A few papers assessing Living Labs describe approaches for redeveloping urban areas and improving blue and green infrastructures by integrating social issues at the same time, such as the providing of inclusive spaces [25] At the time, the literature review was conducted, we could not find a WoS publication linking Living Lab approaches with collaborate planning and co-designing NBS.

Although there were no hits on Living Labs and NBS, the concept can provide different elements or characteristics that can be relevant in the co-design of NBS. When comparing these characteristics with the two case studies, the core elements seen in the two successful NBS collaborative planning approaches and the Living Lab approach are similar in many ways.

Table 1. Core characteristics of Living Labs in literature (selected papers) in comparison to the case studied, inspired from Fohlmeister et al. [14], modified and added: x means "mentioned", (x) means "not explicitly mentioned", SD mean sustainable development, MFI means Mountain Forest Initiative.

	Context	Europe Følstad [69]	Europe Bergvall-Kåreborn & Ståhlbröst [70]	Europe Almirall & Wareham [62]	Rural Schaffers et al. [66]	Urban Voytenko et al. [25]	SD Evans et al. [64]	Overall Leminen [71]	Isar-Plan	MFI
Approach	Methodology					x				
	System		x			x				
	Concept		x							
	Environment, "Ecosystem"	x	x	x	x	x				
	Real Life/Real World Context	x	x	x		x	x	x	x	x
Goals, Characteristics	Innovation	x		x	x	x	x	x		
	Openness	x	x		x	x		x		x
	Sustainability					x	x	x	x	x
	Empowerment		x			x			x	x
	Spontaneity	x	x							
	Multiple Benefits					x			x	x
	Creating/producing Knowledge	x	x	x		x	x	x		x
	Value			x	x	x		x	x	x
Format of Collaboration	Neutral Forum/Meeting Place	x		x		x	x	x	x	x
	User Centred	x	x	x	x	x	x	x	x	x
	Multi-Stakeholder			x	x	x	x	x	x	x
	Quadruple Helix					x		(x)	x	(x)
	Trans-/Interdisciplinarity						x	x	x	x
Core Actions	Experiments, Testbed,	x		x	x	x	x	x		
	Creation, Development, Design	x	x	x	x	x	x	x	x	x
	Prototyping	x	x		x	x				
	Validation, Evaluation, Monitoring	x	x			x		x	x	x
	Development of Technology	x	x	x		x	x	x		
	Products, Solutions, Services	x			x	x	x	x	x	x
	Business Development		x	x	x			x		(x)

Note: The background color means to highlight the 2 cases that are developped in the paper.

3.3. Collaboration and Participation

The common idea of Living Labs is to form partnerships between public organizations, private companies, academia, and people. Living Labs can be considered as both an arena (i.e., geographically or institutionally bounded spaces) or as an approach for intentional collaborative experimentation of researchers, citizens, companies, and local governments [72]. They intend to create an environment of innovation and creativity by increasing the number of persons in charge of the design [73], and much of the Living

Lab literature assumes that gathering a broader spectrum of participants with different backgrounds, lifestyles, ages, expertise, and experiences will create and stimulate new ideas.

The Living Lab approach is commonly defined as "user-centered" [61], which means that persons making use of a solution or innovation or benefitting from it are continuously engaged throughout the process. They are actively involved and part of the entire co-creation process either as equal contributors or as ones designing the solutions themselves. In the latter case, researchers or experts only support the end-users throughout the process. Therefore, a Quadruple Helix Innovation Network is seen as a key characteristic of Living Labs [74]. The four sectors of public organizations, private companies, users (or end-users), and knowledge institutions (academia) interact, link with each other, and intertwine in order to develop solutions.

In reviewing the Isar-Plan with the Living Lab concept, the participative process did not follow a conceptual framework, as the process matured already before the development of the Living Lab concept, but the Isar-Plan fulfills most of the Living Lab criteria. Citizens, public institutions, private organizations, and academia were engaged in all phases of the Living Lab process, from the determinations of goals and objectives, up to the solutions, their design, and implementation [5]. In essence, it was a quadruple helix network, which is a key feature of many Living Lab concepts.

With the Mountain Forest Initiative launched by authorities, departments, and institutions in charge, the initiative aims to provide a meeting place to meet on equal grounds [57]. The related processes follow an overall formal framework that is given by the initiators, such as the facilitation of the processes at project sites and neutral mediation, if needed [47]. The framework from the initiators is also a core feature of Living Lab, which is found in the literature. The participants in the process are composed of representatives from the authorities, civil society, landowners, NGOs, and associations (e.g., forest owner associations), as well as enterprises. Academia is involved in the form of expertise (e.g., wildlife biologists) in order to support activities for round tables or further development of the processes [47].

3.4. Core Actions, Living Lab Steps and Phases

The literature describes similar core actions regarding the joint efforts to create solutions, business models, or products. A strong element in the definitions of Living Labs is the development of a business model or market-based solutions.

Living Labs usually follow a stepwise approach to execute the core actions. Depending on the authors, between three and eight steps are recommended. Similarities can be identified between the authors, despite the differences of the different steps. Usually, three main phases of a Living Lab can be identified [14,48,75] (see Table 2 and Figure 2). In the first phase of a Living Lab process, the goal is to understand the challenge or problem at hand and identify stakeholders that would collaborate on the problem. With the strong focus on end-users or people benefitting from a solution most, strategies are developed regarding how to involve these groups more in-depth with their needs or demands in the full process. While some authors demand continuous engagement throughout the process, in some concepts, where stakeholder involvement and engagement of different groups can vary throughout the process, end-users should at least be actively involved in the development and co-design process [76]. In the second phase, the emphasis is placed on the development and testing of a solution or product. The third phase of the Living Lab process is dedicated to the evaluation. The results, products, or solutions are tested for usability, benefits, and acceptance. When the testing shows that the Living Lab outcome is not sufficient, previous steps can be repeated until a sufficient status is achieved. Sometimes, more steps are described, such as replication or commercialization, which can be considered to be additional phases, as their importance might vary, depending on the context of the literature.

Table 2. Comparison of Living Lab Stages numbered (1–11) as described by the different authors. Inspired by Fohlmeister et al. [14], modified and added, case studies presented in the last two lines.

Source	1st Phase: Setup Phase	2nd Phase: Working Phase	3rd Phase: Outcome & Evaluation Phase	Additional Phases
Guzman et al. [77] based Schaffers et al. [78]	(1) Develop a local user community to function as key actors	(2) Define interest areas and innovation initiatives, (3) Elicit user needs, (4) Encourage user participation in product and service development.	(5) Let all participants evaluate lessons learned and prepare further initiatives	None
Ståhlbröst [75]	(1) Plan and appreciate opportunities	(2) Design	(3) Evaluate	None
Ståhlbröst & Holst [79]	(1) Design concept	(2) Design prototype	(3) Design Innovation	(4) Commercialize
Leminen [80]	(1) Co-create and innovate on new scenarios, concepts and related products ("artefacts")	(2) Explore with all stakeholders and users in the co-creation process for discovering emerging scenarios and usages, (3) Experiment with a large number of users and collect data	(4) Observe, evaluate and assess new ideas, innovative concepts and related technological products in real life situations	None
Coenen et al. [81]	(1) Formulate problem	(2) Build and evaluate	(3) Formalize and learn	None
Voicu-Dorobanţu et al. [82]	(1) Explore with all stakeholders to discover needs of the community through scenarios, debates, augmented reality	(2) Co-create scenarios and prototypes in real-life settings, (3) Experiment and test using pilot and prototypes and collect data	(4) Evaluate and assess solutions with indicators, adoption potentials and needs of resources	None
Cerreta & Panaro [68]	(1) Explore, identify and find local stakeholders and achieve shared objectives, (2) Co-design and develop with specific groups	(3) Test new ways of promoting landscape values and implement actions to enhance and manage local resources	(4) Co-Evaluate and increase knowledge of landscape values on which to base actions	None
Evans et al. [64]	(1) Explore	(2) Experiment	(3) Evaluate	None
Steen & van Bueren, [76]	(1) Initiate, (2) Plan development	(3) Design in a co-creative way, (5) Refine design	(4) Implement, (6) Evaluate	(7) Disseminate, (8) Replicate
Zingraff-Hamed et al. [5]	(1) Start with stakeholder groups to self-organize, (2) Develop formal plan to take action following three major goals: flood protection, recreation and ecological restoration	(3) Co-design NBS within interdisciplinary working groups and refine new ideas, (5) Test solution with models and refine solution within round tables	(4) Implement, (6) Monitor and evaluate ecological outcomes as well as user satisfaction	(7) Summarize lessons learned, (8) Upscale and Communicate
Freuding Freuding & Dinser [46,83]	(1) Scope the forests for potential project areas, (2) Assess project areas for stakeholder constellations and interest, (3) List priority areas, and (4) Install an advisory board for all project areas representing the different stakeholder groups	(5) Describe the problem(s), argue action(s), describe potential measures and management practices include ideas and flexibility from all groups, (6) Create local round tables to discuss, develop and bring in own ideas and propose measures. Authorities only give advice in this phase and provide a neutral mediation if needed, (7) State agreement on medium- and long-term action	(8) Implement measures, (9) Contract external companies to implement, (10) Monitor and evaluate	(11) Disseminate continuously on activities right from the beginning through all phases to create interest and engagement. Replicate and upscale the process in other areas

Note: The background color means the 2 cases we studied in detail in the paper.

3.4.1. Phases and Steps of the Isar-Plan

In reviewing the Isar-Plan in the context of the theory of Living Labs, the three phases of Living Labs are clearly evident. Observing the different concepts reveals many parallels to the more recent concept that is described in Steen and van Bueren [76]. There is a setup phase with step 1—initiation and step 2—plan development. A second working phase follows with step 3—co-creative design and, afterwards, a third phase with step 4—implementation, step 5—refinement, which redirects back to the second phase, and step 6—evaluation. Additional phases can follow with step 7—dissemination and step 8—replication.

In the Isar Case, an initiation phase to provide the river a more natural appearance can be traced back to the 1970s and 1980s. Advocacy groups started demanding an improvement of the degraded ecological and socio-cultural situation. They quickly found partners in new authorities, which were created as a reaction to growing environmental problems and increasing concern and environmental awareness in civil society [85]. As a result, processes started to self-catalyze with the formation of these networks. This step is similar to step 1, as described in Steen and van Bueren [76]. It became clear that new, more natural alternatives to traditional measures such as raising the heights of dams, needed to be implemented. The plan development step, described as step 2 by these authors, was between 1987 and 1999, when energy producers, state offices for water management, nature conservationists, fishermen, as well as consultants in the field of forestry, hydraulics, biology, ecology, river morphology, and landscape architecture collaboratively planned a new, more natural river morphology. Citizens were involved with workshops, collecting ideas, and providing information. Over 100,000 participants drew their requests on maps and elaborated ideas for the Isar [5].

The next phase, starting with step 3, correlates to the co-creative design described in the literature. In 1995, working groups that were composed of experts and government administrations started to work together under the direction of the Water Management Office in Munich. The working groups designed a river providing improved flood protection, while being restored to near-natural conditions and providing much outdoor recreation potential. All of the NGO's on the project were involved in the planning process. All of these important steps of planning and implementation were communicated within the framework of cooperative participation by the Münchner Forum. Public participation was encouraged through internet platforms, info-brochures, excursions, workshops, television, the press, and round table discussions [5].

Step 4—implementation—and phase 3 started with a resolution of the Munich City Council in 2000. The city´s department of construction was then assigned the responsibility of the implementation of the plan. Construction started in stages, from the south of the city, northwards towards the city center. The river restoration measure was completed in 2011 [86].

A refinement of the Isar river restoration was observed, similar to what Steen and van Bueren [76] suggested (going back to phase 2 with step 5—refinement). The final 200 m of the restoration reach the Museum Island. On the east side, the water flow regulation created a sensitive and protected habitat with large gravel bars. Any hydro-morphological change, such as a restoration measures, could have caused major damage to this habitat. Furthermore, the final section of the river restoration measure in the inner city, with limited space availability, as well as historical buildings and bridges that were protected under a preservation order, was very difficult to realize [87]. A competition was held to find the best solution for this extremely complicated stretch of river. A variety of different possible solutions was suggested in the competition ranging from island structures, meandering rivers, to linear interpretations. The decision of the jury contradicted public expectations. While the winning design met the technical parameters as an urban design, the public and NGOs preferred the second-place proposal: widening the river with a romantic scenery of meanders and an island [5]. While, according to the rules of the procedure, the winning design should have been implemented, the first-place planning team revised their design according to the public will. The planned design was tested and the Technical University of Munich conducted a flow simulation while using a 1:20 scale model of the most critical river section in order to ensure that the shape of the restored river would not change the characteristic of the precious habitat north of the restored section [5].

River authorities and NGOs performed the monitoring and management of the restored area, which is equivalent to step 6 in phase 3. Some monitoring data are collected regularly and comparisons can be drawn. However, while data and scattered studies indicate success in many fields, a systematic and regular monitoring and in-depth analyses is lacking. A prime example is the lack of monitoring and in-depth analysis on biodiversity. The reasons for this are a lack of sufficient data prior to restoration and a change in the monitoring metrics after restoration. This is mostly driven by the implementation of the Water Framework Directive in 2000, which brought about major changes in monitoring metrics and methods.

The Isar river restoration shows additional phases that are comparable to some of the Living Lab concepts with a step 7—dissemination, and a step 8—replication. The participating stakeholders strive to upscale the solutions for other sections of the river and other rivers with similar challenges, such as the Lech or the Amper. The "Isar-Plan" is widely recognized internationally as a good practice example and a learning case. It serves as a case study for many research and practice projects, networks, practitioners, and researchers, including the River Network, the European Centre for River Restoration, the European Climate Adaptation Platform Climate-ADAPT, the NATURVATION project, and the PHUSICOS project, which is funded by the European Union's Horizon 2020 research and innovation program.

3.4.2. Phases of the Mountain Forest Initiative

The Mountain Forest Initiative illustrates the three characteristic phases of a Living Lab process in a similar way. The Mountain Forest Initiative process has more steps taken in each phase and a continuous additional phase in parallel for dissemination activities, as shown in Table 2.

In the setup phase in step 1, the project areas were defined at the department level that is responsible for areas on the county level (EU Classification: NUTS 3). The departments assess forests in order to identify where action is most urgent.

In the next step 2, the stakeholder constellations and interest of actors were analyzed. While NGOs, volunteering groups, and landowner associations are easy to identify, this is not the case for forest owners, who play a decisive role in the process. Without being active, taking necessary steps themselves or agreeing upon management activities by contractors, no actions for improving the situation takes place. While many Living Lab processes consider stakeholders to be self-evident, the stakeholder identification is an important step to start the processes. Responsible local staff and facilitators that are employed by the agiencies have access to relevant forest ownership data. In many cases, this is an iterative process with local forest authority and department representatives in charge, while key actors and a core of engaged forest owners and communities (the latter often in their role as one of the forest owners in a project area and acting as a role model) form an initial core group expressing their interest. With owner structure and background changing rapidly, forest owners have an increasing lack of interest, abilities, or skills to manage the forests [88]. Thus, attracting interest, identifying, and motivating forest owners to take care of their forests, and to take action in general is becoming more challenging and considered to be extremely important [89].

Based on this expressed interest, a list of priority areas were developed in step 3. Step 4 started from 2008 when the project gained momentum and an overarching advisory board was established for the Mountain Forest Initiative comprising all of the relevant stakeholders from policy and administration, to different interest groups representing civil society, such as the Alpine Club, hunting associations, landowners, academia, and businesses [83].

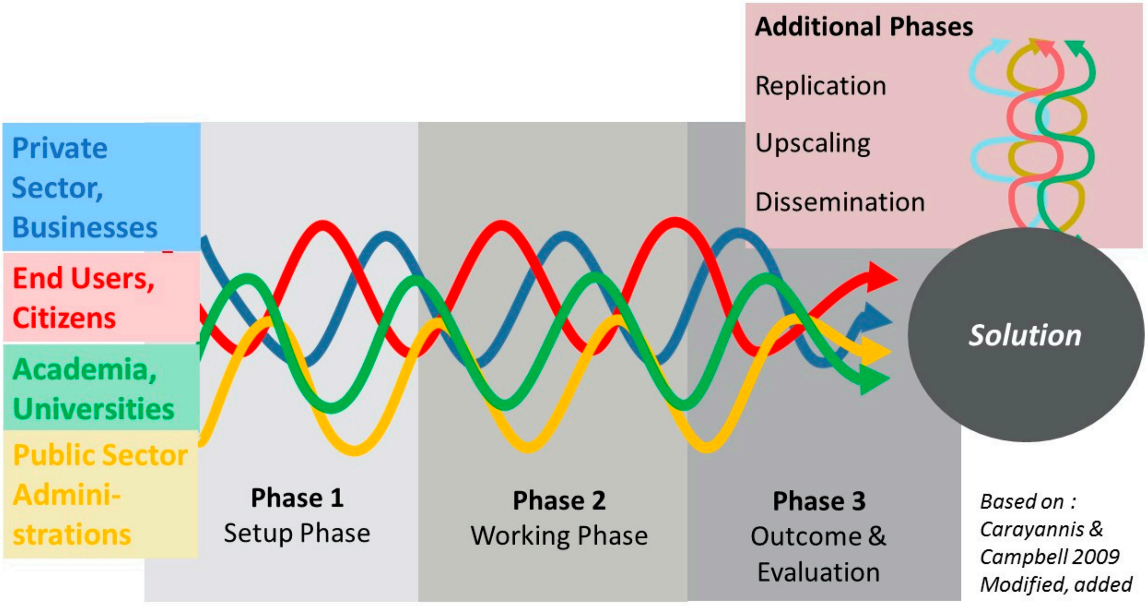

Figure 2. Living Lab steps based on Table 2 and Quadruple Helix Innovation Model by Carayannis and Campbell [84], modified, added.

In the second working phase or step 5, information exchange, discussions, site visits, and round tables take place and possible measures and actions are outlined, described, and suggested. In addition, information is provided on funding programs for maintaining mountain forests. A number of initiatives terminate in the beginning of the second phase, because of a lack of commitment for joint actions or because many forest owners express their disinterest for the funding schemes [83].

If enough forest owners express their interest and take action, step 6 follows, which consists of planning, implementation, and refinement. Usually, the result is management actions focusing on forest regeneration and planting tree species, such as broad leaves or white fir (*Abies alba*), measures to simplify regular management, such as tractor roads, or joint management activities in difficult terrain, such as helicopter transport or organizing cable cranes [56]. If needed, neutral mediation takes place in order to find solutions and compromises. In step 7, agreements are signed on medium and long-term actions that all of the stakeholders want to achieve, and funding is approved.

With often a less detailed description in many of the living lab concepts, an important phase for the Mountain Forest Initiative is the third phase that consists of implementing measures (step 8), contracting (step 9), and a strong focus on monitoring and evaluating the success (step 10). These relate to monitoring the effect of hunting and visitor management concepts in order to reduce browsing in the forest or having systematic inventories. Monitoring takes place in the form of regular inventories and the assessment of browsing. Monitoring is often part of the agreement for these measures and the providing of (co-)funding [46].

While only a few Living Lab concepts consider the additional phases, a key focus of the program is dissemination, outreach, and replication throughout the process [46,83]. For example, the Mountain Forest Initiatives served as a role model for north-eastern Bavaria for making forests more resilient to climate change [56]. In particular, the initiative at the Kempten Department for Food, Agriculture, and Forestry carried out various activities from the beginning, aiming to increase awareness and address society at both the local project area level and county level. This phase is parallel to phases 1–3. There were stands set up at fairs, a regular published magazine for households, and work with schoolchildren, decision makers, the public, and other forest owners. An example of this was the media impacting planting actions with schools or the responsible secretary of the Federal Free State [57,83].

3.5. Stakeholder Roles and Involvement

Four types of actors can take the lead to drive a Living Lab process, according to Leminen et al. [59]. "Utilizer-driven" living labs often deal with product development and testing and, in most cases, companies launch these type of processes to develop their business and, therefore, are in a central position. Educational institutions, such as universities, often launch "Provider-driven" Living Labs to generate knowledge. They can be short-term single projects or long-term innovation platforms. User communities, such as enthusiasts, often facilitate "User-driven" Living Labs. They mainly aim to solve a problem or address a specific interest following a strong bottom-up principle. Public-sector actors, NGOs, or funding institutions, such as municipalities, often initiate "Enabler-driven" Living Labs. By serving regional-development programs and activating key actors in a region, they aim for long-term collaboration. Both of the case studies represent the "Enabler-driven" type.

When compared to other co-creation methods, Living Labs are characterized by the strong engagement and empowerment of end-users or citizens [70], who will benefit from a designed and developed solution or product. The collaboration and networking process in Living Labs is often considered to be most important and even the desired outcome of such processes might, therefore, only be of secondary importance [59,76]. Unlike other participation approaches, all of the participants in Living Labs contribute to the process and, according to most authors, are also innovators. For this purpose, Living Labs aim for a high level of participation throughout all stages from the very beginning through the co-design, and implementation up to the evaluation phase. In theory, the Living Lab approach is often considered to be self-organizing and each participant should have a similar role and relevance in the network [59]. Including all stakeholders in the early phases helps to identify the needs of the citizens and users. It ensures that all stakeholders follow a common goal or vision and that they are aware of the potential impacts of the process [25]. Living Lab processes benefit, in this way, from the different knowledge, skills, experiences, roles, points of view, and needs that are brought in by different stakeholders [90]. This also implies that there is a strong aspect of learning for all participants in the Living Lab process. A strong shared commitment to shared key interests in the process, representativeness to the issue, heterogeneity of participants related to age, gender, culture, background, and perspectives, and the power to make decisions are important elements for an effective Living Lab process [91].

Living Labs utilize the Quadruple Helix Innovation Model [74], which includes actors from universities (providing science-based knowledge and technologies), governments (formulating policies to support innovation), firms (developing and marketing products), and the public/citizens as the fourth actor group [74]. Therefore, stakeholder groups need to be recruited or self-organized from the public sector with administrations, private businesses, citizens, and knowledge institutions, and a standardized setup of essential key stakeholders is not possible [64,76].

3.5.1. Stakeholders in the Isar-Plan

The Isar Case shows that most actors from the four different groups forming a Quadruple Helix Network were intensively involved throughout the process. A driving factor was that almost all had a strong interest and commitment to implement a NBS solution, instead of an even more, massive grey infrastructure [92]. However, not all of the core stakeholders were equally involved in the different phases. For some stakeholders, this can be explained by their role, e.g., as providers of specific knowledge, such as modelling tasks. The varying involvement of end-users, or persons and institutions that receive the benefit, can be also related to lacking frameworks and strategies of stakeholder involvement [92]. The Isar-Plan process shows this "out of bounds" work beyond administrative and hierarchical boundaries at the beginning, while new legal frameworks changed to allow more polycentric governance structures for such co-development processes [5]. Some challenges involved NGOs and civil society in the process, leading to the formation of the "Isar Allianz" as an alliance of NGOs. Nonetheless, the "Isar Allianz" was not formally involved. The "Isar-Plan" and stakeholder participation were formally organized through the "Münchner Forum" citizen´s association, which was assigned to collect and bring in the public opinion with the transparency of the process through internet platforms, info-brochures, excursions, workshops, active presswork, round table discussions, and info-points [85].

3.5.2. Stakeholders in the Mountain Forest Initiative

In the Mountain Forest Initiative, the process is explicitly what is postulated as "user-centered" and putting "the affected into the centre of process" in the Living Labs definition [57]. The most important end-users of the solutions are the forest owners that could be citizens, but also small businesses, such as small family-owned farms. Additionally, stakeholders, such as communities representing the public sector, benefit or are affected. The wider public is involved continuously through representatives or interest groups, such as the German Alpine Club, climbing associations, or nature conservation groups [83]. Academia and knowledge providers are involved for expertise, monitoring, or supervision of the processes or for neutral mediation [46]. However, a key factor is engagement and interest of forest owners, their commitment, and their power in the decision-making process, as solutions on their property depend on their willingness and agreement to implement. Participation is organized by dedicated project managers, together with local forest administrative staff involving external mediators that are funded through the program to facilitate in situations with conflicting interests [46]. A challenge that the Mountain Forest Initiative faces is that there is a conflict of interest with the forest administration being facilitators and drivers of the process, but also the decision-makers. Therefore, Böhling and Arzberger [27] critically reflect on their role in processes in new modes of polycentric governance.

4. Discussion

With the Living Lab concept receiving much attention from both research and policy at various levels, the question is whether the concept can be useful to enhance participation in planning contexts, specifically in selecting, co-designing, and implementing NBS. Can the Living Lab approach provide a suitable formal framework to stimulate the development of partnerships, build trust and to overcome the problems and bottlenecks to the implementation of NBS?

Living Labs are described as a center for innovation [59,79,93]. While restoration measures and NBS may be new approaches and gaining popularity in engineering disciplines, in-depth considerations of NBS is often an entirely new idea. In fact, many NBS solutions are part of traditional knowledge [94]. Nonetheless, with respect to innovation at the core of the Living Lab definition, the implementation of NBS as an alternative way to reduce the risks of hydro-meteorological hazards instead of the massive technical engineering measures that have been used over the past decades can be innovative solutions.

With the two examples presented in the paper, it can be shown that the NBS practice cases share many of the characteristics of Living Labs without having referred explicitly to this concept [5]. In particular, the Isar-Plan, where the process was self-catalyzing, did not follow the given frameworks or make use of previous examples [5]. Nevertheless, broader definitions, such as Leminen [80], and the steps described by Steen and van Bueren [76] for Living Labs, correspond well with the described cases. Therefore, the Living Lab approach can help to systematically define and structure such processes for co-deciding and co-designing NBS from the very beginning.

The three main phases described in most concepts are especially helpful for developing in-depth collaborative approaches in NBS co-design: a first phase to systematically set up and design such a process, a second working phase with respective steps to be taken and a third phase of monitoring and evaluation (Figure 2 further above). The additional phases with dissemination, upscaling, and replication steps can be very important for implementing NBS. The case of the Mountain Forest Initiative shows that these additional phases might be crucial to gain more attendance, raise awareness, and stimulate ongoing and new processes, both within the region and in other regions. For example, the State Ministry of Food, Agriculture, and Forestry decided to have similar programs in the whole of Bavaria, which adapted to the local conditions and needs e.g., programs to make forests more resilient to changing climate conditions in northern or eastern Bavaria [56].

With the potential for many variations of the Living Lab processes that are tailored to different conditions, settings, and starting points, Fohlmeister et al. [14] suggest focusing on Living Lab principles rather than building up custom definitions for Living Labs in the context of co-selecting, co-designing. and co-developing NBSs. Following the arguments of Tress et al. [95], Fohlmeister et al. [14] name a set of concrete principles orientating the set-up, implementation, and quality control of the processes and project outcomes. Living Lab processes in NBS co-design should aim at innovation and learning, building trust, while having a clear scope and goal to work on. Following these principles can be a key factor of success in involving stakeholders from the beginning through co-design and implementation of solutions. In particular, the Mountain Forest Initiative shows the importance of learning and building trust as core elements for successful Living Lab processes [83].

In order to ensure a creative atmosphere, stakeholder composition should put the four different core groups of the Quadruple Helix Innovation Network (the public sector, the private sector, the knowledge institutions, and the civil society) and their demands at the center and involve them intensively right from the beginning (see Figure 2, further above). What is important for finding a NBS solution is that the process tailors solutions to the local context, as shown in the two case studies. Finally, the collaboration and co-designing processes should be open-ended with a strong component of understanding, learning, and co-production of knowledge, as the Mountain Forest Initiative demonstrates with their strong focus on this aspect and new ideas around the process, such as creating new additional learning opportunities [89]. An important element should be continuous monitoring and the evaluation of the Living Lab process itself, as Living Labs can fail due to dissatisfied users or a lack of implementation of innovations. Often, the reasons for these failures are a lack of monitoring and an evaluation of the work and re-adjustment at early stages [76]. The Isar Case highlights the importance of readjustments exemplarily in the planning process of the innermost river section: the competition led to a winning design according to the technical parameters, but the plan was readjusted since it did not satisfy most stakeholders and the public.

When compared to other participatory approaches that were applied in the context of NBS, Living Labs explicitly focus on collaboration with stakeholder involvement right from beginning. The case studies also show this intense collaboration. Nonetheless, quadruple helix innovation networks are often not realized in Living Lab practice. For example, in a study that was conducted by Steen and van Bueren [76], only a small minority of projects fully implemented a Quadruple Helix Innovation Network. The end-users have a strong position of throughout the entire process in theory, but in practice, their main role is contributing only to a few co-design activities or providing information [96]. If the facilitation of such a process strives for the continuous involvement of all actors, systematic stakeholder mapping helps to understand the varying interests throughout the different phases and allows for developing strategies to keep actors motivated and involved at all stages. Recruiting stakeholders systematically for involvement is important for collaborative NBS planning, but oftentimes, this is not a part of the Living Labs, as they consider relevant stakeholders being self-evident, as Zingraff-Hamed et al. [92] point out. While the Isar Case shows that stakeholders can self-catalyze and stakeholders are clearly visible, the Mountain Forest Initiative underlines the usefulness of such a systematic approach in order to identify relevant actors. Stakeholder mapping helps to determine the necessary actors for the different phases around a core group if varying involvement throughout the process is considered.

Especially from the government sector, politicians tend to underestimate the benefits of Living Lab approaches and sometimes lack awareness of the opportunities of such processes [97]. Claude et al. [98] point out the potential barriers for collaboration in Living Labs. In particular, stakeholders may not be willing to participate, due to institutional constraints and cultures. This is often the case for actors from the government sector, as they are members of hierarchical organizations. This can make the progress difficult, since Living Labs explicitly aim to overcome such structures to open up space for innovation and ensure that stakeholders meet as equals, regardless of their background or hierarchical position [18]. Living Labs often exceed the threshold of normative and regulating systems in order to test new ideas and innovation processes. This leads to potential conflicts with typical planning and decision-making practices [74]. However, this relaxation of regulations and normative systems in Living Lab processes can provide favorable conditions for creativity and innovation [74]. Many overarching policies in the EU in many fields intend this. Consequently, this leads to new roles and understandings of roles of decision makers and in decision-making processes of authorities, as seen in the two case studies.

Living Labs that emerge from a political volition are often driven by government institutions, such as authorities, who are users and providers of the process [80]. Consequently, it can be difficult for the other participants to develop ownership for "their" project [98] and actors may lose interest when topics become too political or technical. This is especially crucial, as Living Labs need to achieve and sustain user mobilization and cooperation based on fulfilling user needs, being able to adopt new solutions, or providing user benefits [61]. This can be crucial in NBS, when private landowners need to take measures and actions, as demonstrated by the Mountain Forest Initiative. An important aspect that is drawn from this case is that decisive factors for successful Living Labs can be also create attention, recognition, and acknowledgement for examples of good practice or good role models as part of the dissemination activities.

The Living Lab theory strongly emphasizes business development or models. This might not fit well at first glance when being applied to landscape planning or NBS and it might lead to a lack of certain stakeholder groups in such processes. Leminen et al. [59] describe a lack of the private business sector seeing a need to participate in Living Labs. Companies or firms do not often see value or benefits in participating in Living Labs driven especially by enablers, such as the government or NGOs, as representatives of the public and the business sector often perceive that Living Labs mainly address the objectives and values of these groups [59]. Nonetheless, the Isar Case demonstrates positive economic benefits of NBS [99]. The study demonstrates the added economic values and business opportunities, i.e., for entrepreneurs benefitting from new recreation opportunities and related business models, but also indirect impacts, such as new skills and experiences for small and medium enterprises, such as planning offices that are involved in the Isar-Plan.

The projects that were initiated by the Mountain Forest Initiative intended to create multiple benefits and values besides enhanced protection from natural hazards, such as enhancing biodiversity, creating habitats for endangered species, or visitor management concepts in mountain forests [83]. The development of new business models is not a core focus. Nonetheless, the initiative and actions strive to stimulate an enhanced, continuous maintenance of the forest, such as by constructing tractor roads in difficult terrain or joint extraction and marketing of timber leading to financial benefits for participating private forest owners [56].

In some Living Lab cases, the co-creation of users cannot be realized due to a lack of decision-making power in the facilitation [96]. In the examined NBS cases, public authorities, such as planning offices, water agencies, and authorities in charge of such processes as an outflow of political wills, are final decision-makers. Nonetheless, this raises the issue of conflicts of interest with the role of administrations being the decision-makers of such processes [27].

5. Conclusions

With the increasing need to adapt to climate change, NBS can be a suitable and sustainable way to reduce the resulting risks and exposure to hazards. With their characteristics providing co-benefits and linking with societal aspects, such as retaining or developing a sense of place, as shown in the two examined case studies, their design, implementation, and monitoring can provide many opportunities for the involvement or increasing awareness of stakeholders through aspects of interests for many participants and the broader public. Thus, a sense of ownership "of their solution" can evolve, leading to more acceptance and implementation of measures and might more easily overcome bottlenecks.

Nonetheless, one should be aware that Living Lab processes itself are unable to overcome or eliminate many hindering factors, such as very divagating interests, distrust, or solve conflicts. They often do not automatically lead to jointly developed solutions or NBS designs that everyone can live with well. Living Labs are prone to failure, if seen as a tool to create acceptance for decisions made beforehand. No matter if seen as a methodology, system concept, or an environment, the key elements are openness, knowledge development, learning processes for all participants, and meeting on equal ground, including the ones starting such a process, are important. A key element is putting the ones that are affected in the center of the processes.

With a new role understanding by authorities, administrations, and decision makers as facilitators, enablers, and partners, the two case studies show the key success factors for in-depth stakeholder involvement and participation on collaborative NBS planning. The broad participation of civil society, open-mindedness of administrations, multi-scale and multidisciplinary round tables, neutral mediation to overcome conflicts and building trust, and confidence between the stakeholders, as they meet on equal ground. While the two case studies built up and self-catalyzed their framework over time, the Living Lab concept, especially its philosophy, principles, and phases, provide a sound framework to systematically structure and set up in-depth participation, co-design process right from the very beginning.

It will be interesting to follow up such formalized and structured Living Lab approaches having started in recent years. Valuable lessons learned can be drawn for implementation processes of NBS and co-creating tailored or innovative new solutions and, in particular, the outcomes and experiences that are made with Living Labs from the participant point of view in terms of expectations, learning processes, and experiences made with this collaborative planning approach and solutions found.

Author Contributions: Conceptualization, G.L., A.Z.-H.; methodology, A.Z.-H., G.L.; validation, S.P.; A.O.; formal analysis, G.L., A.Z.-H.; investigation, G.L., A.Z.-H., J.J.H.; resources, A.O., S.P.; writing—original draft preparation, G.L., A.Z.-H., J.J.H.; writing—review and editing, G.L., A.Z.-H., J.J.H., S.P., A.O.; visualization, G.L., J.J.H., A.Z.-H.; supervision, S.P., A.O.; project administration, S.P., A.O.; funding acquisition, A.O. All authors have read and agreed to the published version of the manuscript.

Funding: PHUSICOS has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 776681.

Data Availability Statement: The data presented in this study are openly available online. No new data were created. The data resulting from the interviews (see acknowledgements) are not publicly available.

Acknowledgments: The authors like to thank facilitators, key actors and stakeholders of the two cases for valuable background information, namely Niko Döring, Rolf Renner, Walter Binder and Klaus Bäumler from the Isar-Plan Case, Martin Wentzel, Gunnar Klama, Jürgen Harsch, Ulrich Sauter and Klaus Dinser (AELF Kempten), Peter Tretter, Roland Schreiber and Franz Binder (LWF) for the Mountain Forest Initiative. We share our gratitude with Sandra Fohlmeister for her lead authorship on the PHUSICOS Deliverable D3.1 "Guiding Framework on Living Labs for PHUSICOS" report, serving as a starting point for this presented work.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

WoS search terms and applied procedure

Selected WoS categories: Social Issues, Architecture, Engineering Civil, Education Scientific Disciplines, Management, Area Studies, Geosciences multidisciplinary, Green Sustainable Science Technology, Energy Fuels, Environmental Sciences, Ecology, Education, Educational Research, Food Science Technology, Multidisciplinary Sciences, Forestry, Social Sciences Interdisciplinary, Agriculture Multidisciplinary, Urban Studies, Environmental Studies, Public Administration, Geography, Rehabilitation, Political Science, Operations Research Management Science, Water Resources, Engineering Environmental, Planning Development, and Engineering Multidisciplinary. The categories were selected by the authors based on their expertise. To avoid unintended, we added to the literature list results of the research using the terms "Living Lab*" AND "Climate Change" (N = 15), "Living Lab*" AND Risk Management (N = 2), "Living Lab*" AND Case Study (N = 111), "Living Lab*" AND Europe (N = 34), and "Living Lab*" AND Stakeholder (N = 68). The combination of terms "Living Lab*" AND Nature-based Solution, "Living Lab*" AND Land Use Management, "Living Lab*" AND socio-cultural factors, and "Living Lab*" AND planning cultures did not produce any results.

European Network of Living Labs

Using the found literature from WoS, the search for additional papers and additional work was conducted using the website of the European Network of Living Labs (ENoLL), www.enoll.org in May 2018. The "networks" and "project" sections of the website were screened for projects, their documentations or outcomes or more work by authors found in the WoS papers. We included also making use of materials in the provided links on this website.

References

1. De Paola, F.; Giugni, M.; Pugliese, F.; Romano, P. Optimal Design of LIDs in Urban Stormwater Systems Using a Harmony-Search Decision Support System. *Water Resour. Manag.* **2018**, *32*, 4933–4951. [CrossRef]
2. Santos, J.G. GIS-based hazard and risk maps of the Douro river basin (north-eastern Portugal). *Geomat. Nat. Hazards Risk* **2015**, *6*, 90–114. [CrossRef]
3. Santoro, S.; Pluchinotta, I.; Pagano, A.; Pengal, P.; Cokan, B.; Giordano, R. Assessing stakeholders' risk perception to promote Nature Based Solutions as flood protection strategies: The case of the Glinščica river (Slovenia). *Sci. Total Environ.* **2019**, *655*, 188–201. [CrossRef] [PubMed]
4. European Commission—Directorate-General for Research and Innovation. *Towards an EU Research and Innovation Policy Agenda for Nature-Based Solutions & Re-Naturing Cities*; European Commission: Brussel, Belgium, 2015; 70p. [CrossRef]
5. Zingraff-Hamed, A.; Martin, J.; Lupp, G.; Linnerooth-Bayer, J.; Pauleit, S. Designing a Resilient Waterscape Using a Living Lab and Catalyzing Polycentric Governance. *Landsc. Archit. Front.* **2019**, *7*, 12–31. [CrossRef]
6. Scolobig, A.; Thompsen, M.; Linnerooth-Bayer, J. Compromise not consensus: Designing a participatory process for landslide risk mitigation. *Nat. Hazards* **2016**, *81* (Suppl. 1), 45–68. [CrossRef]
7. Arnstein, S.R. A Ladder of Citizen Participation. *J. Am. Plan. Assoc.* **1969**, *35*, 216–224. [CrossRef]
8. Bodin, Ö. Collaborative environmental governance: Achieving collective action in social ecological systems. *Science* **2017**, *659*, eaan1114. [CrossRef]
9. Zingraff-Hamed, A.; Hüesker, F.; Albert, C.; Brillinger, M.; Huang, J.; Lupp, G.; Scheuer, S.; Schlätel, M.; Schröter, B. Governance Models for Nature-based Solutions: Cases from Germany. *AMBIO*. In Press.
10. Frantzeskaki, N.; McPhearson, T.; Collier, M.J.; Kendal, D.; Bulkeley, H.; Dumitru, A.; Walsh, C.; Noble, K.; van Wyk, E.; Ordóñez, C.; et al. Nature-Based Solutions for Urban Climate Change Adaptation: Linking Science, Policy, and Practice Communities for Evidence-Based Decision-Making. *BioScience* **2019**, *69*, 455–466. [CrossRef]
11. Ershad Sarabi, S.; Han, Q.; Romme, A.G.L.; de Vries, B.; Wendling, L. Key Enablers of and Barriers to the Uptake and Implementation of Nature-Based Solutions in Urban Settings: A Review. *Resources* **2019**, *8*, 121. [CrossRef]
12. Zingraff-Hamed, A.; Schröter, B.; Schaub, S.; Lepenies, R.; Stein, U.; Hüesker, F.; Meyer, C.; Schleyer, C.; Schmeier, S.; Pusch, M. Perception of Bottlenecks in the implementation of the European Water Framework Directive. *Water Altern.* **2020**, *13*, 458–483.

13. National Research Council. *Public Participation in Environmental Assessment and Decision Making: Panel on Public Participation in Environmental Assessment and Decision Making*; Dietz, T., Stern, P.C., Eds.; National Academies Press: Washington, DC, USA, 2008; ISBN 0-309-12399-2. 322p.
14. Fohlmeister, S.; Zingraff-Hamed, A.; Lupp, G.; Pauleit, S. Guiding Framework for Tailored Living Lab Establishment at Concept and Demonstrator Case Study Sites. Deliverable 3.1., PHUSICOS, H2020 Grant Agreement No. 776681. Available online: https://phusicos.eu/wp-content/uploads/2018/10/D3_1_GF_Final_Version_complete_201807312-Disclaimers.pdf (accessed on 30 November 2020).
15. Fohlmeister, S.; Augenstein, I.; Jones, C.; Ramirez, D.; Lupp, G. Starter Toolbox for Stakeholder Knowledge Mapping to Co-Design Nature-Based Solutions at Case Study Sites. Deliverable D 3.2. Work Package 3. PHUSICOS—According to Nature. Horizon 2020. March 2019. GA 776681. Available online: https://phusicos.eu/wp-content/uploads/2019/04/PHUSICOS_D3_2r_WP3_final_20190331.pdf (accessed on 30 November 2020).
16. Bajgier, S.M.; Maragah, H.D.; Saccucci, M.S.; Verzilli, A.; Prybutok, V.R. Introducing students to community operations research by using a city neighborhood as a living laboratory. *Oper. Res.* **1991**, *39*, 701–709. [CrossRef]
17. Mitchell, W.J. *Me++: The Cyborg Self and the Networked City*; MIT Press: Cambridge, MA, USA, 2003; 269p.
18. Nesti, G. Co-production for innovation: The urban living lab experience. *Policy Soc.* **2018**, *37*, 310–325. [CrossRef]
19. Huutoniemi, K.; Klein, J.T.; Bruun, H.; Hukkinen, J. Analyzing interdisciplinarity: Typology and indicators. *Res. Policy* **2010**, *39*, 79–88. [CrossRef]
20. Bekkers, V.; Edelenbos, J.; Steijn, B. *Innovation in the Public Sector: Linking Capacity and Leadership*; Palgrave Macmillan: Basingstoke, UK, 2011; 360p.
21. Linnerooth-Bayer, J.; Scolobig, A.; Ferlisi, S.; Cascini, L.; Thompson, M. Expert engagement in participatory processes: Translating stakeholder discourses into policy options. *Nat. Hazards* **2016**, *81* (Suppl. 1), 69–88. [CrossRef]
22. Edwards-Schachter, M.E.; Matti, C.E.; Alcantara, E. Fostering Quality of Life through Social Innovation: A Living Lab Methodology Study Case. *Rev. Policy Res.* **2012**, *29*, 672–692. [CrossRef]
23. European Commission. Living Labs for Regional Innovation Ecosystems. Available online: https://s3platform.jrc.ec.europa.eu/living-labs (accessed on 30 November 2020).
24. European Commission. *The European Agenda for Research and Innovation 2014–2020*; European Commission: Brussel, Belgium, 2013; Available online: http://s3platform.jrc.ec.europa.eu/living-labs (accessed on 30 November 2020).
25. Voytenko, Y.; McCormick, K.; Evans, J.; Schliwa, G. Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *J. Clean. Prod.* **2016**, *123*, 45–54. [CrossRef]
26. Sutherland, W.J.; Gardner, T.; Bogich, T.L.; Bradbury, R.B.; Clothier, B.; Jonsson, M.; Kapos, V.; Lane, S.N.; Möller, I.; Schroeder, M.; et al. Solution scanning as a key policy tool: Identifying management interventions to help maintain and enhance regulating ecosystem services. *Ecol. Soc.* **2014**, *19*, 3. [CrossRef]
27. Böhling, K.; Arzberger, M.B. New modes of governance in Bavaria's alpine forests: The 'Mountain Forest Initiative' at work. *For. Policy Econ.* **2014**, *49*, 43–50. [CrossRef]
28. Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G. Reprint—Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Phys. Ther.* **2009**, *89*, 873–880. [CrossRef]
29. Mayring, P. *Qualitative Inhaltsanalyse*; Beltz: Weinheim, Germany; Basel, Switzerland, 2007; Volume 9, 135p.
30. Neumann, A.; Gabel, G.; Gröbmaier, W.; Kolbinger, A.; Kraier, W.; Krolo, M.; Mayr, C.; Schaipp, B.; Wolf, B.; Hausner, H.; et al. *Flusslandschaf Isar im Wandel der Zeit*; Bayerisches Landesamt für Umwelt: Augsburg, Germany, 2011; 194p.
31. Zingraff-Hamed, A.; Egger, G. Isar. In *Rivers of the Alps—Diversity in Nature and Culture*; Muhar, S., Muhar, A., Siegrist, D., Egger, G., Eds.; Haupt: Bern, Switzerland, 2019; Volume 1, p. 512.
32. Egger, G.; Gräßer, L.; Reich, M.; Komposch, C.; Dister, E.; Schneider, E.; Norbert, M. Ecosystem Alpine river—Permanent change. In *Rivers of the Alps—Diversity in Nature and Culture*; Muhar, S., Muhar, A., Siegrist, D., Egger, G., Eds.; Haupt: Bern, Switzerland, 2019; Volume 1, p. 511.
33. Döring, N.; Jochum, G. Revitalization of a tamed river: The Isar in Munich. In *Rivers Lost, Rivers Regained: Rethinking City-River*; Knoll, M., Ed.; University of Pittsburgh Press: Pittsburgh, PA, USA, 2006; pp. 288–311.
34. Bayerische Akademie für Naturschutz und Landschaftspflege (Ed.) *Flusslandschaften im Wandel: Veränderung und weitere Entwicklung von Wildflusslandschaften am Beispiel des alpenbürtigen Lechs und der Isar*; Bayerische Akademie für Naturschutz und Landschaftspflege: Laufen, Germany, 2001; 124p, ISBN 3-931175-65-0.
35. Binder, W.; Gabel, G.; Gröbmaier, W. *Flusslandschaft Isar—Von der Landesgrenze bis Landshut: Leitbilder, Entwicklungsziele und Maßnahmen*; Bayerisches Landesamt für Wasserwirtschaft: Munich, Germany; Bayerisches Landesamt für Umwelt: Augsburg, Germany, 2001; 104p.
36. Rädlinger, C.; Hafner, K.; Junge, M.; Nebl, A. *Geschichte der Isar in München*; Schiermeier: Munich, Germany, 2012; 312p.
37. Binder, W. The Restoration of the Isar South of Munich. *Wasserwirtschaft* **2010**, *100*, 15–19. [CrossRef]
38. Wahren, A.; Frank, S.; Walther, P.; Schmidt, W.; Feger, K.-H. Erstellung eines Leitfadens für Ausgleichsmaßnahmen auf landwirtschaftlich genutzten Flächen in den Hochwasserentstehungsgebieten Sachsens. *Hydrol. Wasserbewirtsch.* **2011**, *55*, 155–163.
39. Albrecht, J.; Neubert, M.; Bianchin, S.; Lupp, G. Hochwasserentstehungsgebiete: Leistungsfähigkeit und Grenzen eines innovativen Instruments zur Hochwasservorsorge. *Umw. Plan.* **2017**, *37*, 368–377.

40. Beschta, R.L.; Pyles, M.R.; Skaugset, A.E.; Surfeet, C.G. Peak flow response to forest practices in the western Cascades of Oregon, USA. *J. Hydrol.* **2000**, *233*, 102–120. [CrossRef]
41. Mayer, H.; Ott, E. *Gebirgswaldbau, Schutzwaldpflege. Ein Waldbaulicher Beitrag zur Landschaftsökologie und zum Umweltschutz*; Gustav Fischer Verlag: Stuttgart, Germany, 1991; 587p.
42. Bachofen, H.; Zingg, A. Auf dem Weg zum Gebirgsplenterwald: Kurzzeiteffekte von Durchforstungen auf die Struktur Subalpiner Fichtenwälder. *Schweiz. Z. Für Forstwes.* **2005**, *156*, 456–466. [CrossRef]
43. Borrass, L.; Kleinschmit, D.; Winkel, G. The "German model" of integrative multifunctional forest management—Analysing the emergence and political evolution of a forest management concept. *For. Policy Econ.* **2017**, *77*, 16–23. [CrossRef]
44. Bayerische Staatsforsten. *Bergwaldrichtlinie*; BaySF: Regensburg, Germany, 2018; 15p, Available online: https://www.baysf.de/fileadmin/user_upload/07-publikationen/2018/Bergwaldrichtlinie.pdf (accessed on 30 November 2020).
45. Suda, M.; Schreiber, R.; Schaffner, S.; Koch, M.; Gaggermeier, A. Beratung und Kooperation als Grundlage einer nachhaltigen Waldbewirtschaftung in Bayern. *LWF Wissen* **2013**, *72*, 133–138.
46. Freuding, D.; Dinser, K. Vom Arbeiten mit Bäumen und Menschen—Umweltmediation und Bergwaldoffensive Hinterstein bringen Schutzwaldpflege im Hintersteiner Tal weiter voran. *LWF Aktuell* **2011**, *84*, 17–19.
47. Brosinger, F.; Tretter, S. Die Bergwaldoffensive—Bayern geht neue Wege im Schutzwaldmanagement. *LWF Aktuell* **2009**, *71*, 4–5.
48. Akashi, N.; Nakashizuka, T. Effects of bark-stripping by sika deer (*Cervus nippon*) on population dynamics of a mixed forest in Japan. *For. Ecol. Manag.* **1999**, *113*, 75–85. [CrossRef]
49. Bradshaw, R.H.W.; Hannon, G.E.; Lister, A.M. A long-term perspective on ungulate-vegetation interactions. *For. Ecol. Manag.* **2003**, *181*, 267–280. [CrossRef]
50. Didion, M.; Kupferschmid, A.D.; Bugmann, H. Long-term effects of ungulate browsing on forest composition and structure. *For. Ecol. Manag.* **2009**, *258* (Suppl. 1), 44–55. [CrossRef]
51. Pickering, C.M.; Hill, W.; Newsome, D.; Leung, Y.-L. Comparing hiking, mountain biking and horse riding impacts on vegetation and soils in Australia and the United States of America. *J. Environ. Manag.* **2010**, *91*, 551–562. [CrossRef] [PubMed]
52. Manning, R.E. *Studies in Outdoor Recreation*, 2nd ed.; Oregon State University Press: Corvalis, OR, USA, 1999; 374p.
53. Eagles, P.F.; McCool, S.F. *Tourism in National Parks and Protected Areas. Planning and Management*; CABI Publishing: New York, NY, USA, 2002; 320p.
54. Bell, S.; Tyrväinen, T.; Pröbstl, U.; Simpson, M. Outdoor Recreation and Nature Tourism: A European Perspective; Living Reviews in Landscape Research; 2007. Available online: https://www.imba-europe.org/sites/default/files/EU%20perspective%20on%20outdoor%20recreation%20and%20nature%20tourism.pdf (accessed on 30 November 2020).
55. Leitenbacher, A. "Vorbeugen und Heilen" im Schulterschluss—Die Bergwaldoffensive im Berchtesgadener Land. *LWF Aktuell 2018 82*, 25–28.
56. Brosinger, F.; Tretter, S. Mit Projekten zum Erfolg—Von der "Bergwaldoffensive" aus den Alpen zur "Waldinitiative Ostbayern". *LWF Aktuell* **2014**, *102*, 9–11.
57. Wentzel, M. 10 Jahre Bergwaldoffensive. *Lwf Wissen* **2018**, *82*, 28–29.
58. ARGE Aplpenländische Forstvereine (2010): Alpiner Schutzwaldpreis 2009—Preisverleihung in Bad Tölz, Bayern. Kategorie Innovation und Partnerschaften. Available online: https://www.arge.forstvereine.eu/schutzwaldpreis/preisverleihung/ueberblick/preisverleihung-2009.html (accessed on 30 November 2020).
59. Leminen, S.; Westerlund, M.; Nyström, A.G. Living labs as open-innovation networks. *Technol. Innov. Manag. Rev.* **2012**, *2*, 6–11. [CrossRef]
60. Van Geenhuizen, M. From ivory tower to living lab: Accelerating the use-of university knowledge. *Environ. Plan. C-Gov. Policy* **2013**, *31*, 1115–1132. [CrossRef]
61. Dutilleul, B.; Birrer, F.A.J.; Mensink, W. Unpacking European Living Labs: Analysing Innovation's Social Dimension. *Cent. Eur. J. Public Policy* **2010**, *4*, 60–85.
62. Almirall, E.; Wareham, J. Living Labs: Arbiters of mid- and ground-level innovation. *Technol. Anal. Strateg. Manag.* **2011**, *23*, 87–102. [CrossRef]
63. Wendin, K.; Åström, A.; Ståhlbröst, A. Exploring differences between central located test and home use test in a living lab context. *Int. J. Consum. Stud.* **2015**, *39*, 230–238. [CrossRef]
64. Evans, P.; Schuurman, D.; Ståhlbröst, A.; Vervoort, K. *Living Lab Methodology—Handbook*; U4IoT Consortium: Manchester, UK, 2017; 76p.
65. Leminen, S.; Nyström, A.G.; Westerlund, M. A typology of creative consumers in living labs. *J. Eng. Technol. Manag.* **2015**, *37*, 2–6. [CrossRef]
66. Schaffers, H.; Guzman, J.G.; Merz, C. An Action Research Approach to Rural Living Labs Innovation. In *Collaboration and Knowledge Economy: Issues, Applications, Case Studies*; Cunningham, P., Cunningham, M., Eds.; Ios Press: Amsterdam, The Netherlands, 2008; Volume 5, pp. 617–624.
67. Bertoldi, F.; Schaffers, H.; Ruland, R.; Schoepfer, E.; Rossi, A.; Fusco, L. Stimulating Innovation in the Frascati Living Lab through Supporting Business Incubation. In *Collaboration and Knowledge Economy: Issues, Applications, Case Studies*; Cunningham, P., Cunningham, M., Eds.; Ios Press: Amsterdam, The Netherlands, 2008; Volume 5, pp. 723–730.

68. Cerreta, M.; Panaro, S. From Perceived Values to Shared Values: A Multi-Stakeholder Spatial Decision Analysis (M-SSDA) for Resilient Landscapes. *Sustainability* **2017**, *9*, 1113. [CrossRef]
69. Følstad, A. Living Labs for innovation and development of information and communication technology: A literature review. *Electron. J. Virtual Organ. Netw.* **2008**, *10*, 99–131.
70. Bergvall-Kåreborn, B.; Ståhlbröst, A. Living Lab: An Open and Citizen-Centric Approach for Innovation. *Int. J. Innov. Reg. Dev.* **2009**, *4*, 356–370. [CrossRef]
71. Leminen, S. Q&A. What Are Living Labs? *Technol. Innov. Manag. Rev.* **2015**, *5*, 29–35.
72. McCormick, K.; Schliwa, G. Living labs—users, citizens and transitions. In *The Experimental City*; Evans, J., Karvonen, A., Raven, R., Eds.; Routledge: Abingdon, UK, 2016; pp. 163–178. ISBN 9781138856202.
73. Westerlund, M.; Leminen, S. Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. *Technol. Innov. Manag. Rev.* **2011**, *1*, 19–25. [CrossRef]
74. Concilio, G. Urban Living Labs: Opportunities in and for Planning. In *Human Smart Cities. Urban and Landscape Perspectives*; Concilio, G., Rizzo, F., Eds.; Springer: Cham, Germany, 2016; pp. 21–40.
75. Ståhlbröst, A. A set of key principles to assess the impact of Living Labs. *Int. J. Prod. Dev.* **2012**, *17*, 60–75. [CrossRef]
76. Steen, K.; van Bueren, E. The Defining Characteristics of Urban Living Labs. *Technol. Innov. Manag. Rev.* **2017**, *7*, 21–33. [CrossRef]
77. Guzman, J.G.; del Carpió, A.F.; Colomo-Palacios, R.; de Diego, M.V. Living Labs for User-Driven Innovation: A Process Reference Model. *Res. Technol. Manag.* **2013**, 29–39. [CrossRef]
78. Schaffers, H.; Budweg, S.; Kristensen, K.; Ruland, E. A living lab approach for enhancing collaboration in professional communities. In Proceedings of the 15th International Conference on Concurrent Enterprising, Leiden, The Netherlands, 22–24 June 2009.
79. Ståhlbröst, A.; Holst, M. *The Living Lab Methodology Handbook*; SmartIES: Luleå, Sweden, 2012; 76p, Available online: http://www.ltu.se/cms_fs/1.101555!/file/LivingLabsMethodologyBook_web.pdf (accessed on 30 November 2020).
80. Leminen, S. Coordination and Participation in Living Lab Networks. *Technol. Innov. Manag. Rev.* **2013**, *3*, 5–14. [CrossRef]
81. Coenen, T.; Donche, V.; Ballon, P. LL-ADR: Action Design Research in Living Labs. LL-ADR: Action design research in living labs. In Proceedings of the 2015 48th Hawaii International Conference on Systems Sciences, Kauai, HI, USA, 5–8 January 2015; IEEE Computer Society: Los Alamitos, CA, USA; pp. 4029–4038. [CrossRef]
82. Voicu-Dorobanţu, R. Living Labs and C2PPartnerships: A Participatory Solution or Just Another Buzz Concept for Regional and Local Development? *Ovidius Univ. Ann. Econ. Sci. Ser.* **2016**, *16*, 120–126.
83. Freuding, D. Die Bergwaldoffensive am AELF Kempten—BWO setzt auf rege Kommunikation und intensive Mitwirkung aller Beteiligten. *LWF Aktuell* **2009**, *71*, 6–8.
84. Carayannis, E.G.; Campbell, D. 'Mode 3' and 'Quadruple Helix': Toward a 21st century fractal innovation ecosystem. *Int. J. Technol. Manag.* **2009**, *46*, 201–234. [CrossRef]
85. Reichholf, J.H.; Arzet, K. *Das Buch zum Abschluß des Projekts "Isarplan"*; Buch & Media: Munich, Germany, 2011; 240p.
86. Renner, S.S.; Schuhwerk, F. *Das Buch zum Isarplan in München, Teil 2*; Buch & Media: Munich, Germany, 2012; 230p.
87. Schaufuß, D. *Isar-Plan—Water Management Plan and Restoration of the Isar River, Munich (Germany)*; Climate ADAPT Case studies: Brussels, Belgium, 2015; Available online: https://climate-adapt.eea.europa.eu/metadata/case-studies/isar-plan-2013-water-management-plan-and-restoration-of-the-isar-river-munich-germany (accessed on 30 November 2020).
88. Hogl, K.; Pregernig, M.; Weis, G. What is new about new forest owners? A typology of private forest ownership in Austria. *Small-Scale For. Econ. Manag. Policy* **2005**, *4*, 325–342. [CrossRef]
89. Lupp, G.; Sauter, U. *Allgäuer Waldakademie, Zwischenbericht*; Project Report; 2013; 61p.
90. Paskaleva, K.; Cooper, I.; Linde, P.; Peterson, B.; Gotz, C. Stakeholder Engagement in the Smart City: Making Living Labs Work. In *Transforming City Governments for Successful Smart Cities*; Rodrígez-Bolívar, M.P., Ed.; Springer: New York, NY, USA, 2015; pp. 115–145.
91. Dvarioniene, J.; Gurauskiene, I.; Gecevicius, G.; Trummer, D.R.; Selada, C.; Marques, I.; Cosmi, C. Stakeholders involvement for energy conscious communities: The Energy Labs experience in 10 European communities. *Renew. Energy* **2015**, *75*, 512–518. [CrossRef]
92. Zingraff-Hamed, A.; Hüesker, F.; Lupp, G.; Begg, C.; Hunang, J.; Oen, A.; Vojinovic, Z.; Kuhlicke, C.; Pauleit, S. Stakeholder Mapping to Co-Create Nature-Based Solutions: Who Is on Board? *Sustainability* **2020**, *12*, 8625. [CrossRef]
93. Bergvall-Kåreborn, B.; Eriksson, C.I.; Ståhlbröst, A. Places and Spaces within Living Labs. *Technol. Innov. Manag. Rev.* **2015**, *5*, 37–47. [CrossRef]
94. Cohen-Shacham, E.; Walters, G.; Janzen, C.; Maginnis, S. (Eds.) *Nature-Based Solutions to Address Global Societal Challenges*; IUCN: Gland, Switzerland, 2016; 114p.
95. Tress, B.; Tress, G.; Fry, G. Researchers' experiences, positive and negative, in integrative landscape projects. *Environ. Manag.* **2005**, *36*, 792–807. [CrossRef]
96. Veeckman, C.; van der Graaf, S. The City as Living Laboratory: A Playground for the Innovative Development of Smart City Applications. In Proceedings of the 2014 International ICE Conference on Engineering, Technology and Innovation (ICE), Bergamo, Italy, 23–25 June 2014; pp. 1–10.
97. Galiano, A.; Impedovo, D.; Pezzuto, M. OpenKnowledge and OpenGovernment: The experience of the municip@zione Living Lab project. *J. E-Learn. Knowl. Soc.* **2014**, *10*, 53–64.

98. Claude, S.; Ginestet, S.; Bonhomme, M.; Moulene, N.; Escadeillas, G. The Living Lab methodology for complex environments: Insights from the thermal refurbishment of a historical district in the city of Cahors, France. *Energy Res. Soc. Sci.* **2017**, *32*, 121–130. [CrossRef]
99. Pugliese, F.; Caroppi, G.; Zingraff-Hamed, A.; Lupp, G.; Giugni, M. Nature-Based Solutions (NBSs) application for hydro-environment enhancement. The case study of the Isar River (DE). *Environ. Sci. Proc.* **2020**, *2*, 30. [CrossRef]