Design Science

A framework for 'configuring participation' in living labs

Fumiya Akasaka[1], Yuya Mitake[1], Kentaro Watanabe[1] and Yoshiki Shimomura[2]

[1]*Human Augmentation Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Chiba, Japan*
[2]*Department of System Design, Tokyo Metropolitan University, Tokyo, Japan*

Abstract

In recent years, 'living lab (LL)', a design approach that actively involves users as partners from the early stage of the design process, has been attracting much attention. Compared with the traditional participatory design or co-design approaches, one of the distinctive features of the LL approach is that the process of and opportunity for user participation tends to be long-term and complex. Thus, LL practitioners must appropriately plan and design effective integration of user participation into the design process to promote co-creation with users. In other words, LL practitioners are required to 'configure user participation' for the effective promotion of co-creation. However, to date, the knowledge on how to properly configure long-term and complex user participation in LLs has not been systematically clarified, nor have its methodologies been developed. This study develops a novel framework for configuring user participation in LLs. Through a literature review and analysis on LL case studies, we identified the 11 key elements in five categories that should be considered while configuring user participation in LLs. Furthermore, on the basis of the identified elements, we developed a novel framework for configuring user participation in LLs, which is called the participation blueprint. We have demonstrated its use and have also discussed its theoretical and practical contributions to the LL and co-design research community.

Key words: Co-design, Living Lab, Configuring participation, Participation blueprint

Received 16 December 2021
Revised 07 October 2022
Accepted 10 October 2022

Corresponding author
F. Akasaka
fumiya.akasaka@aist.go.jp

Des. Sci., vol. 8, e28
journals.cambridge.org/dsj
DOI: 10.1017/dsj.2022.22

1. Introduction

In recent years, co-creating products and/or services with users has gained increasing importance in response to the rising complexity of social issues and the diversification of values. In this context, 'living lab (LL)' (Følstad 2008; Bergvall-Kåreborn, Holst & Stahlbrost 2009; Almirall, Lee & Wareham 2012; Leminen, Westerlund & Nyström 2012), which is a design approach that actively involves users as partners from the early stage of the design process, has been attracting attention. In LL, users are actively involved in a co-creative design process. Here, they collaboratively identify challenges to overcome, create ideas for responding to the challenges and test them in real-life environments (Bergvall-Kåreborn & Stahlbrost 2009). Therefore, users are expected to 'participate' in various phases of the LL process.

A design approach where users participate in its process is traditionally called participatory design (PD; Schuler & Namioka 1993; Kensing & Blomberg 1998). It has been actively studied and practised since the 1970s, primarily in

Scandinavian countries. Compared with the traditional PD approach, one of the distinctive features of the LL approach is that the process of and opportunity for the users to participate tends to be long-term and complex. While traditional PD often involves users in the specific phases of the design process (mainly idea generation and/or prototyping; Brandt 2006; Kensing & Greenbaum 2012), LL involves users in various phases, such as in problem exploration, idea generation, prototyping and tests (experiments; e.g., Almirall *et al.* 2012; Juujärvi & Pesso 2013). Each participation opportunity often involves a different set of participating users (Akasaka and Nakatani 2021); some participation opportunities are small (i.e., involving only a few people), whereas others are large (i.e., involving hundreds of people; Schuurman *et al.* 2011). This long-term and complex process of user participation is one of the key features of the LL approach. Given these characteristics of LLs, it is necessary for LL practitioners to appropriately plan and design how to effectively integrate user participation into the design process to effectively promote co-creation with users in LLs. In human–computer interaction (HCI) research, Vines *et al.* (2013) proposed 'Configuring Participation' as a concept that indicates a detailed consideration of the participation process, such as timing, form, role, scale and method of user participation. In their words, LL practitioners are required to configure user participation to effectively promote co-creation in LLs.

However, to date, the knowledge on 'how to properly configure long-term and complex user participation in LLs' has not been systematically clarified, nor have its methodologies been developed. Recently, the use of the LL approach has gained traction across a variety of organisations, from companies and designers to local governments, Non-Profit Organisations and civic communities (Emilson, Hillgren & Seravalli 2014; Malmborg *et al.* 2015). Many of them have less experience in participatory approaches including LLs. Building knowledge and developing methodologies for configuring user participation is, therefore, an important issue that the co-design and LL research community should address.

The purpose of the study is to develop a novel framework for configuring user participation in LLs through a literature review. We first collected a wide range of case study papers on LL. We focused on case study papers because they present concrete descriptions of knowledge (or know-how) for the effective promotion of LL practices, based on experiences from actual LL projects. Through a literature survey and analysis, we identified key elements that should be considered when configuring user participation in LLs. Based on the elements identified, we developed a novel framework for configuring user participation in LLs.

The contributions of this study are as follows. First, this study clarifies the elements should be considered while configuring user participation in LLs. It makes an important contribution to the theory construction in the field of LLs and co-design, especially the theory on user participation. Second, this research develops and presents a novel framework as a practical tool for configuring participations in LLs. This framework is a practically useful outcome for design practitioners in planning and managing co-design projects including LLs. Thus, this study makes not only theoretical contributions, but also practical contributions to the LLs and co-design research community.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

2. Related studies

2.1. Participatory design

Research on PD, a design approach with user participation, was initiated in the 1970s in Scandinavia. In early PD research, practical studies based on action research approaches (Kensing & Greenbaum 2012) were conducted to explore challenges to introduce new technologies and to improve the power of workers in various 'workplaces'. Examples of these workplaces include the steel industry (Nygaard & Bergo 1975), the printing industry (Bødker *et al.* 1987) and the medical field (Bjerknes & Bratteteig 1988).

Later, in the 2000s, the concept of co-design, which emphasises the equality of the relationship between designers and users, emerged (Sanders & Stappers 2008; Steen, Manschot & De Koning 2011). During that time, the scope of PD expanded. Research projects, such as 'Community-Based PD' (DiSalvo, Clement & Pipek 2012; Grönvall, Malmborg & Messeter 2016), a PD approach involving regional civic communities, and 'Large-Scale PD' (Dalsgaard 2010; Dalsgaard & Eriksson 2013), a large-scale PD project in an urban setting, started developing. Early PD research focused on the workplace, which was a spatially and culturally closed realm. Community PD and large-scale PD focused on local communities and cities, respectively, which are open realms. In this open participatory approach, various users participated in design through various channels (Dalsgaard 2010). As a result, 'participation' in design has become increasingly complex and diverse.

2.2. Living labs

LL initially referred to a laboratory that imitated everyday spaces, to evaluate various technologies and devices (Schuurman, De Marez & Ballon 2015; Hossain, Leminen & Westerlundd 2018). Typical examples of this approach include MIT PlaceLab (Intille *et al.* 2005) and Georgia Tech's Aware Home (Kidd *et al.* 1999). Influenced by the Scandinavian PD research, it evolved into a co-creation approach that emphasised the long-term participation of users or citizens.

Figure 1 depicts the LL process model, which was developed by one of the authors based on a survey of actual LL cases (Yasuoka *et al.* 2018). Although the design phases themselves (the nodes of the process model) in this figure are not significantly different from those of the typical design process, the LL process can be characterised by the following three points. First, users are involved as co-creative design partners from the early to late stages of the process. Second, this co-creative design process is often long-term (e.g., several months to several years). Finally, the prototypes are experimentally tested in a real-life environment from a comparatively early stage. Given these characteristics, in LLs, users participate in various phases of the design process (e.g., problem exploration, idea generation, prototyping and testing; Juujärvi & Pesso 2013). The format and scale of the user participation often differ in each phase (Arlati *et al.* 2021). The user roles (e.g., information provider and co-designer) are also diverse (Nyström *et al.* 2014; Leminen, Nyström & Westerlund 2015). Therefore, when we organise LL projects, it is important to properly plan and design the role, form and scale of the users, considering the phase and purpose as well as the users' characteristics (Dalsgaard & Eriksson 2013).

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

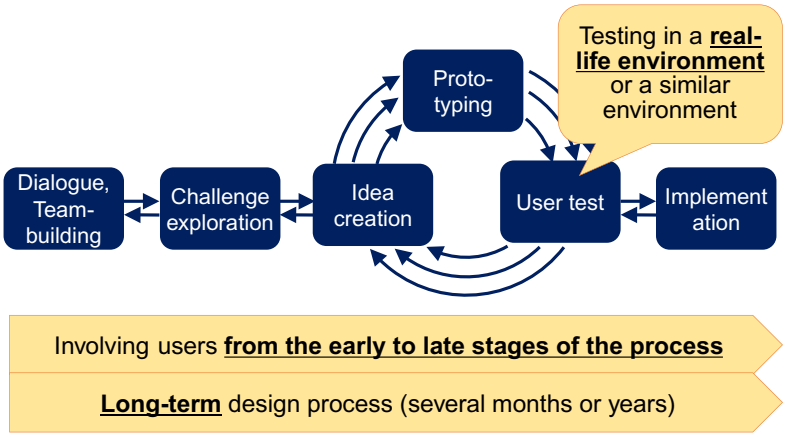


Figure 1. Living lab process model (illustrated based on Yasuoka *et al.* (2018)).

2.3. Configuring participation

Vines *et al.* (2013) reconsidered the concept of 'Participation' in design, based on their recognition of the problematic overuse of participatory approaches in design research in the HCI field. In their paper, Vines *et al.* (2013) proposed the notion of 'configuring participation' as a key concept that must be considered by practitioners and researchers of PD projects. The term 'configuring participation' here refers to designing the process of participation in design, in other words, the configuration of the participation experience itself.

Vines *et al.* (2013) argued that participation in design occurs not only in the state of yes and no, or in and out, but that it has various degrees of awareness and engagement across the design process. Therefore, it is important for practitioners of the participatory approach to consider configuring participation across all forms and levels. These include, for example, passive and active participation. As mentioned above, user participation in LLs often tends to be more long-term and complex than in typical PD. Therefore, it is even more important to appropriately configure user participation across the LL processes.

2.4. Existing works related to configuring participation

Existing studies related to configuring participation can be divided into two categories: the first proposes specific methods for effectively managing each participation opportunity in the design. The methods here mainly correspond to a structured dialogue with users, and a participatory workshop (WS). For example, Kensing and Halskov proposed a participatory WS method, called the future WS, to generate new actions to change the current state through dialogue between designers and users (Kensing & Halskov 1992). Foverskov & Binder (2011) and Hussain & Sanders (2012) proposed a method for the participatory prototyping of services using physical objects, such as mock-ups and dolls. Brandt & Messeter (2004) proposed a method for creating services with users through game-style WS, using photos and cards. The methods described in this section are only for configuring 'single' participation opportunity. They cannot manage the configuration of multiple and complex user participation, which is the focus of this study.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

The second category refers to configuring multiple and diverse participation in the design process. These types of studies are often published as case studies that report and discuss the results and findings of design projects, in the areas of LLs and large-scale PDs. For example, Ogonowski *et al.* (2013) reported the results and findings of an LL project that lasted for more than 2 years for the development of a home entertainment device. This revealed the importance of creating a space where users with different attributes (e.g., tech-savvy and nontech-savvy) can simultaneously participate and build trust with the participants. Through the practical experience of a large-scale PD project in a city (Aarhus in Denmark), Dalsgaard & Eriksson (2013) clarified the keys to be considered when designing and operating a participatory WS in a large-scale and long-term PD project. They summarised the findings as design considerations for future practitioners. These studies provided specific findings for the effective promotion of LLs, some of which are related to configuring participation. However, these findings are derived from a single case study, meaning they have limitations regarding generalisation and the systematisation of knowledge. In addition, practical methods or methodologies have not been developed, creating a difficult situation for practitioners to utilise the findings in their actual practices.

3. Research approach

3.1. Overview

The purpose of the study is to develop a novel framework for configuring user participation in LLs through a literature review. Figure 2 illustrates the overall approach of the study. As shown in Figure 2, we first collected a wide range of 'case study papers' on LLs. Many researchers from various regions and research fields have published case studies reporting on their LL project practices. Such research not only provides theoretical descriptions, but also concretes descriptions of the insights or lessons learned from the case studies. We therefore gathered case study papers as useful data sources to obtain knowledge (or know-how) for the effective promotion of LL practices obtained from actual LL project experiences. We then surveyed the contents of each literature and extracted the findings, or the lessons learned from them. The extracted findings were then analysed by using an affinity diagram (Beyer & Holtzblatt 1997). The findings were categorised into meta-groups. Through this process, we identified the key elements that should be

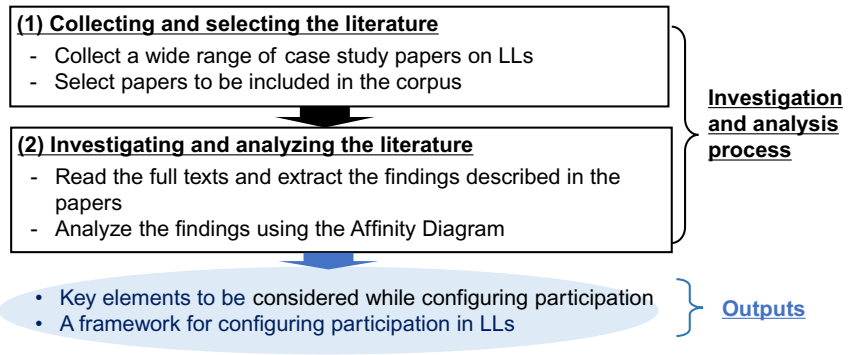


Figure 2. Approach of this study.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

considered when configuring participation in LLs. Based on the analysis results, we finally developed a framework for configuring the participation in LLs. This can act as a practical tool for future LL practitioners or researchers.

3.2. Collecting and selecting the literature

To collect a wide range of case study papers on LLs, we used three academic databases (DBs). The first is the Web of Science (WoS), which is one of the world's largest academic DBs. Given that LL is applied to various fields, such as smart cities, healthcare and information systems, we chose the WoS that contains tremendous numbers of academic papers and conference proceedings from a wide range of fields. The other two DBs are the ACM Digital Library (ACM DL) and the IEEE Xplore, which are operated by the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE). Both are among the world's largest academic societies in the field of information technology, computer science and information engineering. Given that LL and its related fields (such as PD and co-design) originated from research involving information system development in an organisational and societal context, several practical studies on PD projects, including LLs, have been published in ACM- and IEEE-related journals and conferences.

In this study, we searched for academic papers that included the words 'living lab' and 'design' in its basic information (title, keywords and abstract) from the above-mentioned DBs. We considered them to be appropriate keywords for collecting papers mentioning 'practical case studies on design projects using the LL approach'. The detailed search settings are presented in Table 1. As shown in Table 1, we did not filter by the papers' publication year. All the papers in each DB as of the date (18 May 2021) were considered search targets. In this study, only the journal papers and

Table 1. Detailed search settings to collect literature

Category	Settings
DBs	WoS, ACM DL and IEEE Xplore
Search words	The following four patterns are used to search in each academic DB. Note that '*' means a forward match search, which includes related terms that include 'design' at the beginning (e.g., 'designs' and 'designing'). (i) *'Living Lab' AND 'design*'* (ii) *'Living Labs' AND 'design*'* (iii) *'Living Laboratory' AND 'design*'* (iv) *'Living Laboratories' AND 'design*'*
Search scope	Title, Abstract and Keywords
Publication year	All the papers in each DB, as of the search date (18 May 2021; WoS: 1900–2021,ACM DL: 1990–2021, IEEE: 1990–2021)
Format	Journal papers and international conference proceedings
Others	Excluded non-English papers

Abbreviations: ACM DL, ACM Digital Library; DB, data base; IEEE, Institute of Electrical and Electronics Engineers; WoS, Web of Science.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

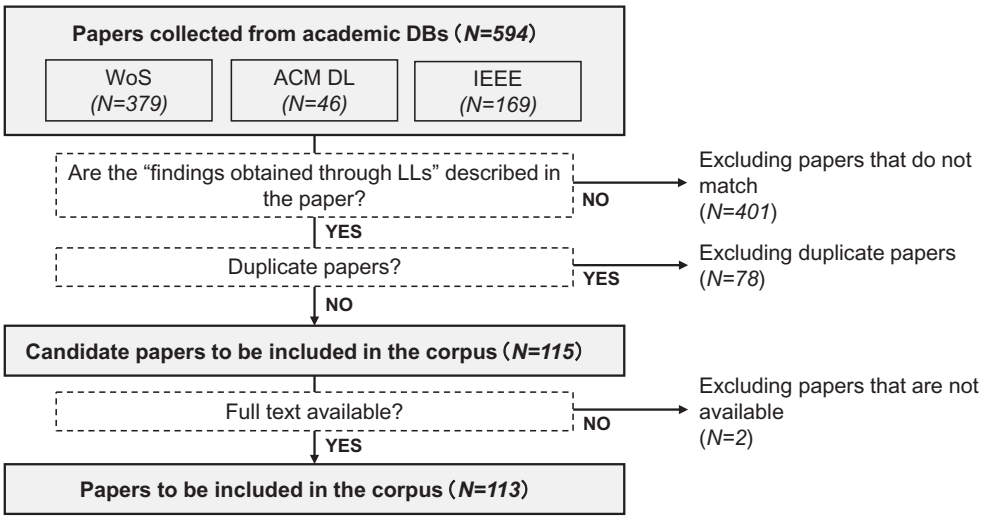


Figure 3. Selection process.

international conference proceedings were retrieved. We excluded other styles of publication (e.g., reports and book chapters). We also excluded non-English papers. As a result, a total of 594 papers were found. Of these, 379 papers were from WoS, 46 were from ACM DL and 169 were from IEEE Xplore.

After the data collection, for the purpose of creating a corpus (a list of papers to be deeply investigated in this study), we selected papers through the process shown in Figure 3. First, we extracted basic information, such as the paper's title, author list, journal's name or proceedings, publication year and the abstract. We then read each paper's title and abstract, and selected the papers that included descriptions regarding 'findings obtained through the practice of LL projects'. Papers that were difficult to judge based on the information given only in the title and abstract were tagged as 'pending'. The main body of the pending paper was read to judge whether to include them in the corpus. In this selection process, duplicate papers that were included in multiple DBs were eliminated.

As a result of the selection process, 115 papers were included in the corpus. We subsequently checked if it was possible for the authors to obtain the full text of the papers. Two papers that were not available were excluded from the corpus. Finally, we compiled a corpus containing 113 papers for the literature review (see the Supplementary Material). The formats and publication years of the papers included in the corpus are shown in Figure 4.

3.3. Investigating and analysing the literature

Figure 5 shows the procedure to analyse the literature. We read the papers' full text included in the corpus and exhaustively extracted their descriptions related to 'findings or lessons learned from the case' in each paper. We listed them in the form of a spread sheet. Thereafter, from the descriptions listed, we picked up the findings or lessons that specifically referred to 'user participation' in LLs. Here, we selected the findings on user participation as exhaustively as possible by working with several

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

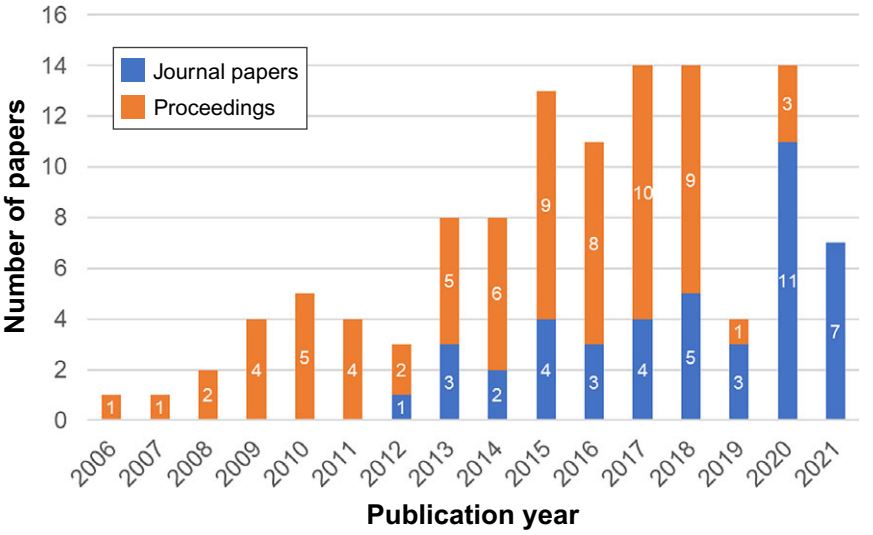


Figure 4. Papers collected in this study.

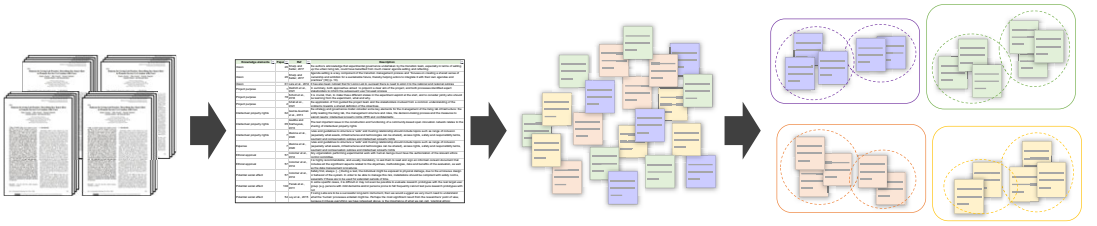


Figure 5. Analysis procedure.

researchers. We then transcribed the titles of the selected findings onto digital sticky notes on a web-based digital whiteboard tool. Finally, we analysed the selected findings using an affinity diagram (Beyer & Holtzblatt 1997) to categorise them into semantically similar meta-groups. We collaboratively conducted this analysis by using the web-based digital whiteboard service. We first synchronously categorised the findings, and thereafter asynchronously checked the results several times.

By conducting this type of bottom-up analysis, we exploratively clarified the key elements that should be considered when configuring the user participation in LLs. The detailed results and findings of the analysis are explained in the next section.

4. Results

4.1. Key elements for configuring participation in LLs

As a result of our analysis, we identified five categories and 11 elements that should be considered when configuring participation in LLs. The categories and elements

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Table 2. Key elements to be considered in configuring participation in LLs

Category	Overview	Key elements
Phase	In which phase (i.e., when) and for what purpose do the users participate? Note that PoPs are not a one-time opportunity in an LL project, but are often held multiple times.	– Phase – Purpose
Participants	What kind of users should participate in each PoP? What scale (number) of users should participate? What are the roles that users play in the PoP?	– Attribute – Scale – Role
Format	What kinds of channels/places should be set up for users to participate? What methods should be applied to effectively promote collaboration and co-creation with users in each PoP?	– Channel/Place – Method
Contact	How to recruit participants to achieve user participation? What kinds of points of contact should be set up to maintain the relationship with users?	– Recruitment – Contact point
Motivation management	How to stimulate and maintain the users' motivation to participate? What are the factors that stimulate the motivation to participate? What are the barriers that prevent users from maintaining and increasing their motivation?	– Motivator – Obstacle

Abbreviation: PoP, point of participation.

are shown in Table 2. The details of each category and the key elements therein are described below, together with some representative descriptions in the literature surveyed in this study. In the following section, we refer to the single opportunity of user participation (e.g., interviews, questionnaires, participatory WS, dialogue and user testing) as 'points of participation (PoPs)'. In this context, the 'participation' in LL can be regarded as a combination of one or more PoPs.

The first category identified was 'Phase (of participation)'. As shown in Figure 1, the LL design process consists of multiple phases, such as team building, problem exploration, idea generation, prototyping, user testing and social implementation. These are often set up across multiple phases. (Note that the number and content of the participation points vary depending on the purpose of the project.) In addition, Colomer *et al.* (2014) recommended implementing multiple participation tasks (i.e., user tests) during the test phase, depending on the level of the prototype quality (operational reliability, accuracy, etc.). This implies that various participation points can exist even within a particular phase. Consequently, it is necessary for LL practitioners to carefully consider in which 'phase' (i.e., when) to set the PoP in the LL process. Another important aspect to note is that each PoP has different 'purposes' (i.e., a purpose to set up the user participation). Therefore, in the LL practice, the strategic planning of the purpose of setting up PoPs is important, along with the perspective of 'when' (Menny, Voytenko & McCormick 2018).

The second category was 'Participants'. We found that the three elements 'Attribute', 'Scale' and 'Role' of the participants (users) need to be considered

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

when planning the PoPs in LLs. 'Attributes' refers to the characteristics of users regarding their abilities (e.g., technology savvy or not) and attitudes (e.g., motivation). 'Scale' refers to the number of users participating in each PoP. Existing studies show that the scale of the participation should be optimised according to the purpose and phase of the participation (Menny *et al.* 2018). In addition, existing studies suggest considering the 'role' of users in the design process. Leminen, Westerlund & Nyström (2014) identified a variety of user roles (such as informants, testers and co-creators), and the level of engagement varies according to the role. It is important to assign appropriate roles and engagement levels for each user, rather than having all the participants be actively involved and play a central role (Schuurman *et al.* 2010).

The third category is the 'Format (of participation)'. The format of participation at each PoP includes various 'channels or places', for example, 'digital participation', using PCs and smartphones, and 'face-to-face participation', such as participatory WSs. In addition, to realise effective collaboration with users at each PoP, it is also important to consider the kind of method that should be applied. Various methods have been applied in past LL projects. These are such as the participatory WS method originally proposed in the PD field (García-Guzmán *et al.* 2013; Kopeć, Nielek & Wierzbicki 2018), the idea competition method to obtain several ideas (Reichel & Schelhowe 2008) or the use of gamification to encourage users' proactive participation (Kopeć *et al.* 2018; Jiang, Xiao & Cao 2020).

The fourth category is the 'Contact', which refers to the point of contact with the participants. Existing studies mention two important aspects of contact with the participants. The first is the initiation of contact with the participants, in other words, the 'recruitment' of participants. Since the recruitment method influences the appropriateness and number of participating users, it is important to carefully consider the recruitment of the participants (Svensson, Eriksson & Ebbesson 2010; Panek *et al.* 2011; Ogonowski *et al.* 2013). The second is maintaining continuous contact with the participants, that is, the 'communication', with the participants. Previous LL studies have noted the importance of setting up a contact point to maintain a continuous relationship with the users (Šifrer *et al.* 2012; Ley *et al.* 2015; Ahmadi *et al.* 2020). This is especially for responding to questions from the users and to communicate in detail with them.

The fifth category is 'Motivation Management'. Many LL cases contain multiple PoPs throughout their design process. Some of them may require a long period of user involvement (e.g., in the case of conducting a long-term social service experiment). Participating in a design many times, or for a long period of time, is generally a highly burdensome process for users, resulting in participants sometimes dropping out from LL projects (Ogonowski *et al.* 2013; Georges, Schuurman & Vervoort 2016; Habibipour *et al.* 2017). Therefore, maintaining and stimulating participants' motivation is a very important issue for LL practitioners. The results of the literature review of this study indicate that the two factors 'Motivators' and 'Obstacles' are important to address this issue. The former refers to factors that stimulate participants' motivation, such as incentives for participation (Kviselius *et al.* 2008) and the empowerment of users (Vallentin-Holbech *et al.* 2020). The latter denotes factors that hinder the participants' motivation, such as a heavy burden on participants (Ley *et al.* 2015), a loss of trust in the prototype (Alaoui & Lewkowicz 2015) or insufficient usability of the prototype (Åström *et al.* 2015). To achieve continuous and active user participation, it is important to

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

provide attractive motivators to participants and eliminate obstacles as much as possible.

4.2. Participation blueprint – a framework for configuring participation in LLs

The five categories and 11 elements described in Table 2 are important findings from the literature review and study analysis. While there is no doubt about the importance of these text-based findings, it is also worth noting that these forms of knowledge (i.e., long and academic descriptions of knowledge) are difficult for practitioners to use. In this study, we translate text-based knowledge into a diagrammatic framework that will support LL practitioners in configuring participation in LLs.

Figure 6 illustrates the framework proposed in this study. This framework, which we call 'participation blueprint (PBP)', is a tool to support configuring user participation in LLs, with visual representations. The PBP consists of five lanes, corresponding to the five categories (phase, participants, format, contact and motivation management) identified in this study. The elements in each category are represented as the sublanes of each category. Especially, in the 'Phase' lane, the six steps of team building, problem exploration, idea generation, prototyping, testing and social implementation are described based on the LL process model, as shown in Figure 1.

By using the five lanes of the PBP, LL practitioners can comprehensively consider how to configure user participation from various perspectives for each design phase. Note that the PBP is merely a tool to give LL practitioners' viewpoints to support them in configuring user participation. In other words, it does not deterministically impose an ideal form of user participation on LL practitioners, as do manuals. Rather, it is a tool to support them in flexibly designing PoPs that are suitable for their projects, according to the context and circumstances of the field or region. In addition, during the LL project, it will be important for LL practitioners to modify and update the pre-described PoPs on the basis of the project status and progress. The PBP is thus a tool to support LL practitioners to flexibly configure and operate user participation processes in LL projects based on the context of the field.

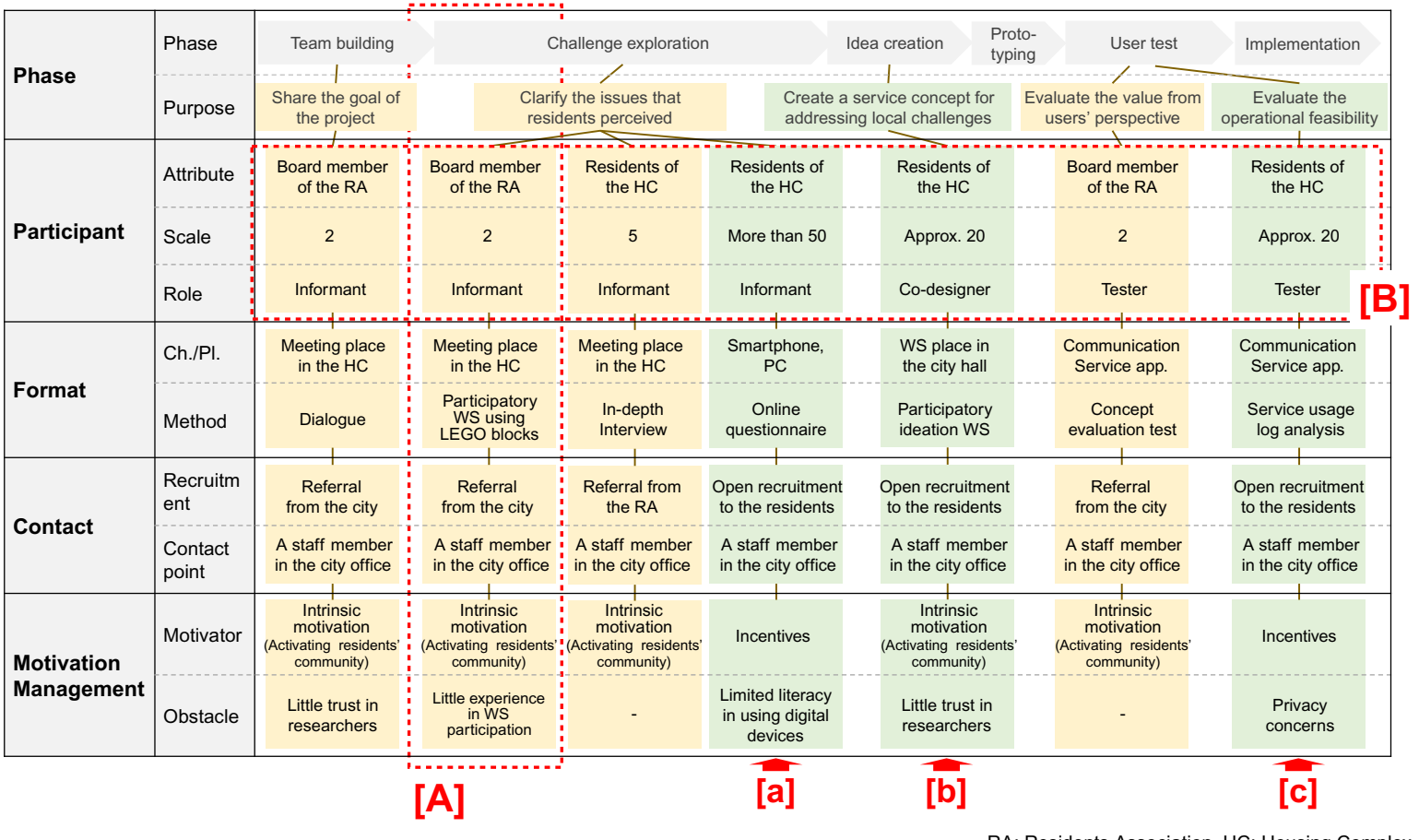
4.3. How to use the PBP

Example case

In this section, we exemplify how user participation can be planned and described with the PBP framework. Figure 6 shows the example case. Here, all the PoPs in an LL case, which are promoted by one of the authors, have been illustrated. In the illustrated example application, we have first (i) depicted the PoPs that were operated in the case, and then (ii) planned additional PoPs to improve the participatory process in the case. In Figure 6, for the ease of readers' understanding, the PoPs that were actually operated are coloured yellow, and additional PoPs are coloured green.

The case considered is an LL project aimed at building social relationships among citizens and for building local community in a suburban area of Tokyo,

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press



RA: Residents Association, HC: Housing Complex

Figure 6. Participation blueprint.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Japan. One of the serious problems people faced in this region was a decrease in social connections among the elderly due to the COVID-19 pandemic. In particular, we focused on a large housing complex in the area. Many of the residents there had been ageing; they had not been able to communicate with other residents due to the restrictions that had been imposed on the activities of residents' associations. Moreover, many elderly people were not familiar with using digital devices, which limited their communication options and thus were unable to maintain contact with the local communities. The loss of social contacts may also lead to a decline in the Quality of Life of residents there.

In this project, we designed a digital communication service for supporting the community living in a housing complex, in collaboration with the local people (e.g., members of the neighbourhood association and residents of the complex). This project focused on activating and maintaining multigenerational communication in the area, such as between younger and older generations. In the following paragraph, we have explained the usage of the PBP on the basis of the case description, which is illustrated in Figure 6.

Using the PBP

In the PBP, each PoP is configured by describing the elements of each sublane in the 'vertical' direction (see Part [A] in Figure 6). By using the PBP in this direction, LL practitioners can discuss and plan the detailed contents of PoPs from various perspectives, as on the basis of the 11 elements depicted in Table 2. For example, Part [A] in Figure 6 describes that a 'participatory WS' was conducted at 'a meeting place in a housing complex', with the participation of 'two' of the 'neighbourhood association members', to 'clarify the issues that local residents perceived' in the 'issue exploration phases', and that the role of the participants was that of 'informants'. In addition, Part [A] in Figure 6 also shows that the participants were recruited upon 'request from the local government'. The contact points oversaw 'a local government employee'. The users were participating with an 'intrinsic motivation to revitalise the neighbourhood association'.

This example shows that the PBP enables us to simultaneously consider perspectives, such as when, for what purpose, where and with whom to implement the PoP; what the user role is; how the users can be contacted and what motivates the users to participate in the design process. LL practitioners can discuss and plan the content of the PoP that is appropriate for its phase and purpose, for example, a face-to-face participatory WS with a small number of users for conducting an intensive discussion of ideas, or a large-scale questionnaire for collecting a wide range of opinions from users. Furthermore, LL practitioners can consider factors that are often overlooked, such as the contact point and the users' motivation to participate, which are important for improving the quality of the participation process.

In contrast, after multiple PoPs have been described, reviewing the PBP 'horizontally' along the lanes allows us to understand the entire structure of the participatory process under consideration, especially the diverse forms of participation. For example, as shown in Part [B] in Figure 6, by looking horizontally at the 'Participants' lane, LL practitioners can easily evaluate in advance whether the participatory process is configured to allow for the involvement of a variety of

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

people. From the whole structure of the 'Channel or Place' lane, LL practitioners can review what kind of participation environment (physical place and digital participation tools) must be prepared to seek the user participation throughout the design process.

In this example, checking the lanes horizontally allowed us to recognise the bias of the participants and participation formats in the LL process. Therefore, for improving the participation process in this LL, we added three new PoPs (i.e., PoPs coloured green in Figure 6). First, we added a 'large-scale questionnaire using online forms' in the challenge exploration phase (Part [a] in Figure 6). Although interviews were actually conducted with only five residents to explore issues to be solved, it would have been more effective to seek people's opinion by administering the questionnaire at a large-scale to understand the potential issues. Second, in the idea generation phase, 'a participatory WS where the residents played the role of co-designers' was added (Part [b] in Figure 6), since we noticed that activities for co-creating service concepts with residents were really important to obtain their agreements. Third, in the user test phase, we added 'social experiments of the service app' (Part [c] in Figure 6). This addition was made because such experiments were important to verify the usability and the acceptability of the app.

As mentioned above, the proposed PBP enables LL practitioners to reflect on the appropriateness and diversity of the planned participation process. In PD projects, including LLs, it has been reported that some problems (e.g., bias in opinions) are caused due to participants' bias towards a certain group (Gebhardt, Brost & König 2019). Therefore, ensuring the diverse forms of participation (i.e., preparing various formats for participation and involving a variety of users as participants) is important in LL practice. The PBP framework developed in this study makes configuration of a diverse participation process possible.

5. Discussion

5.1. Theoretical contributions

As mentioned above, although the importance of configuring participation in design has been argued in design research thus far, there has been little research on systematising knowledge or developing methodologies for configuring participation. In response to this, in this study, through a literature review of LL case studies, we have identified the key elements (the five categories and 11 elements shown in Table 2) that should be considered while configuring the user participation in LLs. These key elements can contribute to the theoretical discussion of user participation in LLs. In LL research, realising continuous and active user participation has been an important issue. Previous studies have often adopted the case study approach and derived findings and lessons learnt from the case. However, these results are highly context-dependent knowledge on LL practices. In contrast, this study integrated the results of the previous studies into more generalised, structured knowledge on user participation, which can be used in a variety of contexts. We therefore believe that this study includes an important achievement for building a theoretical foundation of LLs.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Looking at a different but related research arena such as the field of urban planning and public policy, Arnstein's 'Ladder of Citizen Participation' (Arnstein 1969) has been proposed as a theory of citizen participation. It is a model that divides the level of citizen participation into eight stages (manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control). 'Operation' is at the bottom and 'citizen control' is at the top of the ladder. It states that reaching the top of the ladder, that is, giving greater authority to citizens, is important. This model conceptually clarifies how citizens (i.e., users of public services) should participate in discussions of public issues. However, it does not address the question of how exactly user participation should be configured.

In response to Arnstein's model's limitation, the five categories and 11 elements identified in this study are structural and concrete knowledge for configuring the user participation in LLs. In addition, because the categories and elements were derived based on a survey of many existing LL case studies, they may be generalised to a certain extent. Our findings are therefore important in contributing to the establishment of a theory for participation in design.

5.2. Practical contributions

In this study, beyond the literature review and analysis, we proposed the PBP, which is a novel framework for configuring participation in LLs. In an LL project that involves complex and/or long-term user participation, it is difficult to determine the entire process of user participation at the beginning of the design process. LL practitioners should therefore flexibly change and reconfigure the process. They should also format the user participation, depending on the situations that arise during the project (Hillgren, Seravalli & Emilson 2011).

The results of the example case descriptions using PBP show that it allowed us to configure user participation considering various viewpoints. This indicates the potential of PBP to provide useful clues for LL practitioners in planning user participation. In addition, using PBP in this study allowed us to identify the biases of participants and participation formats in our previous case and obtain insights to configure more diverse user participation in future projects. These results suggest the 'potential' usefulness of PBP in supporting the planning, modification and reconfiguration of user participation in LL projects.

The existing gap between research and practice, that is, the Research–Practice Gap (Norman 2010; Buie, Hooper & Houssian 2013) has been regarded as a serious challenge in design research. This gap indicates that the knowledge obtained through design research is rarely utilised by design practitioners. Colusso *et al.* (2017) refer to tools and methods such as design cards (Wölfel & Merritt 2013; Fedosov *et al.* 2019) to fill this gap as 'translational resources (TRs)'. They strongly emphasise the importance of researchers actively developing TRs to effectively utilise research results in design practice. The PBP developed in this study may be regarded as a framework for facilitating the utilisation of the findings shown in Table 2. Therefore, the PBP is exactly the TR that connects the results of the literature survey, the analysis and LL practices. Therefore, the PBP is not just theoretical knowledge, but a useful, practical framework that can provide support to future LL practitioners.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

5.3. Limitations

In this study, we collected case study papers on LL as a data source and analysed them to identify key elements that should be considered when configuring user participation. Case studies contain project descriptions and practical knowledge obtained from the project, but information on detailed context and minor activities is often missing. Such incompleteness of data sources is one of the limitations of this study. In future, we will conduct in-depth interviews with LL practitioners to extract richer, contextual information of LL practices. Such additional investigations will help to identify elements or perspectives that this study missed and, if necessary, will revise or enhance the results of this study.

Meanwhile, in this study, we proposed the PBP, which is a novel framework for configuring user participation in LLs. It is developed based on the findings of a literature review and is expected to be useful in practice. However, in this study, we have only presented a case example of the use of the PBP. We have not yet verified its usefulness in a practical setting. Therefore, our future research will include applying the PBP to the planning and configuring of user participation in actual LL projects, which the authors are promoting, and analysing the results thereof to verify its usefulness. In the future case applications, we will contribute to the LL research community by investigating questions such as whether PBP is useful in supporting inexperienced practitioners or how it can support experienced practitioners.

While the framework for configuring user participation has been presented in this study, we have not yet developed a 'methodology' that includes the detailed procedures for using it. To enable effective use of PBP by LL practitioners, further discussion on 'how to use' the PBP is strongly required, such as defining the detailed procedures and rules to use PBP for planning and configuring user participation in LLs. In this context, it is also important to construct methods to support configuring user participation using the PBP. This is such as clarifying patterns and building a DB of knowledge on the user participation process. In the future, we will further develop a detailed procedure, and support the methods described above. We also aim to establish a comprehensive methodology for configuring the user participation process in LLs.

6. Conclusion

In this study, we focused on 'configuring user participation' in LLs. Through a literature survey and analysis, we identified the key elements that should be considered when configuring user participation in LLs. Furthermore, we developed a novel framework for configuring user participation in LLs, which is called the PBP. We demonstrated how to use the PBP with an example case. The example showed that the proposed PBP enables LL practitioners to consider multifaceted LL activities based on the key elements identified in this study, when discussing and planning the details of user participation. It also presented that the PBP is useful for LL practitioners to reflect on the appropriateness and diversity of the planned participation process. On the basis of the example description, we also discussed its theoretical and practical contributions to the LL research community. Our future research will include applying the PBP to the planning and configuration of user

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

participation in actual LL projects to verify its usefulness. We also plan to develop a methodology for configuring user participation in LLs.

Supplementary Materials

To view supplementary material for this article, please visit http://doi.org/10.1017/dsj.2022.22.

Financial support

This study is partially supported by JSPS KAKENHI Grant No. JP21K21327.

References

Ahmadi, M., **Eilert, R.**, **Weibert, A.**, **Wulf, V.** & **Marsden, N.** 2020 Feminist living labs as research infrastructures for HCI: the case of a video game company. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'20)*, pp. 1–15. Association for Computing Machinery.

Akasaka, F. & **Nakatani, M.** (2021) Citizen Involvement in Service Co-creation in Urban Living Labs. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS'21)*, 10 pp. Institute of Electrical and Electronics Engineers.

Alaoui, M. & **Lewkowicz, M.** 2015 Practical issues related to the implication of elderlies in the design process: the case of a living lab approach for designing and evaluating social TV services. *IRBM* **36** (5), 259–265.

Almirall, E., **Lee, M.** & **Wareham, J.** 2012 Mapping living labs in the landscape of innovation methodologies. *Technology Innovation Management Review* **2** (9), 12–18.

Arlati, A., **Rödl, A.**, **Kanjaria-Christian, S.** & **Knieling, J.** 2021 Stakeholder participation in the planning and design of nature-based solutions. Insights from CLEVER cities project in Hamburg. *Sustainability* **13** (5), 2572.

Arnstein, S. R. 1969 A ladder of citizen participation. *Journal of the American Institute of Planners* **35** (4), 216–224.

Åström, J., **Ruoppila, S.**, **Ertiö, T.**, **Karlsson, M.** & **Sarah-Kristin, T.** 2015 Potentials and challenges of a living lab approach in research on mobile participation. In *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and ACM International Symposium on Wearable Computers (UbiComp/ISWC'15 Adjunct)*. Association for Computing Machinery.

Bergvall-Kåreborn, B., **Holst, M.** & **Stahlbrost, A.** 2009 Concept design with a living lab approach. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS'09)*, pp. 1–10. Institute of Electrical and Electronics Engineers.

Bergvall-Kåreborn, B. & **Stahlbrost, A.** 2009 Living lab: an open and citizen-centric approach for innovation. *International Journal of Innovation and Regional Development* **1** (4), 356–370.

Beyer, H. & **Holtzblatt, K.** 1997 *Contextual Design: Defining Customer-Centered Systems*. Elsevier.

Bjerknes, G. & **Bratteteig, T.** 1988 The memoirs of two survivors: or the evaluation of a computer system for cooperative work. In *Proceedings of the ACM Conference on Computer-Supported Cooperative Work (CSCW'88)*, pp. 167–177. Association for Computing Machinery.

Bødker, S., **Ehn, P.**, **Kammersgaard, J.**, **Kyng, M.** & **Sundblad, Y.** 1987 *A Utopian Experience. Computers and Democracy: A Scandinavian Challenge*. pp. 251–278. Avebury.

Brandt E. 2006 Designing exploratory design games: a framework for participation in participatory design? In *Proceedings of the ACM Participatory Design Conference (PDC'06)*, pp. 57–66. Association for Computing Machinery.

Brandt, E. & **Messeter, J.** 2004 Facilitating collaboration through design games. In *Proceedings of the ACM Participatory Design Conference (PDC'04)*, pp. 121–131. Association for Computing Machinery.

Buie, E., **Hooper, C.** & **Houssian, A.** 2013 Research-practice interaction: building bridges, closing the gap. In *Proceedings of the ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA'13)*, pp. 13–16. Association for Computing Machinery.

Colomer, J. B. M., **Salvi, D.**, **Cabrera-Umpierrez, M. F.**, **Arredondo, M. T.**, **Abril, P.**, **Jimenez-Mixco, V.**, **Garcia-Betances, R.**, **Fioravanti, A.**, **Pastorino, M.**, **Cancela, J.** & **Medrano, A.** 2014 Experience in evaluating AAL solutions in living labs. *Sensors* **14** (4), 7277–7311.

Colusso, L., **Bennett, C. L.**, **Hsieh, G.** & **Munson, S. A.** 2017 Translational resources: reducing the gap between academic research and HCI practice. In *Proceedings of the ACM Conference on Designing Interactive Systems (DIS'17)*, pp. 957–968. Association for Computing Machinery.

Dalsgaard P. 2010 Challenges of participation in large-scale public projects. In *Proceedings of ACM Participatory Design Conference (PDC'10)*, pp. 21–30. Association for Computing Machinery.

Dalsgaard, P. & **Eriksson, E.** 2013 Large-scale participation: a case study of a participatory approach to developing a new public library. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'13)*, pp. 399–408. Association for Computing Machinery.

DiSalvo, C., **Clement, A.** & **Pipek, V.** 2012 Communities: participatory design for, with and by communities. In *Routledge International Handbook of Participatory Design*, pp. 182–209. Routledge.

Emilson, A., **Hillgren, P. A.** & **Seravalli, A.** 2014 Designing in the neighborhood: beyond (and in the shadow of) creative communities. In *Making Futures: Marginal Notes on Innovation, Design, and Democracy*. The MIT Press.

Fedosov, A., **Kitazaki, M.**, **Odom, W.** & **Langheinrich, M.** 2019 Sharing economy design cards. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'19)*, pp. 1–14. Association for Computing Machinery.

Følstad, A. 2008 Living labs for innovation and development of information and communication technology: a literature review. *Electronic Journal of Virtual Organization and Networks* **10**, 99–131.

Foverskov, M. & **Binder, T.** 2011 Super dots: making social media tangible for senior citizens. In *Proceedings of the 2011 Conference on Designing Pleasurable Products and Interfaces*, pp. 1–8. Association for Computing Machinery.

García-Guzmán, J., **Del Carpio, A. F.**, **De Amescua, A.** & **Velasco, M.** 2013 A process reference model for managing living labs for ICT innovation: a proposal based on ISO/IEC 15504. *Computer Standards and Interfaces* **36** (1), 33–41.

Gebhardt, L., **Brost, M.** & **König, A.** 2019 An inter-and transdisciplinary approach to developing and testing a new sustainable mobility system. *Sustainability* **11** (24), 7223.

Georges, A., **Schuurman, D.** & **Vervoort, K.** 2016 Factors affecting the attrition of test users during living lab field trials. *Technology Innovation Management Review* **6** (1), 35–44.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Grönvall, E., **Malmborg, L.** & **Messeter, J.** 2016 Negotiation of values as driver in community-based PD. In *Proceedings of the ACM Participatory Design Conference (PDC'16)*, pp. 41–50. Association for Computing Machinery.

Habibipour, A., **Georges, A.**, **Schuurman, D.** & **Bergvall-Kåreborn, B.** 2017 Drop-out in living lab field tests: a contribution to the definition and the taxonomy. In *Proceedings of the Open Living Lab Days 2017*, pp. 7–20. European Network of Living Labs.

Hillgren, P. A., **Seravalli, A.** & **Emilson, A.** 2011 Prototyping and infrastructuring in design for social innovation. *CoDesign* **7** (3), 169–183.

Hossain, M., **Leminen, S.** & **Westerlundd, M.** 2018 A systematic review of living lab literature. *Journal of Cleaner Production* **213**, 976–988.

Hussain, S. & **Sanders, E. B. N.** 2012 Fusion of horizons: co-designing with Cambodian children who have prosthetic legs, using generative design tools. *CoDesign* **8** (1), 43–79.

Intille, S. S., **Larson, K.**, **Beaudin, J. S.**, **Nawyn, J.**, **Munguia-Tapia, E.** & **Kaushik, P.** 2005 A living laboratory for the design and evaluation of ubiquitous computing technologies. In *Proceedings of the ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA'05)*, pp. 1941–1944. Association for Computing Machinery.

Jiang, C., **Xiao, Y.** & **Cao, H.** 2020 Co-creating for locality and sustainability: design-driven community regeneration strategy in Shanghai's old residential context. *Sustainability* **12** (7), 2997.

Juujärvi, S. & **Pesso, K.** 2013 Actor roles in an urban living lab: what can we learn from Suurpelto, Finland? *Technology Innovation Management Review* **3** (11), 22–27.

Kensing, F. & **Blomberg, J.** 1998 Participatory design: issues and concerns. *Computer Supported Cooperative Work (CSCW)* **7** (3), 167–185.

Kensing, F. & **Greenbaum, J.** 2012 Heritage: having a say. In *Routledge International Handbook of Participatory Design*, pp. 41–56. Routledge.

Kensing, F. & **Halskov, K.** 1992 Generating visions: future workshops and metaphorical design. In *Design at Work: Cooperative Design of Computer Systems*, pp. 155–168. Lawrence Erlbaum Associates Inc.

Kidd, C. D., **Orr, R.**, **Abowd, G. D.**, **Atkeson, C. G.**, **Essa, I. A.**, **MacIntyre, B.**, **Mynatt, E.**, **Starner, T. E.** & **Newstetter, W.** 1999 The aware home: a living laboratory for ubiquitous computing research. In *Proceedings of the International Workshop on Cooperative Buildings*, pp. 191–198. Springer-Verlag.

Kopeć, W., **Nielek, R.** & **Wierzbicki, A.** 2018 Guidelines towards better participation of older adults in software development processes using a new SPIRAL method and participatory approach. In *Proceedings of the 11th International Workshop on Cooperative and Human Aspects of Software Engineering*, pp. 49–56. Association for Computing Machinery.

Kviselius, N. Z., **Ozan, H.**, **Edenius, M. and Andersson, P.** 2008 The evolution of living labs – propositions for improved design and further research. In *Proceedings of the 5th International Conference on Innovation and Management (ICIM 2008)*, pp. 842–856. Institute of Electrical and Electronics Engineers.

Leminen, S., **Nyström, A. G.** & **Westerlund, M.** 2015 A typology of creative consumers in living labs. *Journal of Engineering and Technology Management* **37**, 6–20.

Leminen, S., **Westerlund, M.** & **Nyström, A. G.** 2012 Living labs as open-innovation networks. *Technology Innovation Management Review* **2** (9), 6–11.

Leminen, S., **Westerlund, M.** & **Nyström, A. G.** 2014 On becoming creative consumers – user roles in living labs networks. *International Journal of Technology Marketing* **9** (1), 33–52.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Ley, B., **Ogonowski, C.**, **Mu, M.**, **Hess, J.**, **Race, N.**, **Randall, D.**, **Rouncefield, M.** & **Wulf, V.** 2015 At home with users: a comparative view of living labs. *Interacting with Computers* **27** (1), 21–35.

Malmborg, L., **Light, A.**, **Fitzpatrick, G.**, **Bellotti, V.** & **Brereton, M.** 2015 Designing for sharing in local communities. In *Proceedings of the ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA'15)*, pp. 2357–2360. Association for Computing Machinery.

Menny, M., **Voytenko, Y.** & **McCormick, K.** 2018 Urban living labs and the role of users in co-creation. *Gaia* **27** (1), 68–77.

Norman, D. A. 2010 The research-practice gap. *Interactions* **17** (4), 9–12.

Nygaard, K. & **Bergo, O. T.** 1975 The trade unions – new users of research. *Personal Review* **4** (2), 5–10.

Nyström, A. G., **Leminen, S.**, **Westerlund, M.** & **Kortelainen, M.** 2014 Actor roles and role patterns influencing innovation in living labs. *Industrial Marketing Management* **43** (3), 483–495.

Ogonowski, C., **Ley, B.**, **Hess, J.**, **Wan, L.** & **Wulf, V.** 2013 Designing for the living room: long-term user involvement in a living lab. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'13)*, pp. 1539–1548. Association for Computing Machinery.

Panek, P., **Hlauschek, W.**, **Schrenk, M.**, **Werner, K.** & **Zagler, W. L.** 2011 Experiences from user centric engineering of ambient assisted living technologies in the living lab Schwechat. In *Proceedings of the 17th International Conference on Concurrent Enterprising*, pp. 1–8. Institute of Electrical and Electronics Engineers.

Reichel, M. & **Schelhowe, H.** 2008 Experience in evaluating AAL solutions in living labs: driving innovation through civic involvement. In *Proceedings of the ACM International Conference on Interaction Design and Children (IDC'08)*, pp. 141–144. Association for Computing Machinery.

Sanders, E. B. & **Stappers, P. J.** 2008 Co-creation and the new landscape of design. *CoDesign* **4**, 1–16.

Schuler, D. & **Namioka, A.** 1993 *Participatory Design: Principles and Practices*. CRC Press.

Schuurman, D., **De Marez, L.** & **Ballon, O.** 2015 Living labs: a systematic literature review. In *Proceedings of the Open Living Lab Days 2015*, 17 pp. European Network of Living Labs.

Schuurman, D., **De Moor, K.**, **De M arez, L.** & **Evens, T.** 2011 A living lab research approach for mobile TV. *Telematics and Informatics* **28** (4), 271–282.

Schuurman, D., **De Moor, K.**, **De Marez, L.** & **Evens, T.** 2010 Investigating user typologies and their relevance within a living lab-research approach for ICT-innovation. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS'10)*, 10 pp. Institute of Electrical and Electronics Engineers.

Šifrer, A., **Pucihar, A.**, **Kljajić-Borštnar, M.** & **Lenart, G.** 2012 Development of the prototype solution for user involvement in the living lab approach. In *Proceedings of the 35th International Convention MIPRO*, pp. 1705–1708. Institute of Electrical and Electronics Engineers.

Steen, M., **Manschot, M.** & **De Koning, N.** 2011 Benefits of co-design in service design projects. *International Journal of Design* **5** (2), 8.

Svensson, J., **Eriksson, I. C.** & **Ebbesson, E.** 2010 User contribution in innovation processes – reflections from a living lab perspective. In *Proceedings of the Hawaii International Conference on System Sciences (HICSS'10)*, 10 pp. Institute of Electrical and Electronics Engineers.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press

Vallentin-Holbech, L., **Dalgaard, G. J.**, **Dietrich, T.**, **Rundle-Thiele, S.**, **Majgaard, G.**, **Lyk, P.** & **Stock, C.** 2020 Co-creating a virtual alcohol prevention simulation with young people. *International Journal of Environmental Research and Public Health* **17** (3), 1097.

Vines, J., **Clarke, R.**, **Wright, P.**, **McCarthy, J.** & **Olivier, P.** 2013 Configuring participation: on how we involve people in design. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'13)*, pp. 429–438. Association for Computing Machinery.

Wölfel, C. & **Merritt, T.** 2013 Method card design dimensions: a survey of card-based design tools. In *Proceedings of the 14th International Conference on Human–Computer Interaction (INTERACT)*, pp. 479–486. International Federation for Information Processing.

Yasuoka, M., **Akasaka, F.**, **Kimura, A.** & **Ihara, M.** 2018 Living labs as a methodology for service design: an analysis based on cases and discussions from a systems approach viewpoint. In *Proceedings of the International Design Conference (DESIGN2018)*, pp. 127–136. Design Society.

https://doi.org/10.1017/dsj.2022.22 Published online by Cambridge University Press