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To cite this article: Rianne Dekker , Juan Franco Contreras & Albert Meijer (2020) The Living Lab as a Methodology for Public Administration Research: a Systematic Literature Review of its Applications in the Social Sciences, International Journal of Public Administration, 43:14, 1207-1217, DOI: [10.1080/01900692.2019.1668410](https://doi.org/10.1080/01900692.2019.1668410)

To link to this article: <https://doi.org/10.1080/01900692.2019.1668410>



Published online: 01 Oct 2019.



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# The Living Lab as a Methodology for Public Administration Research: a Systematic Literature Review of its Applications in the Social Sciences

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## ABSTRACT

Living labs have become a promising methodology for public administration research to design and study public innovations. Surprisingly, public administration research has paid scant attention to living labs to date. An obvious obstacle to the application of a living lab approach in public administration is unclarities about the value, validity and application of this methodology. This study systematically reviews current applications of living labs in social sciences and links this to opportunities for public administration research. It presents a set of guidelines for the use of living labs in public administration research and reflects upon the value of this specific methodology.

## KEYWORDS

Living lab; public innovation; collaborative innovation; design-oriented public administration; systematic literature review

## Introduction

Public innovation increasingly takes place in open and collaborative arrangements between public and private actors (Bekkers & Tummers, 2018; Mergel & Desouza, 2013; Sørensen & Torfing, 2011). In many cases, citizens are involved as co-creators of the product or service (Voorberg, Bekkers, & Tummers, 2015). A concrete and emerging form in which such processes of public innovation are organized and studied are so-called living labs. Living lab refers both to a methodology to experimentation and innovation as well as the physical spaces in which this is situated. Concrete examples are ‘urban living labs’ of local governments in which citizens and local actors are collaboratively developing solutions to problems in their own neighbourhoods (cf. Voytenko, McCormick, Evans, & Schliwa, 2016).

By featuring collaboration, innovation and participation, living labs can contribute to public administration (PA) research into public innovation, public–private partnerships and co-creation. Furthermore, they fit a trend toward experimentalist and design-oriented approaches in public administration (Bason, 2016; Sabel & Zeitlin, 2012). As a methodology to simultaneously *design* and *research* public innovation, the living lab enables researchers to help tackle the problem at hand by involvement in experimentation and testing of new solutions. Living labs offer a new approach for design-oriented PA research. They may answer a call for generating more usable knowledge for practitioners to tackle grand societal challenges (Perry, 2012; Pollitt, 2017). The European

Commission has been strategically supporting living labs to strengthen innovation in the European Union (EC, 2009, 2010) and the European Network of Living Labs (ENoLL), was constituted with the aim of connecting living labs for knowledge exchange.

Surprisingly, PA research has paid scant attention to living labs to date.<sup>1</sup> Therefore, it is yet unclear whether they can live up to the promise of connecting PA research to solving real-world problems and whether they are a robust method to study public innovation. An obvious obstacle to the application of a living lab approach in PA research is the lack of conceptual and methodological clarity (cf. Bergvall-Kärebörn & Ståhlbröst, 2009). ‘Living labs’ or ‘living laboratories’ were originally developed for technological innovation in the 1990s. Since the 2000s, living labs have been an emerging practice in the social sciences, focusing on social innovation. However, a large variety of research practices has been gathered under this label. In some cases, living labs are collaborative practices embedded in research projects and in others they are experimentation sites that are part of a university or government institution.

Also, there is no shared understanding of the types of research objects suitable to the living labs approach, nor systematic knowledge on and efforts to address limitations of the living lab approach. By systematically reviewing applications of living labs in social sciences, this study evaluates the relevance of the living lab approach as a research and design methodology for public administration research. Three research questions are addressed:

- (1) *What are the distinctive characteristics of living lab in the social sciences and is there a common practice that is relevant to PA?*
- (2) *What objects of study have been studied with a living lab approach in social sciences and to what extent do these fit PA?*
- (3) *How is the living lab approach applied as a research methodology in the social sciences and what opportunities and limitations does this bring for PA research?*

By conducting a systematic literature review of academic publications on living labs in social sciences, this study evaluates whether and how the living lab can be a valuable research approach. Discussion of the results of this analysis amounts to a set of practical, methodological and ethical guidelines for the use of living labs in PA research.

The paper is structured as follows. Section two presents the method used for the meta-synthesis of the literature and sections three to five present the answers to the research questions: section three analyzes common characteristics of living labs in the social sciences, section four assesses the objects of research in living lab studies and their relation to PA research, and section five analyzes research methodologies of living labs and assesses the opportunities and limitations of living labs as a research approach. On the basis of this analysis of the literature, section six presents guidelines for the application of the living lab approach in PA research. Section seven concludes that living labs show potential for PA research, but a shared definition, robust methods and ethical questions warrant attention in order to make this approach valuable to our field. The overview and guidelines presented in this paper form a basis for the application of living labs in PA research.

## Methodology

### Data collection and analysis

Systematic reviews aim to be comprehensive in their coverage of the literature, to pay careful attention to the quality of included evidence, and to take a clear, systematic approach to the synthesis of the data. This study follows the PRISMA method for conducting systematic literature reviews to ensure transparency and rigour (Moher, Liberati, Tetzlaff, & Altman, 2009, p. 265). The PRISMA method involves four phases: identification, screening, eligibility assessment and inclusion (Liberati et al., 2009).

First, relevant records in two of the largest academic databases were identified: Scopus and Web of Knowledge – Social Science Citation Index (WoK-SSCI).

These databases were chosen because they cover a large and known set of social science journals. This literature review aims to capture and review all practices that go by the name of ‘living lab’ rather than evaluating the full variety of related design-approaches going by different names. Therefore, the search string “living lab\*” was used to find all publications identifying as ‘living lab’ studies, while excluding the search terms “labor” OR “labour” to exclude a large strand of literature studying “living labor”. The conclusions reflect upon the idiosyncrasies of the living lab in relation to other design approaches.

Five search parameters were applied: a) the search string should appear in the publication title, abstract or keywords (Scopus) or publication title (WoK)<sup>2</sup>; b) the query was limited to the domain of social science; c) only English publications addressing an international scholarship were included; d) only academic journal articles were included to ensure scientific rigour and avoid including corresponding conference papers or dissertations; and e) publications ranging from 2000 to 2017 were included to capture the first evidence and current practice of the living lab approach.<sup>3</sup> The latest revision of the search was done on May 7, 2017.<sup>4</sup> The combined set of records included 88 references, after removing 7 duplicates from the set.

To evaluate the exhaustiveness of the sampling and to include relevant publications beyond these two academic databases, a backward search of the references of this set of publications was conducted. This yielded 45 additional records.<sup>5</sup> The content of the total set of 133 publications was subject to the assessment of eligibility and accessibility. Twenty-three publications were eliminated because they used the expression ‘living labs’ only in passing and not with reference to a research approach. Another 23 publications were excluded from the sample because the journals were not accessible through our university library and we had no success in obtaining the articles by contacting the authors. Three publications were excluded because they are literature reviews.<sup>6</sup> In total, 84 records were included in the analysis (an appendix listing the full set of publications is available through the Utrecht University repository DOI: 10.24416/UU01-Z86EGU). [Figure 1](#) summarizes the data collection procedure.

A qualitative meta-synthesis of the set of publications was conducted in order to answer the research questions (Walsh & Downe, 2005; Zimmer, 2006). This entails comparative analysis of the contents of the publications in light of the research questions from which a new understanding of the findings is generated. In each publication, living lab practices, methods, objects of study and identified research opportunities and limitations of

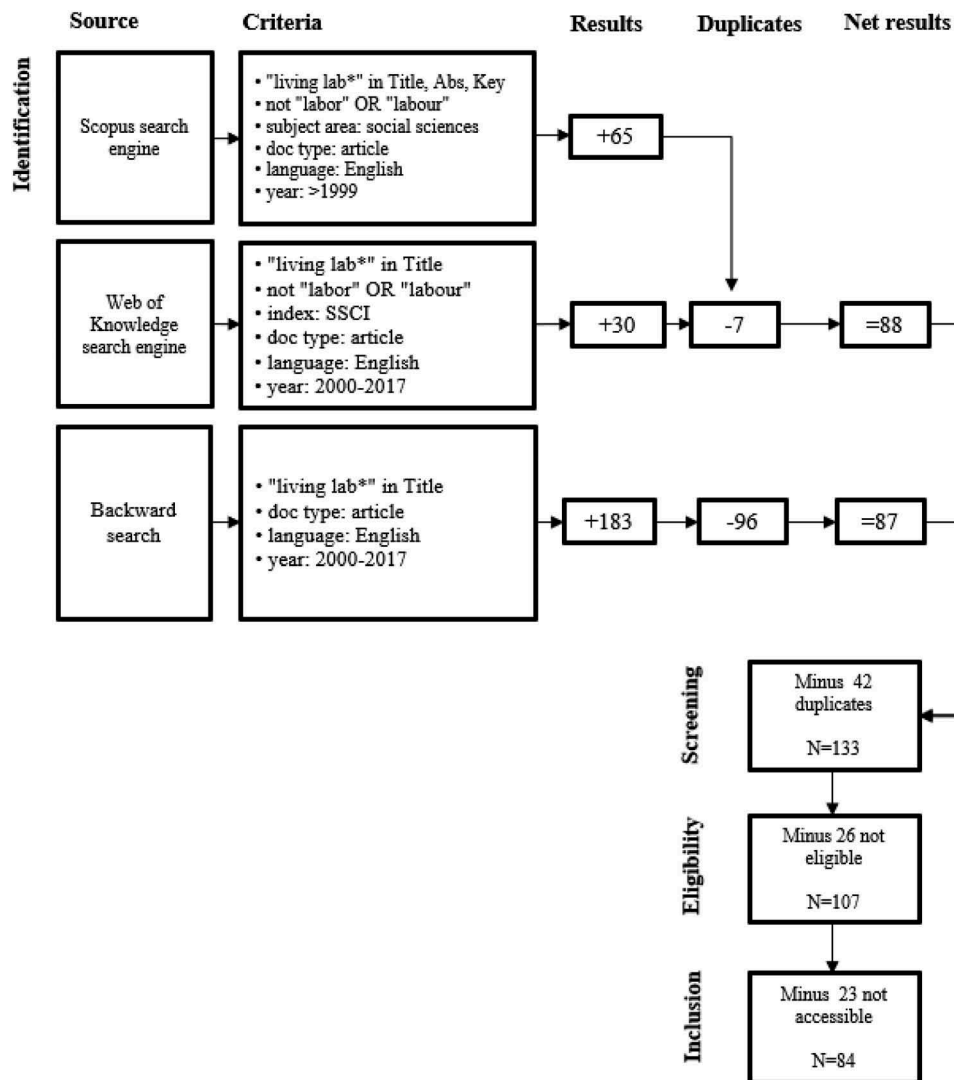


Figure 1. PRISMA flow diagram.

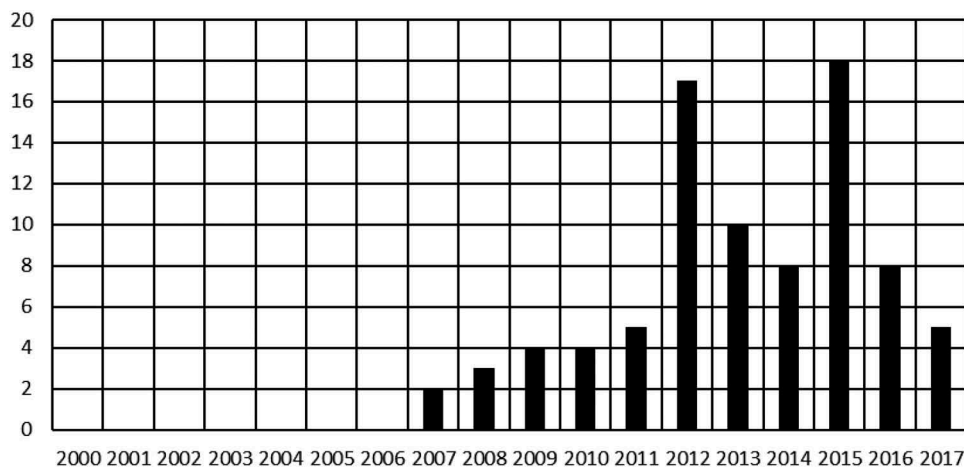
living labs were coded. Consequently, relevant text fragments were extracted to a database listing all publications. These were then subject to a second round of coding with the purpose of identifying similar elements and patterns. Also, notable differences between articles and mutual critiques were coded. The coding process was intensively discussed and compared between the authors. As a final step of our analysis, the numbers of publications mentioning various elements were counted to provide context to the prevalence of findings.

### Descriptive overview of publications

Figure 2 demonstrates an increase in published articles about living labs in social science. This is indicative of an emerging approach. However, this has to be interpreted with caution. Schuurman (2015, p. 14–16) has noted that

there is an inactivity rate of about 40% among existing living labs, and a declining trend in the growth of the number of active living labs in Europe.

The academic impact of the papers is modest with an average number of 25 Google Scholar citations. A matrix of the mutual references between the reviewed studies and network analysis helps assess the impact of the various studies in this emerging strand of literature (cf. Ritz, Brewer, & Neumann, 2016). For each study, the number of citations and in-degree centrality are reported, the latter is defined as the ratio between the number of times an article was cited by the other studies and the total number of reviewed studies minus one. Table 1 displays the five highest-ranking studies. The results show that the in-degree centrality of living lab studies is generally quite low – which is indicative of a fragmented field of study. Studies that are most central to the field of literature are early publications and studies presenting



**Figure 2.** Number of articles in English in the social sciences on living labs between 2000 and 2017 (N = 84).

**Table 1.** Publications ranked by number of citations and in-degree centrality.

Publication	In-degree centrality	Times cited	Rank
Almirall and Wareham (2008)	0,21	219	1
Leminen, Nystrom, and Westerlund (2012)	0,14	134	2
Dutilleul et al. (2010)	0,14	103	3
Bergvall-Kåreborn and Ståhlbröst (2009)	0,11	137	4
Almirall and Wareham (2011)	0,11	98	5

multiple living lab cases. Approximately 1/4 of the publications on living labs is published in three journals: *Technology Innovation Management Review* (N = 13), *Digital Policy, Regulation and Governance* (previously known as *Info*) (N = 6), and *The Electronic Journal for Virtual Organizations and Networks* (N = 4). The topical scope of these journals indicates that in social sciences, a majority of living labs focus on socio-technical innovation. Living labs supporting social or public innovation are either less common or are published with an alternative framing of the methodology.

Table 2 shows the distribution of publications on living labs by type of publication. The vast majority of publications about living labs (86%) are empirical qualitative case studies, 12% are conceptual papers and the remaining 2% consists of quantitative studies. An important distinction should be made between studies that report on a living lab study the authors conducted themselves, and studies reporting on (and often

**Table 2.** Living lab studies in social science, by type of study.

Type of study	N	%
Empirical – Single case study	39	46,4
Empirical – Multiple case study	33	39,3
Conceptual/Theoretical	10	11,9
Empirical – Quantitative approach	2	2,4
<b>Total</b>	<b>84</b>	<b>100</b>

comparing) living labs of others. This latter type of study comprises half of our sample (N = 41). Because the research methodologies of living labs were usually also addressed, these publications were also taken into account in the analysis.

### Practices of living labs

How are living labs put into practice? Applications in social science take different approaches but have four common elements. These are living labs (1) being a research and development process of innovation (N = 75); (2) being a collaboration between multiple stakeholders (N = 55); (3) taking place in a real-life setting (N = 65); and (4) involving users as co-creators (N = 75). 44 studies combine all four elements in their living lab approach, others describe only two or three (Table 3).

First, living labs foster innovation in an iterative process of gradually improving and refining a product in successive stages of research and design. Studies generally distinguish three to six phases in the research and design cycle (N = 40, cf. Almirall & Wareham, 2011). Usually, the initial phase entails inventory of users' needs and wishes, the middle phase(s) the design of a prototype and the last phase evaluation of the product or service. Key to living labs is that the process can take spontaneous turns and yield unexpected results (cf. Følstad, 2008). The end-result of the process is not fixed at the beginning. In successive iterations, the design improves and becomes more concrete. The living lab therefore has a medium-to long-term time span (N = 17, cf. Følstad, 2008). In many cases, the living lab is not just a temporary testbed, but it *is* the product or service that remains available to the users for a longer period of time.

**Table 3.** Elements of living labs definition.

No.	Name of element	Publications (N = 81 <sup>7</sup> )
1	<b>Research and development process</b>	<b>75</b>
	Staged process	40
	Medium- to long-term	17
2	<b>Collaboration between multiple stakeholders</b>	<b>55</b>
3	<b>Real-life setting</b>	<b>65</b>
	Local or regional	21
4	<b>Involvement of users as co-creators</b>	<b>75</b>
	Specialized knowledge from user-perspective	24

A second core element of living labs is that they are a cooperation between multiple stakeholders – varying from universities to businesses, government organizations and NGOs (N = 55). These stakeholders each have an interest in the product or service that is being developed and they deliver input from various perspectives. As a result, living labs are often public-private partnerships and usually co-funded by the participating stakeholders.

The third core element of living labs is the locus of the research and design process (N = 65). This is the physical setting in which the product or service is envisioned to be implemented. These can be people's homes, organizations, cities ('urban living labs') or regions. Innovations are developed to fit the specific local context. At the same time, this real life setting means that the naming of living labs after controlled *lab* environments is misleading and indicative of how social science tends to uncritically adopt concepts from the natural sciences.

The fourth and last core element of living labs is that users are closely involved as 'co-creators' of the product or service (N = 75). They are considered to have specialized knowledge from a user-perspective. They are involved from the early onset of the innovation process and their experiences and preferences become part of the product or service that is being designed. This is also referred to as 'user-driven' innovation (cf. De Moor et al., 2010a). It is sometimes claimed that user involvement in the living lab will (creatively) empower the individual user (Bergvall-Kåreborn & Ståhlbröst, 2009) or the community as a whole (Hooli, Jauhainen, & Lähde, 2016). However, there are also ethical risks involved with user-driven innovation. Users often do not have a say in the scope of the living lab and the innovation that they co-create is sometimes taken away from them after the innovation process ends.

Building upon on these four elements of living lab practices and definitions offered in these studies, a common definition to be used in social science including PA would be as follows:

*Living labs are a research and design methodology applied by research institutes in cooperation with public*

*and private partners for developing and testing innovations in co-creation with users in real-life settings.*

This definition highlights that living labs build upon the tradition of (participatory) action research in their aim to produce both scientifically and socially relevant knowledge and transformative action (Bartels & Wittmayer, 2014; Huxham, 2003), but put an emphasis on specific aspects of the approach such as an iterative process of design and testing and co-creation with users. These specific elements make living labs an interesting method for studying processes of public innovation. The next section outlines which types innovation have been studied through living labs so far.

### Objects of study of living labs

By definition, all living lab studies focus on innovation. Fourteen studies did not specify the specific type innovation. These include conceptual papers focusing on *processes* of open, user-driven or collaborative innovation in general (e.g. Almirall & Wareham, 2008; Gascó, 2017). In the remaining 70 studies, products and services that were being innovated were coded, while assessing their relevance to PA. Here, specific attention was paid to living lab articles in PA journals in order to analyze their objects of study and any evaluation of PA relevance that these studies offer.

Table 4 indicates that in social science there is still an obvious link of living labs to studies of ICTs, focusing on ICTs' usability (N = 16). This is relevant for PA as public innovation often involves new technologies. For example, four living lab studies focused on the topic of e-government and e-participation (Bergvall-Kåreborn & Ståhlbröst, 2009; Cleland, Mulvenna, Galbraith, Wallace, & Martin, 2012; Edwards-Schachter, Matti, & Alcántara, 2012; Galiano, Impedovo, & Pezzuto, 2014). Also, a total of 21 living lab studies had urban development, rural development or smart cities as their object of study. This fits the place-based feature of living labs that was outlined in the previous section. Smart city living labs link ICTs to

**Table 4.** Objects of study in living lab studies in social science.

Object of study	Publications (N = 70)
ICTs	16
(Sustainable) Energy	9
Urban development	8
Healthcare	7
Rural/Regional development	7
Smart cities	6
Private sector	5
E-government	5
Education	3
Mobility	1
Other/various	3

urban development with big data. Other studies of urban and rural development investigate for example participative governance arrangements in cities (Bifulco, Tregua, & Amitrano, 2017), sustainability (Voytenko et al., 2016), or citizen involvement in urban planning (Lehmann, Frangioni, & Dube, 2015). Nine studies focus on (sustainable) energy. Also, applications of the living lab approach in public domains such as healthcare, education and mobility are emerging. Five studies focused specifically on innovation in the private sector, for example commercial product design (e.g. Kusiak, 2007).

Current published applications of living labs in social science journals still tend to focus on socio-technical innovations. The objects of research indicate that living labs are a suitable approach to support and study processes of social and in particular public innovation as well. They can help develop new policy and governance solutions related to grand societal challenges such as democracy and participation, urban development and sustainable energy. Likely applications of living labs in PA are in studies of ‘collaborative’ or ‘open’ processes of innovation and experimentalist governance in which co-creation of products or services is key (Mergel & Desouza, 2013; Sabel & Zeitlin, 2012; Sørensen & Torfing, 2011; Voorberg et al., 2015). Current PA applications of living labs are indeed studying these types of public innovation (Bifulco et al., 2017; De Moor et al., 2010a; Edwards-Schachter et al., 2012; Van Geenhuizen, 2013).

### Research methods of living labs

This part of the analysis assesses the merits of the research methods used in living lab studies in relation to PA research. There is a large variation in the research methods used in living labs (Table 5). Because of successive iterations of design, living labs usually include multiple moments of data collection and monitoring over time. Most studies use a combination of methods, referring to ‘a mixed-method approach’ (e.g. Ley et al., 2015). An important benchmark used in evaluating solutions, is the user-experience. If users are not satisfied with a mid-term outcome, the design process will take another iteration.

The most common research method of living labs is continuous monitoring the use of the product or service by users in the real-life setting of the living lab (N = 50). In many original applications of living labs for technological innovation, the product itself generates user-data. Also in social science living labs, ‘data logging’, ‘sensor data’, and ‘behavioral data’ are used to monitor changes in user behavior (N = 21). This data is generated in real-time by the technological instruments that are used. These include for example on-body sensors, audio sensors or data

**Table 5.** Methodology of living labs.

No.	Method	Frequency
1	<b>Monitoring</b>	<b>50</b>
	Digital user data	21
	Observation	29
2	<b>Qualitative methods</b>	<b>57</b>
	Interviewing	33
	Focus groups	20
	User panels	4
3	<b>Quantitative methods</b>	<b>26</b>
	Surveys	20
	Experimentation	6
4	<b>Specific methodology</b>	<b>27</b>
	Document analysis	9
	Specific toolkit	18

Note: a single publication may combine multiple research methods.

transmitter devices (De Moor, Ketyko, & Joseph, 2010b). A good example is Schwartz et al.’s (2015) study of home energy management systems, generating data on households’ energy use. In many other studies, user behavior is monitored by way of observation (N = 29). Direct and real-time monitoring of user’s activities can produce rich data in an unobtrusive way (Mulder, Velthausz, & Kriens, 2008). This facilitates insights into the day-to-day behavioral patterns of users (Dutilleul, Birrer, & Mensink, 2010; Korman, Weiss, & Kizony, 2016; Mulder et al., 2008).

Cross-sectional moments of qualitative data collection and analysis are the second most popular type of research method in living labs (N = 57). In most cases, this means that interviews are conducted with users about their experiences, as well as with the stakeholders involved in the living lab to measure their satisfaction with the innovation process and product design. The specific type of qualitative interviewing varies between (semi-) structured and open, in-depth interviews (N = 33). Also, many studies ask participants of the living lab to reflect upon their experiences in a group setting. These studies speak of focus groups (N = 20), or in case of repeated focus groups, ‘user panels’ (N = 4: including De Moor et al., 2010a).

With the exception of studies analyzing automatically generated user data, quantitative methods in living lab studies in the social sciences are rare. In a smaller number of studies quantitative data collection and analysis took place, often to contextualize qualitative data on user-experiences in case studies (cf. Brankaert, Den Ouden, & Brombacher, 2015). In N = 20 studies, surveys with closed questions were conducted and analyzed quantitatively to assess user experiences (cf. Wendin, Astrom, & Stahlbrost, 2015). Furthermore, some living labs include a research strategy of experimentation (N = 6). These for example include a quantitative ex ante and ex post test of user-experience, creating a quasi-experimental setting.

Lastly, a number of studies uses a specific methodology or toolkit in which research is subordinate to the design process. Some studies provide a thick

description of the design process based on observation and document study ( $N = 9$ ). Other studies apply a specific design toolkit or methodology ( $N = 18$ ). A prominent example of such a toolkit is Mulder et al.'s (2008) 'harmonization cube'. This provides living lab studies with a framework to report on various key aspects of the living lab, but does not provide specific guidelines for researching the innovation.

When assessing the relevance of these research methodologies for PA, little methodological consistency and standardization in the field can be found. Also, there have been scarce efforts to conduct empirical assessments of the merits of the living lab approach, either in comparison with other methodologies, or to understand the long-term impacts of living labs (cf. Voytenko et al., 2016).

In terms of research opportunities and limitations, the ecological validity of living lab studies is generally high. Observed behavior can be generalized to natural behavior in the world as products or services are tested in a real-life setting with intended user groups. When interventions are introduced in the users' own context, implementation effects are avoided (Brankaert et al., 2015) and evaluative claims are likely to be well grounded (cf. Shadish, Cook, & Campbell, 2002). As the 'lab' setting is not controlled, researchers also collect rich data going beyond user behavior and experience. This involves also factors involving the broader context in which the product or service is developed and implemented, such as the cooperation between the public and private stakeholders and public and political support for the intervention. Due to the lack of a control group or a controlled environment, however also Hawthorne effects are likely to occur. Users are closely involved in all phases of the research and design process and there is extensive attention for their needs and wishes. Therefore, improvement in user experience throughout the project may result from the living lab setting instead of the improved product or service.

High ecological validity of living lab studies generally goes along with lower external validity and generalizability of findings (Følstad, 2008). Because of the specific research setting in which the product or service was designed, evaluative claims can be generalized to other user groups or settings only to a limited extent. Related to this, the scalability of living labs is a concern: extending the scale or transferring the model elsewhere has proven difficult (Schwartz et al., 2015). Also, established living labs experience difficulties in assuring continued financing over time to make the living lab sustainable (Schaffers & Turkama, 2012). These issues call for developing a better connection between living labs and broader policy frameworks (cf. Cleland et al., 2012). Also ethical issues are present as living labs

require informed consent of users for their participation over longer time periods (Korman et al., 2016). Furthermore, it may not be ethical to again withdraw the product or service from the users after the development process has finished (Ley et al., 2015).

A final research opportunity for PA is that living labs accelerate knowledge valorization to practitioners. Collaboration in public-private partnerships spurs early dissemination of knowledge to practitioners (Van Geenhuizen, 2013). In turn, stakeholders in the living lab diffuse knowledge in their networks (Almirall & Wareham, 2011). However, balancing the interests of partners in the living lab can be a challenge – not only in implementation of the living lab, but also in dissemination and (commercial) exploitation of the developed product or service (Hooli et al., 2016). Stakeholders in the living lab may object dissemination of information before they have access to the finished product or may specifically object dissemination of information on failed designs and shortcomings in the design.

### **Guidelines for the living lab methodology in public administration research**

This systematic review has highlighted the value of living labs for public administration research, but also challenges and limitations of this approach. In many ways, the living lab approach builds upon general principles for sound research practice (McNabb, 2002; Miller & Whicker, 1999), but there is a need for methodological robustness. Guidelines for action research (e.g. Whyte, 1991), provide an important basis for this and, in addition, Khanlou and Peter (2005) provide a useful overview of ethical guidelines for participatory action research (see also Coontz, 1999, p. 17–18 for a discussion of ethical dilemmas in applied settings). Furthermore, specific features of living labs such as the collaboration between public and private actors, co-creation by users, the focus on innovation and the real-life setting require specific attention. For that reason, drawing upon the corpus of publications and general literature on research in the social sciences, specific guidelines for living lab research in public administration were formulated that can be used to strengthen the designs of living lab projects, to tackle methodological, practical, and ethical issues and to enhance the value for practitioners. These guidelines are presented in Table 6 and discussed below.

### **Methodological robustness**

With regard to the research methods of living labs, more systematic reporting of the research design is



**Table 6.** Guidelines for living labs in public administration research.

<i>Methodological robustness</i>	<p>Project initiation</p> <ul style="list-style-type: none"> <li>● Report the specific starting situation and aims for which the living lab was implemented to prevent pro-innovation bias;</li> <li>● Develop a research design and indicate at the start how and under which conditions this can be adapted;</li> </ul> <p>Data collection</p> <ul style="list-style-type: none"> <li>● Use mixed methods to collect information from different angles or motivate the choice for one specific method of data collection;</li> <li>● Engage different researchers in the collection of data to prevent a bias in the observations;</li> <li>● Ensure that user experience is part of data collection and analysis;</li> </ul> <p>Data analysis</p> <ul style="list-style-type: none"> <li>● Apply process tracing to analyze effects of interventions;</li> <li>● Engage a devil's advocate in the analysis to challenge analyses and conclusions and to prevent group think;</li> <li>● Engage an independent analyst to assess the role of researchers;</li> </ul> <p>Reporting</p> <ul style="list-style-type: none"> <li>● Explicate to what extent the study adheres to various elements of the living lab definition;</li> <li>● Report on both successful and failed living labs;</li> <li>● Report the roles and interests of researchers and other stakeholders in the living lab;</li> <li>● Present an explicit reflection on the impact of context and process characteristics on the research findings.</li> </ul>
<i>Practical implementation</i>	<ul style="list-style-type: none"> <li>● Clearly define the role of each partner in the living lab and apply methods of process management to the implementation of the living lab to ensure productive collaboration and mutual trust;</li> <li>● Reach an explicit agreement about the balance between the societal and academic outputs of the living lab.</li> </ul>
<i>Ethical and legal issues</i>	<ul style="list-style-type: none"> <li>● Provide a clear operationalization of the key principles guiding interventions: informed consent and do no harm, given the intensive and long-term engagement of users;</li> <li>● Inform stakeholders and users about the double role of the researchers: contribution to the lab and academic knowledge production;</li> <li>● Obtain explicit and continuous permission from the stakeholders that this information can be used for independent research and academic publications;</li> <li>● Do not only consider the effects for target groups in the living lab but also external effects such as damage to the broader environment;</li> <li>● Have the living lab reviewed by an institutional review board that takes both the practical and academic value into account.</li> </ul>
<i>Value for practitioners</i>	<ul style="list-style-type: none"> <li>● Conduct an ex-ante legal analysis to identify legal risks and find appropriate ways of dealing with them.</li> <li>● Build strong methodological knowledge about living labs and convey this to practitioners when they are designing a living lab;</li> <li>● Engage both in a supportive and a critical way with stakeholders in the living lab: be a critical friend.</li> </ul>

advised including reflection on methodological limitations. What stages did the research and design process entail? What user groups were part of the living lab? How were they selected? How many iterations took place to come to the final product? What data were collected by which methods of data collection? What research methods were used in the analysis? What evaluation criteria were used and how were these decided? To what extent and how were different stakeholders involved as partners in the living lab and how has this influenced the research and design process? Systematic reporting of these aspects of the research design and also acknowledging the idiosyncratic nature of knowledge that is generated in living lab research help the reader to better situate the findings and their broader relevance. More specific guidelines include registering the living lab project before the start to prevent a pro-innovation bias in the reporting of results and stimulate publication on 'failed' living labs (cf. Dickersin & Drummond, 2003), the key role of process tracing in theory development (George & Bennett, 2005) and doing this with outsiders to prevent groupthink (Janis, 1982), and explicit reflection on the role and position of researchers in the reporting of results of living labs as is common in interpretive research (Agar, 1980).

### **Practical implementation**

Before starting the living lab, the role of each partner in the living lab should be explicated. Principles of process management (De Bruijn & Ten Heuvelhof, 2010) can be applied to the living lab to ensure a productive collaboration with stakeholders and end-users. Multiple and even conflicting views on the product or service are not inherently problematic, but will contribute to the applicability of the design. The partners should reach an explicit agreement about the balance between commercial, societal and academic outputs of the living lab and moments and ways to disseminate them.

### **Ethical issues**

Continued informed consent of users involved in living labs is crucial (Schuck, 1994). Users need to understand that the lab is used for generic (and sometimes commercial) knowledge production and that living labs may end when this process is finished. They also need to be able to end their commitment to the living lab at any time. Conflicting interests between stakeholders may surface in living lab collaboration (Dutilleul et al., 2010) and the interests of the users involved in the living lab may be overlooked (Ley et al., 2015). The interests and integrity of the research partner may be

pressured by diverging interests and limit the independence of research. Therefore, the ex-ante analysis of ethical risks is recommended.

### Value for public administration practice

To tackle the challenge of sustainable funding and scalability of living labs, it is crucial to show the value of these labs for practitioners and private stakeholders. The value of continued social experimenting has to be demonstrated. To this end, researchers should not only engage in instrumental analyses of the lab but also contribute a reflection on the desirability of interventions. Also, they should advise on transferability and scalability of certain aspects of the living lab, rather than the full concept.

### Conclusions

Living labs have developed as a distinctive research and design methodology for co-creating innovation with the involvement of public and private stakeholders. They are not only distinctive by being situated in a real-life context. In comparison with design labs or innovation experiments (Bason, 2016; McGann, Blomkamp, & Lewis, 2018; Tönurist, Kattel, & Lember, 2017), living labs place more emphasis on iterative ways of learning-by-doing and are less focused on developing a common idea of the problem and solution. In comparison with action research (Bartels & Wittmayer, 2014; Huxham, 2003), there is a more prominent role for the users in the evaluation of the product or service.

Living labs show good potential for research into public policy and public administration. The living lab approach answers a call for generating actionable and situated knowledge on real-life problems – also referred to as *phronesis* (cf. Flyvbjerg, 2001). Furthermore, the living lab itself can generate relevant insight into three key PA research topics: public innovation, collaboration between public and private stakeholders and co-creation. Public innovation requires a milieu of facilitating design and testing of interventions (Bekkers & Tummers, 2018; Moore & Hartley, 2008). Co-creation with citizens and public-private partnerships (PPPs) are relevant governance modes that can be studied within living labs (e.g. Bovaird, 2004).

The living lab approach is however only just emerging in the field of PA. A common definition, robust methods and normative questions demand attention in order to make this approach valuable to public administration research. This study proposes a definition and a set of guidelines that can form the basis for using living labs in public administration research. The set of guidelines for living lab research for public innovation offers a basis for

methodological robustness, practical implementation, dealing with ethical issues and highlighting the value of living labs for practitioners. All in all, it is argued that living labs broaden the methodological toolkit of research into public administration, not as a method in its own regard but as a research approach combining a number of methods and techniques in a novel way and setting.

### Notes

1. Only four articles on living labs have been published in PA journals included in the 2016 Thomson Reuters' Journal Citation Report. These are (Edwards-Schachter et al., 2012; De Moor et al., 2010a; Van Geenhuizen, 2013; Bifulco et al., 2017). Taking into account the broader field of public administration, 15 journal articles in PA report a living lab approach. These numbers indicate that the living labs have not yet become a common approach in PA research.
2. Web of Knowledge allows for searching either in title or full publication. Because the living lab is a very specific approach, this is usually mentioned in the title. The backward search ensured that we did not miss any relevant publications that mention living labs only in the full text.
3. The concept of living labs is often ascribed to Prof. Dr. William J. Mitchell (cf. Budweg, Schaffers, Ruland, Kristensen, & Prinz, 2011; Cleland et al., 2012; Eriksson, Niitamo, & Kulkki, 2005). The referenced work, however, never mentions living labs. Others (cf. Bergvall-Kåreborn & Ståhlbröst, 2009; Schuurman, 2015) point to the white paper by Markopoulos and Rauterberg (2000) as the first publication on the current concept of living labs. This paper was used the starting point of this literature review.
4. In Scopus, the advanced search query was: TITLE-ABS-KEY (“Living lab\*”) AND NOT (labor OR labour)) AND SUBJAREA (soci) AND DOCTYPE (ar) AND LANGUAGE (english) AND (PUBYEAR > 1999). In Web of Knowledge-SSCI, the advanced search query was: TI = (“living lab\*”) NOT TI = (labour OR labor) AND DT = (Article) AND PY = (2000–2017) AND LA = (English).
5. Of the full list of 3596 references, 405 mentioned ‘living lab\*’ in the title, including 96 duplicates. Two hundred and twenty-two non-academic references were eliminated, while keeping relevant journal articles. Many of these articles are published in journals which are not indexed in WoK-SSCI or Scopus. While this may raise doubt over the quality of the articles, it is important to take these into account to capture this emerging field of study. Many key authors of living lab studies have published in both indexed and non-indexed journals and often reference both types of articles. Furthermore, non-indexed journals often combine science and business insights (e.g. Technology Innovation Management Review). As the analysis shows, living labs are usually a cooperation between academia and stakeholders from the private or public sector. Therefore, it is not surprising that relevant publications on living labs can be found in journals writing to this mixed audience.

6. Følstad (2008). Living labs for innovation and development of communication technology: A literature review. *The Electronic Journal for Virtual Organisations and Networks*, 10, 99–131.
7. Three studies do not offer any elements of a definition.

## Funding

This work was supported by the Institutions for Open Societies Utrecht University, the Netherlands.

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