

Towards Third-Generation Living Lab Networks in Cities

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“*All the evolution we know of proceeds from the vague to the definite.*”

Charles Sanders Peirce (1839–1914)
Philosopher, logician, mathematician, and scientist

Many cities engage in diverse experimentation, innovation, and development activities with a broad variety of environments and stakeholders to the benefit of citizens, companies, municipalities, and other organizations. Hence, this article discusses such engagement in terms of next-generation living lab networks in the city context. In so doing, the study contributes to the discussion on living labs by introducing a framework of collaborative innovation networks in cities and suggesting a typology of third-generation living labs. Our framework is characterized by diverse platforms and participation approaches, resulting in four distinctive modes of collaborative innovation networks where the city is: i) a provider, ii) a neighbourhood participator, iii) a catalyst, or iv) a rapid experimenter. The typology is based on an analysis of 118 interviews with participants in six Finnish cities and reveals various ways to organize innovation activities in the city context. In particular, cities can benefit from innovation networks by simultaneously exploiting multiple platforms such as living labs for innovation. We conclude by discussing implications to theory and practice, and suggesting directions for future research.

Introduction

Living labs are increasingly accepted as a prominent form of open innovation (e.g., Bergvall-Kåreborn et al., 2015; Brankaert et al., 2015; Guimont & Lapointe, 2016; Hakkarainen & Hyysalo, 2016). The roots of the concept may be traced back to Knight (1749), who referred to “living laboratory” as the elements and conditions of a body and an environment of an experiment. More recent studies apply living labs in heterogeneous fields and suggest that this phenomenon provides ample research opportunities (cf. Leminen, 2015). Following the definition of Westerlund and Leminen (2011), the present study views living labs as: *“physical regions or virtual realities, or interaction spaces, in which stakeholders form public–private–people partnerships (4Ps) of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts.”*

Although the literature on living lab is rich with various concepts, methodologies, research streams, and tools (Dutilleul et al., 2010; Følstad, 2008; Leminen & Westerlund, 2016, 2017), studies increasingly document the plurality of living labs using different conceptualizations (e.g., Leminen et al., 2012; Rits et al., 2015; Savelkoul & Peutz, 2017; Schuurman et al., 2016; Ståhlbröst & Lassinantti, 2015). Among them, Leminen and colleagues (2012) classify living labs as user-, enabler-, utilizer-, or provider-driven. Moreover, the outcomes of innovation activities are linked with the characteristics of the living lab, its driving party, and the selected strategy – and the living lab’s structure is that of an open innovation network (Leminen & Westerlund, 2013; Leminen et al., 2016; Steen & van Bueren, 2017; Veeckman et al., 2013). Similar to the notion of open innovation networks (Jarvenpaa & Wernick, 2012), living labs typically comprise different stakeholders, such as suppliers, customers and users, competitors, research units of universities, and other institutions and organizations, all of whom brings their interests to the collaboration and innovation.

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Living labs also may be classified by stakeholder roles (Leminen et al., 2014; Leminen, Turunen, & Westerlund, 2015; Nyström et al., 2015). A city or an urban environment as well as involved stakeholders and their roles are encompassed in many recent living lab studies (e.g., Juujärvi & Lund, 2016; Steen & van Bueren, 2017). Previous research is unified in that cities have a crucial role to support plurality of innovation activities in the urban context (e.g., Leminen & Westerlund, 2015; Markkula & Kune, 2015; Tukiainen et al., 2015; Tukiainen & Sutinen, 2015). Given that various types and modes of collaborative innovations are flourishing in the city context (Sutinen et al., 2016), cities have drawn increasing attention from both innovation scholars and practitioners. Experimentation, innovation, and development activities in cities include a variety of modes of collaborative innovation, including hackathons, innovation labs, innovative purchasing, open spaces, participatory budgeting, makerspaces, fablabs, co-working places, and innovation spaces (e.g., Bogers et al., 2017; Hyysalo et al., 2014, 2016; Kohtala & Hyysalo, 2015; Schuurman & Tönurist, 2016).

Acknowledging the categorization of living labs phenomenon by Leminen (2015) – in other words, viewing living labs as a context, a method, and a conceptualization – the present study contributes to this perspective and labels the variety of collaborative innovation as “third-generation living lab networks”. The first of generation living labs focused on the landscape(s) of living labs as real-life environments intertwined with users and stakeholder activities. The second generation of living labs considered methods and methodologies as a part of innovation activities in the real-life environment. The third-generation living labs portray different modes of collaborative innovation, where different stakeholders and particularly users have crucial roles in innovation on platforms. Following Habib, Westerlund, and Leminen (2015), the present study defines third-generation living labs as: *“platforms with shared resources, which organize their stakeholders into a collaboration network(s), that relies on representative governance, participation, open-standards, and diverse activities and methods to gather, create, communicate, and deliver new knowledge, validated solutions, professional development, and social impact in real-life contexts.”*

Numerous studies document innovation activities in the smart city context (e.g., Khomsi, 2016; Ojasalo & Kauppinen, 2016; Ojasalo & Tähtinen, 2016), where various types of collaborative innovations and platforms

have emerged in practice and that have been discussed in the scholarly literature (Bollier, 2016; Raunio et al., 2016; Walravens & Ballon, 2013).

Among the many definitions of “platforms” provided in the literature, Raunio and colleagues (2016) propose that a platform refers to *“any operating environment, technology, system, product or service, whose development has been systematically opened up to outside developers, and whose key aims are the benefit produced by the platform’s users to each other and the network effect brought by participation.”* The platform-based operating method is a key to digitalized participatory urban development, which significantly increases the innovation impact and participatory nature of development (Raunio et al., 2016). One of the key concepts used in this connection is “innovation platform”, which requires that a city can shift its mindset from government to governance so that its focus will shift to the development and realization of development goals instead of regulation and enforcement of decisions. In other words, the city should adopt the role of coordinator rather than executor. Similarly, cities have begun to see their citizens as co-designers, co-producers, and co-learners (Bollier, 2016), suggesting that citizens move away from being subjects to being active participants in innovation (Leminen et al., 2014). Simultaneously, cities increasingly rely on expertise and resources on different communities (Anttiroiko, 2010). Moreover, platform orientation arises from profound social changes in cities (Raunio et al., 2016). Taken together, prior research has suggested the importance and role of the city as an enabler of innovation, yet studies on living labs are sparse on various roles that cities can adopt. In particular, there is a need for research on the implications of next-generation living lab networks in the city context. Hence, through this study, we aim to understand collaborative innovation networks in cities, herein referred to as “third-generation living lab networks”. Accordingly, we pose the following research questions:

- *What are collaborative innovation networks and their roles in cities?*
- *How can cities exploit such collaborative innovation networks?*

The article is organized as follows. First, we review previous literature to create a framework of collaborative innovation in cities. Then, we describe our research design and research process. Thereafter, we describe the key findings regarding collaborative innovation in

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cities through six cases resulting in four types of novel third-generation living lab networks. Finally, we discuss the theoretical and managerial implications and provide directions for future research on third-generation living labs.

Towards Third-Generation Living Labs

We propose a framework on collaborative innovation based on two dimensions arising from previous literature on living labs and cities. The dimensions are i) “platform” (Anttiroiko, 2016; Bollier, 2016; Ojasalo & Tähtinen, 2016; Raunio et al., 2016; Walravens & Ballon, 2013) and ii) “participation approach” (Hossain, 2016; Leminen, 2013; Leminen & Westerlund, 2015, 2017; Steen & van Bueren, 2017). The framework demonstrates the differences between collaborative innovation networks in the city context. The platform dimension distinguishes between the city and the neighbourhood, building on the notion that cities or their parts are increasingly documented as *platforms* (Anttiroiko, 2016). A neighbourhood or a suburb could also refer to a smaller entity or unit within a city, such as a school, a hospital, a community house, or a geographical area such as a park.

As to platform as the first dimension, living labs are generally viewed as platforms for innovation (Almirall & Wareham, 2008; Anttiroiko, 2016; Dell’Era & Landoni, 2014; Habib et al., 2015). Ojasalo and Tähtinen (2016) argue that, in the context of cities, the owner of the innovation platform is usually a city, and the platform functions as an innovation vehicle between the city and external actors. Walravens and Ballon (2013) study platform business models for smart cities (in particular, business models of mobile service offerings of cities). The authors put forward a “public business model grid”, where they have a dimension of public value, spanning from direct to indirect public value, and a dimension of governmental involvement, spanning from limited to strong. Raunio and colleagues (2016) propose that, through platforms, citizens become an active part of public service development and the city’s role changes from being a service provider to a facilitator of innovative services. The authors conclude that platform thinking has also been viewed as the next development stage of conventional cluster policy, suggesting a re-organization of innovation collaboration in the city community. Furthermore, Raunio and colleagues (2016) make a “simplistic but practical division” between platforms, by categorizing them into i) intermediary platforms that create value by conveying the products or

services of others (e.g., Uber, Alibaba, eBay); ii) development platforms or platform ecosystems that produce value by co-creating products and services with other companies (e.g., Microsoft, Intel, SAP); and iii) integrated platforms that function as intermediaries but also have a large external developer network (e.g., Google, Facebook, Apple, Amazon) (Gawer, 2009; Evans & Gawer, 2016; Thomas et al., 2014).

The platform owner (usually a city, a higher education institute, or a development company) facilitates, or organizes the facilitation of, the activities and defines the goal(s) of the platform. Platforms can be rather permanent physical or digital environments or less permanent environments, such as pop-up events, co-creation competitions, and hackathons. Anttiroiko (2016) documents participatory innovation platforms of three case cities, and states that, given that the city government facilitates these platforms and that they are integrated with the official planning system and local development policy, they resemble enabler-driven living labs. Furthermore, Anttiroiko (2016) observes three points of business–citizen interaction, namely open data, public services, and urban development. All of Anttiroiko’s (2016) case cities support open data and knowledge sharing, focus on the development of public services with platforms within the smart city framework, and utilize innovation platforms in neighbourhood revitalization. He also highlights that citizens are, in most cases, customers or users, but they sometimes play the role of empowered residents or citizens whose needs push the design of local services. Thus, living labs can either span over the whole city (i.e., the “city as a platform”) or focus on a specific neighbourhood.

Leminen (2013) classifies living labs into four types based on their coordination approach (i.e., bottom-up versus top-down) and participation approach (exhalation-dominated versus inhalation-dominated). He argues that a top-down approach is led or coordinated in accordance with centralized and official targets, whereas a bottom-up approach focuses on local needs and operates at the grassroots level. Whereas the inhalation-dominated innovation approach aims at fulfilling the needs of the driving party of the living lab, the exhalation-dominated innovation approach aims at fulfilling the requirements of other stakeholders. Leminen (2013) proposes to encourage parties to share their knowledge, expertise, and resources with the open innovation network. The exhalation-dominated approach engages stakeholders in collective action in the open innovation network to fulfill the needs of the others (Leminen, 2013).

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The second dimension of our framework, “participation approach”, depicts the innovation approach either as exhalation-dominated or inhalation-dominated. In this respect, Steen and van Bueren (2017) operationalized a definition of urban living labs, which was used to assess 90 sustainable urban innovation projects in the city of Amsterdam. They summarized the characteristics of living labs as four elements: aims, activities, participants, and context. Living labs are aimed at innovation and formal learning, and activities of living labs include development, co-creation, and iteration. Specifically, urban living labs aim at urban sustainability. Participants are public and private actors, users and knowledge institutes, and all the involved stakeholders have decision-making power. The context of the living lab is that of a real-life, and in many urban living labs, this means a territory or a space-bound place. Notably, Steen and van Bueren (2017) argue that most of the projects that label themselves as living labs do not include all the defining elements of a living lab.

To summarize, our conceptual framework captures the characteristics of collaborative innovation in the city context. Using the bipolar dimensions of platform and participation approach as principal axes in the framework, we can distinguish between four different modes of collaborative innovation networks in cities. We anticipate that the two-dimensional framework, as shown in Figure 1, can help us to identify existing collaborative innovations in cities, and a further analysis of the dimen-

sions enables us to capture differences and similarities between the models.

Research Design

We chose collaborative innovation networks, particularly living labs in cities, by exploring their innovation processes and contexts in order to contribute to the discussion on open innovation networks. The study applies a qualitative, multiple case study approach (Yin, 1989) by analyzing a unique data set encompassing 118 interviews in six cities in Finland. The selected case cities are at the forefront of development of collaborative innovation networks, and they represent a broad variety of collaborative innovation, such as living labs, hackathons, innovative purchasing, participatory budgeting, open spaces, makerspaces, fablabs, co-working places, innovation spaces, and so forth. These various modes or types met the suggested criteria of collaborative innovation networks in cities, where one specific form, a living lab, is associated with a real-life environment, multiple stakeholders, and the pivotal role of users (Almirall & Wareham, 2011; Bergvall-Kåreborn & Ståhlbröst, 2009; Leminen, 2013, 2015; Leminen et al., 2014; Leminen, Nyström, & Westerlund, 2015). As suggested by Jensen and Rogers (2001), we organized the cases as snapshot studies, meaning that the cases represented the diversity of innovation activities driven by different actors in networks (Leminen et al., 2012). In addition, we utilized secondary data consisting of websites, bulletins,

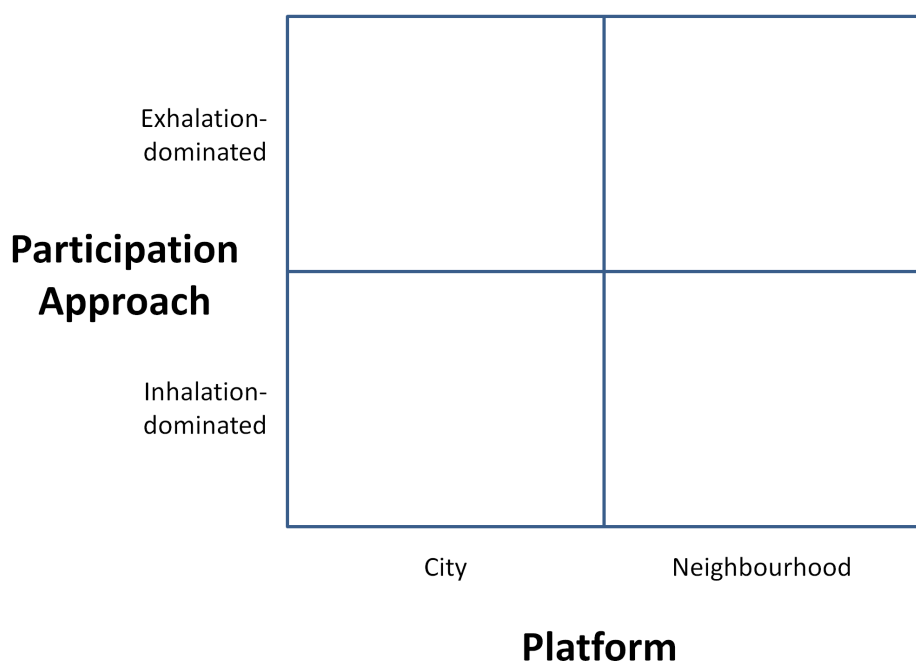


Figure 1. A conceptual framework for collaborative innovation networks in cities

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magazines, and reports to gain further understanding of some of the collaborative innovation networks or to resolve arising issues or inconsistencies in the interviews.

Data collection

We collected all of the interview data in 2017. We audio recorded and transcribed all face-to-face meetings and meetings by phone, and followed an interview guide when collecting information from various themes of collaboration innovations (Patton, 1990), and we had the informants verify the findings. Understanding different modes of collaborative innovations in cities and the roles of platform(s) and the gained benefits for different stakeholders in such collaborative innovation networks exemplify the themes of the semi-structured and open-ended questions. Our informants comprised various stakeholders representing different modes of collaborative innovation networks, especially living labs. The selected informants were interviewed because they have in-depth knowledge and first-hand experience of collaborative innovation in cities. The informants included CEOs, civil servants, directors, managers, professors, researchers, project coordinators, technical specialist, and citizens (users as innovators). The names of organizations and the identities of informants are withheld to maintain confidentiality.

Data analysis

An overview of the data analysis and the phases of the study is presented in Table 1. We organized the empirical data according to the informant, the date of interview, the type of informant, and the case. Then, we followed a multi-staged data analysis process consisting of open coding, focused coding, identification of innovation processes, and theorizing the codes. The main unit of analysis was the collaborative innovation: stakeholder activities and the characteristics of collaboration innovation networks. The original transcribed interviews were analyzed and coded by the researchers. We searched the words associated with activities, innovation processes, contexts, methods, methodologies, platforms, stakeholders, and tools using a content analysis technique. For instance, we coded stakeholders as utilizers, enablers, providers, or users to identify the characteristics of third-generation living labs. So doing, we followed the examples of Roberts (1997) and Neuendorf (2002) to understand the cases by coding and content analysis. We first coded the original, word-by-word transcribed empirical material independently and then compared, discussed and agreed on the results.

In the second phase, the first round of coding resulted in describing and identifying participation approaches

Table 1. Data analysis process

Data Analysis Phases	Task	Outcome
1. Open coding	<ul style="list-style-type: none"> Organize dataset Identify collaborative innovation networks and informants 	Overview of cities, collaborative innovation networks, informant, type of informant, and time of interview
2. Focused coding #1	<ul style="list-style-type: none"> Identify and briefly describe participation approaches and platforms in cities 	Overview of innovation activities resulted in identifying participation approaches and platforms in cities
3. Focused coding #2	<ul style="list-style-type: none"> Analyze innovation through the identified innovation activities and participation approaches as well as contexts and platforms Compare data to theory 	Detection of previously identified innovation activities and participation approaches (Leminen, 2013; Nyström et al., 2014) as well as contexts and platforms (Anttiroiko, 2016)
4. Theorizing the codes	<ul style="list-style-type: none"> Synthesize phases 1 to 3: analyze identified modes in collaborative innovation networks Identify theoretical implications Identify managerial implications 	Classification of the participation approaches and platforms resulting in four archetypes of collaborative innovation networks in cities (Figure 2)

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and platforms in cities. We then analyzed the four archetypes of collaborative innovation networks by categorizing participation approaches and platforms in six cities (Figure 2). We anticipate that the four archetypes of collaborative innovation networks in cities are our key findings.

Findings and Discussion

In this study, we analyze and classify the variety of collaborative innovation activities in six Finnish cities. So doing, we establish a framework based on platform and participation approach, which puts forward four diverse archetypes, or modes, of collaborative innovation in the city context, which are illustrated in Figure 2:

- A. The city as a provider
- B. The city as a neighbourhood participator
- C. The city as a catalyst
- D. The city as a rapid experimenter

A. The city as a provider

The mode of *city as a provider* (lower-left corner of Figure 2) represents an inhalation-dominated participation approach where improvements are done to the city’s own service provisioning, and an entire city is seen as a platform. In brief, this mode refers to exposing the service provisioning of a city to others in order to improve its services and processes for citizens.

Improvements to services and processes are undertaken with a broad variety of stakeholders such as companies and research institutes by providing expertise for a city. Activities are often initiated by the city’s strategic aims to pursue predefined improvements for its services. The city endeavours to create points where stakeholders can anchor their activities to the city’s operations, facilities, areas, and routes, and to gather information, test, co-create, and validate products, services, and systems. The city has specific city-wide targets, and it spells out how companies and other actors need to act with it, and what kinds of benefits they can receive. When the city exposes its processes to others, a network or an ecosystem forms around the city that organizes activities to streamline and develop the city’s service provisioning.

An innovation platform produces ideas, solutions, and knowledge for making public services and their production more efficient, while the city acts as a utilizer of the results. The city scales processes by providing guidebooks while companies and research institutes gather information, test, develop, and co-create products, services, and systems. Companies may also be utilizers benefiting from the results of innovation activities in their product and service development processes. Rather than being active actors, users are essentially treated as “lab rats” for testing products, services, and systems. Therefore, this mode does not make use of the full expertise and potential of citizens. The innovation

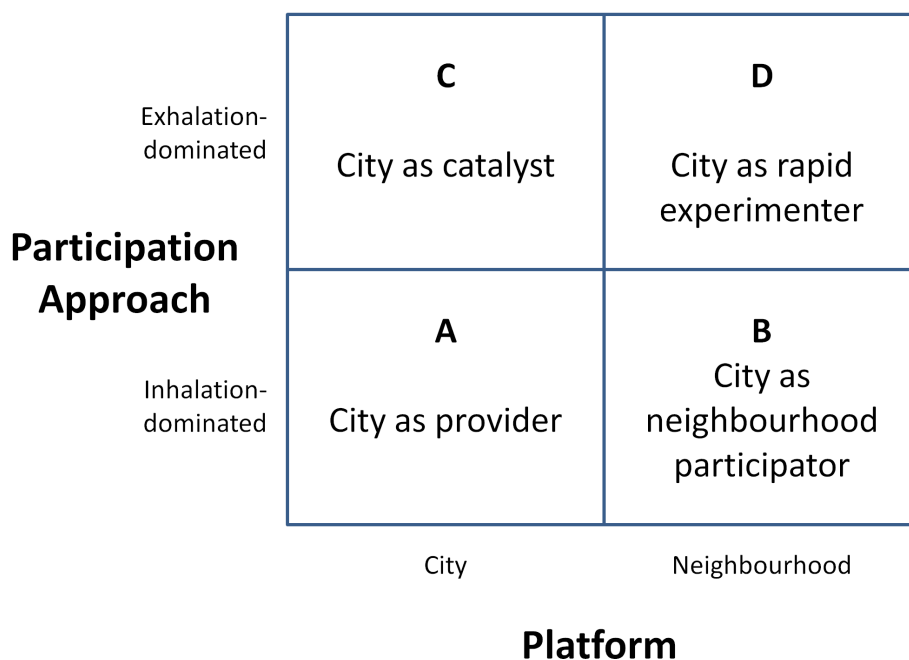


Figure 2. Collaborative innovation modes in cities

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mechanism of this mode assumes a city exposes its activities to companies and research institutes that collect information from processes of the city and improve the city's service provisioning.

B. The city as a neighbourhood participator

The mode of *city as a neighbourhood participator* (lower-right corner of Figure 2) represents an inhalation-dominated participation approach where the neighbourhood is seen as a platform. The mode refers to improving the neighbourhoods of citizens and their living conditions by local, grassroots activities initiated by the citizens. Similarly to the previous mode, innovation activities are initiated by and aimed at improving the conditions of the driving party. Specifically, citizens lead and benefit from innovation activities in this mode. In other words, a city engages itself in the collaborative innovation process, participates in activities, and supports citizen activities rather than attempting to steer the innovation activities.

A network or an ecosystem forms around a neighbourhood/community that organizes action to solve citizens' needs and aims to bring benefits for its citizens. Success is based on the activity and enthusiasm of citizens, and activities in this mode require patience from the city, not vast resources. The implemented operations are often small and quick, and easy to accomplish by the city. Examples of social innovations in our data included gardening activities initiated by the citizens in a neighbourhood, a village fête in the neighbourhood, and a digital bulletin board installed in stairwells – all of them jointly developed with the citizens. Another example: a residential area was isolated and there were hardly any services, but citizens, a local grocery store, and the developer of the residential area jointly ideated a drop-off location where the grocery store delivers online food purchases for pick-up by customers. Later, this resulted in the establishment of a specific e-grocery.

In this mode, the city is an enabler by participating in and supporting innovation activities in neighbourhoods. Scalability into citywide solutions is not as important as in the previous mode. However, the platform is the source of ideas and needs, which are the cultivated and developed into commercialized products, start-up companies, or social innovations. In contrast to the previous mode, where citizens act as lab rats, citizens here lead innovation activities or are participants in innovation activities with other stakeholders and can be perceived as co-creators or creative consumers

(Leminen et al., 2014, 2015). The innovation mechanism of this mode assumes that the city not only initiates, participates in, and supports activities, but also collects the best ideas for further development.

C. The city as a catalyst

The mode of *city as a catalyst* (upper-left corner of Figure 2) represents an exhalation-dominated participation approach where the entire city is a platform. The city boosts the development of companies and increases value of their operations by combining other aims and connecting other actors to the service provisioning in a city region. The main objective of the city is not to develop more efficient services for itself but to enhance and nourish business ecosystem(s) through living labs, when no companies take a role in order to boost and cultivate new networks and ecosystems in the city.

A network or an ecosystem forms around the city's own service provisioning, where living labs have a built-in role in the city's operations and service production. The city is a catalyst that opens up its service production and processes. The platform can be physical, virtual, or hybrid, and it consists of processes and procedures of the city, such as city planning and land use, wellbeing and healthcare, and the educational system. Although the city opens up the service production and data resources, it becomes a development platform for companies to develop, experiment, test, and validate products, services, and systems.

Because living labs and their activities are intertwined with the catalyst's service production and processes, they generate diverse value for the stakeholders. Put differently, by combining the conventional service provisioning of the city, as well as its processes, the city pursues benefits that are difficult to obtain otherwise. For example, residential area planning can be arranged with an innovative conveyancing competition, where construction companies and others compete on ideas that they implement, and they seek to identify potential companies interested in jointly building and experimenting with new types of houses and housing solutions such as zero-energy homes. Such operations catalyze development and stimulate adoption and creation of new solutions and services in the building industry.

In addition, co-operation between various sectors increases, and cross-pollination and learning take place between different sectors. The long-term benefits for

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the city are realized through activated business life in the city and through the success of companies developing their products and services, as the mode assumes prolonged development in the city region. Further, the scaling mechanism of the mode postulates learning and understanding of the principles of living labs by sharing and transferring knowledge regarding experiences of innovation activities between humans rather than formulating knowledge in manuals as the activities of living labs are at different maturity levels.

A city acts as an enabler by enhancing and nourishing a business ecosystem. That is, the innovation mechanism of this mode assumes opening the city's service provisioning and boosting business ecosystem(s) in the city. Companies and research institutes test, develop, and co-create their products, services, and systems. Although the roles of platforms are twofold, they enhance development, experimentation, testing, validation of companies' services, products, and systems, and act as showrooms for companies' activities and their outputs. Similar to the first mode, users act as mere "lab rats" for testing products, services, and systems; thus, the mode does not benefit from the full potential of citizens.

D. The city as a rapid experimenter

The mode of *city as a rapid experimenter* (upper-right corner of Figure 2) represents an exhalation-dominated participation approach, where the platform is a neighbourhood, unit, or a specific theme or activity rather than the entire city. This mode refers to accomplishing trials of new products, services, and systems by companies to gather experience and knowledge, to learn fast from such experiments, and to accelerate their product and service development processes and growth. The mode assumes development in predetermined thematic areas or neighbourhoods through rapid experiments that the city supports with a modest financial or non-financial stake in publicly funded projects. The city arranges competitions of rapid experimentation dedicated to certain predefined thematic fields, activities, or areas such as energy efficient solutions, smart mobility, health, and other solutions for smart cities. In other words, the city supports the growth of small companies and the business ecosystem by enabling rapid experiments.

The city has no specific short-term targets but can realize long-term benefits as it initiates a business network or an ecosystem around the needs that will be solved through rapid development. The development process will provide benefits to other stakeholders, bring new

solutions for the city or citizens, and develop the platform or its processes. The benefits of rapid experimentation increase, at least indirectly, and include flexibility, learning, and knowledge transfer. The developed solutions can be scalable to other contexts, but the scaling is conducted by the involved companies.

The benefits of the participating companies are twofold. First, the companies can gather information, test, develop, and co-create their products, services, and systems. Second, they may look for references for their products and services in cities. Users' or citizens' specific roles may vary, and they may act as "lab rats" for testing products, services, and systems; yet, their full potential and expertise as a part of innovation activities may be involved. This mode assumes learning from trial and error; such flexibility can be achieved by bringing in new actors and developing limited and rapidly implementable solutions for topical problems in real environments. Table 2 presents characteristics of collaborative innovation in different types of third-generation living labs.

To summarize, our findings indicate that cities may simultaneously use several collaborative innovation modes and that innovation can adopt different modes at the same time. Furthermore, because the needs of cities are often versatile, various modes of platforms (virtual, physical, or hybrid) and operational models (ranging from everyday basics to complex collaborative innovation networks) are increasingly used. Consequently, a city must possess capabilities to simultaneously handle the variety of forms. A city has to be able to develop its basic services that it has legal obligations to provide to its citizens, and to activate companies, act efficiently and innovatively, and at the same time conduct small experiments benefiting its citizens and companies. In contrast to prior studies on living lab networks (e.g., Leminen et al., 2012; Leminen et al., 2014, 2015, 2016; Nyström et al., 2014; Steen & van Bueren, 2017), which documented innovation activities through the importance of users in various innovation networks characterized by openness in cities, we argue that cities play a pivotal role by enabling innovation activities using different mechanisms to boost innovation with different parties.

Conclusion

This study classified the variety of collaborative innovation activities in six cities in Finland. The study identified two essential dimensions in previous literatures on

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living labs and cities, namely platforms and participation approaches, in order to propose a framework that demonstrates differences of current and potential collaborative innovation networks in cities. The study aimed to understand the plurality and variety of collaborative innovation networks in cities, referred to as third-generation living lab networks. Particularly, the

study attempted to take a step towards research that would review implications of the third-generation of living labs in cities. Therefore, this study not only illuminates four collaborative innovation modes but also contributes to the growing literatures of open innovation networks and living labs by describing the ways living lab networks are exploited in the city context.

Table 2. Characteristics of collaborative innovation in different types of third-generation living labs

Characteristic	Types of Third-Generation Living Labs			
	A. The city as a provider	B. The city as a neighbourhood participator	C. The city as a catalyst	D. The city as a rapid experimenter
Definition	Expose service provisioning of a city to improve its services and processes for citizens with a broad variety of providers providing expertise for a city	Improve neighbourhood or living conditions of citizens by local, grassroots activities initiated by citizen(s)	Boost development of companies and increase value of operations by combining other aims and connecting other actors to service provisioning in a city region	Accomplish trials of new products, services, and systems by companies to gather experience and knowledge and learn fast, and to accelerate companies' development processes and growth
Strategy	Strategic R&D activity with preset objectives, where city utilizes the outcomes to streamline its service provisioning	Problem solving by collaborative accomplishments with neighbourhood	Enhancing or nourishing city's business ecosystem(s)	Learning and operations development through rapid experimentations
Organization	Network/ecosystem forms around a city that organizes actions to streamline its service provisioning	Network/ecosystem forms around a neighbourhood/community, organizing action to solve citizens' needs and bring value for citizens	Network/ecosystem forms around a city's own service provisioning or its data storages	Network/ecosystem initiated by needs to be solved by rapid development
Participation approach	Inhalation-dominated (city – city)	Inhalation-dominated (citizens – citizens)	Exhalation-dominated (city – companies)	Exhalation-dominated (city – companies)
Platform	Entire city and its spaces, places, areas, processes, and routes	Neighbourhood, suburb of a city, or theme	Entire city and its spaces, places, areas, processes, and routes	Neighbourhood, suburb of a city, or theme
Role of platform	Provide new ideas, solutions and knowledge Boost service provisioning and make production of public services more efficient	Ideas and needs are cultivated and developed towards commercialized products, startups, or social innovations	Enhance development, experimentation, testing, validation of companies' services, products, and systems A showroom for companies' products and services	Bring new solutions for the city or citizens, and develop the platform or its processes

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Table 2. (continued) Characteristics of collaborative innovation in different types of third-generation living labs

Characteristic	Types of Third-Generation Living Labs			
	A. The city as a provider	B. The city as a neighbourhood participator	C. The city as a catalyst	D. The city as a rapid experimenter
Enabler (city)	<i>Expose, align, and improve</i> Initiate innovation activities and create anchorage points	<i>Initiate, participate, and support</i> Participate in and support innovation activities	<i>Open, activate, and boost</i> Enhance or nourish business ecosystem(s)	<i>Learn from trial and error</i> Promote rapid prototyping with small incentives
Utilizer (city)	Benefit directly and scale up results of streamlined service provisioning	Harvest ideas and needs from innovation activities and use them in development activities	Bring new solutions for citizens and develop the platform or its processes	Bring new solutions for citizens and develop the platform or its processes
Utilizer (companies)	Benefit from the results of innovation activities	Harvest ideas, needs, and results from innovation activities and use them in development activities	Benefit from results of innovation activities Platform as a showroom for products and services	Learn through rapid experimentations Look for references
Provider (companies and research institutes)	Gather information, test, develop, and co-create products, services, and systems	Gather information, test, develop, and co-create products, services, and systems	Gather information, test, develop, and co-create products, services, and systems Develop the platform	Gather information, test, develop, and co-create products, services, and systems Develop the platform
User/citizen	“Lab rats”	Leader or equal participants	“Lab rats”	“Lab rats” or equal participants
Innovation mechanism	Parallel skiing (alignment)	Participate, do not activate Collect the best ideas	Added value is produced for others by adding different processes and activities to city’s own operations	Flexibility achieved by bringing in new actors and developing limited and rapidly implementable solutions
Outcome	New ideas, knowledge, and solutions for streamlined service provisioning	Social innovations and solutions offering pleasure and benefits for citizens Commercialized products or companies (e.g., digital notice boards, food halls)	New products and services Showroom for companies’ activities Business ecosystem growth, new jobs	New solutions for a city and its citizens Showroom for companies’ activities Business ecosystem growth, new jobs
Lifespan	Short, medium, or long	Long	Long	Short

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Theoretical implications

There are three theoretical contributions that the study highlights in regard to the discussions on collaborative innovation and open innovation networks particularly in the area of living labs. First, the paper suggested a *new conceptual framework* for revealing collaborative innovation networks in the city context: the third-generation of living lab networks (Figure 1). Second, the framework distinguished *four archetypes of collaborative innovation* through third-generation living lab networks based on their participation approach and the platform: A. the city as a provider, B. the city as a neighbourhood participator, C. the city as a catalyst, and D. the city as a rapid experimenter. Third, the study proposed that *cities reinforce long-term participation and engagement of stakeholders*, suggesting various benefits to all stakeholders. Each of these contributions is described as follows:

1. *Conceptual framework*: Mulder (2012) argues that the existing living labs fail to benefit from their full potential, because they rely too much on traditional user-centric lab methodologies, forgetting the “living part” that makes a living lab an exceptional methodology. The framework suggested in the present study illuminates various types of collaborative innovation. The dimensions of the framework include the platform (in terms of “city” versus “neighbourhood”) and the participation approach (in terms of “inhalation-dominated” versus “exhalation-dominated”). Whereas the former dimension is grounded on exploiting different platforms in cities, the latter is grounded on the assumption on the participation approach.
2. *Four archetypes of third-generation living labs*: The conceptual framework distinguishes four archetypes of third-generation living labs based on the participation approach and the platform. The *city as a provider* assumes that an entire city is viewed as a platform, and its service provisioning is exposed to other stakeholders in order to improve and make services and their processes more efficient, as well as to provide expertise for the city. The mode of the *city as a neighbourhood participator* refers to improving neighbourhood of citizens or their living conditions by local, grassroot innovations by citizens, where the platform is a neighbourhood or a suburb of city, and such innovation activities are conducted for the benefits of citizens themselves. The *city as a catalyst* refers to a mode where the city boosts the development of companies and increases value of its own operations by combining other aims and connecting other actors to its service provisioning in the entire

city region. Finally, the *city as a rapid experimenter* considers a part of city (e.g., a neighbourhood) as a platform, where it attempts to learn fast from the rapid experiments and to accelerate companies’ service and product development processes.

3. *Cities reinforce long-term participation and engagement of stakeholders*: The extant literature proposes many benefits from engaging multiple stakeholders and particularly users in organization’s innovation activities (e.g., Leminen & Westerlund, 2012; Leminen, 2015). Although the benefits are widely acknowledged, Hannukainen and colleagues (2017) note that user-oriented innovation activities may not be rooted in part of an organization’s innovation and development activities even though the organizations are excited by such modes and find them useful. One explanation for this might be that many company-driven living lab targets are, by nature, short term; for instance, the goal may be to solve a company’s instant needs in their innovation activities (Leminen et al., 2012). Our study proposes that cities increasingly reinforce the long-term participation and engagement of users, citizens, and other stakeholders particularly in the city as provider and city as catalyst modes because cities’ innovation and development activities are increasingly coupled into their service-provisioning. Therefore, if a city succeeds in aligning its modes in collaborative innovation networks with its long-term mission and goal, and in building appropriate anchorage points for other stakeholders, the structure can become a long-lasting part of the city’s innovation system.

Managerial implications

From the managerial perspective, the study contributes a framework, or tool, to identify and categorize collaborative innovation networks in cities. The framework and the identified characteristics of the modes with regards to collaborative innovation networks portray different stakeholders and their activities and benefits. We described four different types of third-generation living lab networks based on their participation approach and platform whose interests dominate the network’s operation. By identifying each mode in collaborative innovation networks in cities, managers may link their own innovation and development processes as a part of the city’s activities. In other words, cities may provide many benefits for managers when cities are seen as platforms, source(s) of data, and sources of needs by the citizens and the city. More specifically, managers may learn that cities have a key role in boosting companies’ own innovation and development activities,

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ranging from testing and validating their products to co-creating and developing new ones. Particularly companies should prepare for a revision of their roles and activities corresponding to identified collaborative innovation networks in cities.

Limitations and future research

All studies have their limitations. First, the present study put forward a matrix where we selected participation approach as one dimension while excluding the dimension of coordination approach presented by Leminen (2013). The coordination approach could be included in the matrix in future research. We were not able to include all the different stakeholders in the studied collaborative innovation networks, the third-generation networks, because of the limited resources. However, we believe that our data set is sufficiently rich and covers multiple types of informants and diverse collaborative innovation networks in six cities. Yet, the limitation may affect the results on modes in collaborative innovative networks in the city context. We share the view that living labs are coupled into the contexts (Leminen, 2015), and further research is needed for different modes of collaborative innovation networks. For example, new platforms enable citizens to participate and engage in development and innovation activities in cities, and it is crucial to understand the mutual interests and mechanisms of open and collaborative innovation activities. Therefore, we propose more research on how different stakeholders should be motivated in order to be engaged in the development and innovation processes in collaborative innovation networks, and on what actions are necessary to keep stakeholders engaged. Further, we propose the importance of studying the relations of different collaborative and open innovation networks. Also, we suggest a need for additional research on the characteristics in open and collaborative innovation networks. Therefore, we call for further analyses of specific cases, eventually including how different stakeholders employ collaborative and open innovation networks in cities. Are there relations (or correlations) between different types of cities, collaborative innovation networks, and the position of the informants? To conclude, we call for more research on collaborative innovation networks, the third-generation networks.

Acknowledgements

The authors gratefully appreciate the anonymous blind reviewer and the Editor-in-Chief, Chris McPhee for their valuable comments, suggestions, and guidelines to improve this article. Special thanks are also extended to Director for Services Development Päivi Sutinen and all of the interview subjects who kindly shared their knowledge and experience as stakeholders in living labs and other forms of collaborative innovations in cities. The authors express their gratitude to City of Espoo and the 6-aika program for funding the development of the article as a part of the Living Lab 3.0 project.

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Citation: Leminen, S., Rajahonka, M., & Westerlund, M. 2017. Towards Third-Generation Living Lab Networks in Cities. *Technology Innovation Management Review*, 7(11): 21–35. <http://doi.org/10.22215/timreview/1118>



Keywords: living lab, third-generation, open innovation, networks, innovation, co-creation, city, smart city, collaborative innovation

Academic Affiliations and Funding Acknowledgements



The Federal Economic Development Agency for Southern Ontario (FedDev Ontario; feddevontario.gc.ca) is part of the Innovation, Science and Economic Development portfolio and one of six regional development agencies, each of which helps to address key economic challenges by providing regionally-tailored programs, services, knowledge and expertise.

- *The TIM Review receives partial funding from FedDev Ontario's Investing in Regional Diversification initiative.*



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- *The TIM Review is published in association with and receives partial funding from the TIM program.*