Open Innovation Processes in Living Lab Innovation Systems: Insights from the LeYLab

Dimitri Schuurman, Lieven De Marez, and Pieter Ballon

> *"Innovation happens because there are people out there doing and trying a lot of different things.*
>
> Edward Felton
> Professor of Computer Science and Public Affairs

Living labs have emerged on the crossroads of the open innovation and user innovation frameworks. As open innovation systems, living labs consist of various actors with each playing their specific role. Within this article, we will take an open innovation perspective by analyzing the knowledge spill-overs between living lab actors through three in-depth innovation case studies taking place within the LeYLab living lab in Kortrijk, Belgium. The results illustrate how living labs foster the three open innovation processes of exploration, exploitation, and retention. From our analysis, we conclude that living labs are particularly useful for exploration and, to a lesser extent, exploitation. In terms of retention, living labs seem to hold a large potential; however, the success and the nature of the innovation processes depend on the sustainability of living labs, the number of innovation cases, and the alignment of these cases with the living lab infrastructure. Based on these findings, a concrete set of guidelines is proposed for innovating in living labs and for setting up a living lab constellation.

Introduction

A shift in the dominant mode of innovation – from vertically integrated innovation towards a more distributed mode of innovation – has forced companies to alter both their research and development processes and their approach to innovation management. Instead of focusing on hiring people with all relevant skills and knowledge, and investing heavily in internal research and development capacities, companies had to actively look outside their walls for knowledge and technology to complement internal assets. This shift in the dominant mode of innovation not only required companies to adapt by developing or acquiring different skills and abilities, it also encouraged a growing body of research into the nature and occurrence of distributed innovation processes.

In the literature, there are two major research streams linked to the phenomenon of distributed innovation: open innovation and user innovation (Bogers and West, 2012; tinyurl.com/ba3gg3x). The *open innovation* paradigm takes the firm's perspective and examines the financial benefits of engaging in distributed innovation (West and Bogers, 2013; tinyurl.com/kcu2yw3). In contrast, the *user innovation* stream looks at distributed innovation processes from the perspective of the user (von Hippel, 2009; tinyurl.com/kj52zv5). In this stream, the focus of the analysis lies mainly on the utility gains the innovation brings to the user. A specific situation where these two perspectives come together is the case of user entrepreneurs, where users innovate and decide to commercialize their innovation themselves (Shah and Tripsas, 2007; tinyurl.com/mvo5sd9).

Within the context of distributed innovation, *co-creation* can be seen as a bridge between the perspectives of open innovation and user innovation. Co-creation moves beyond the single-inventor perspective to consider innovation as the collaborative development

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of two or more stakeholders. This process involves knowledge inflows and outflows between complementary partners, including horizontal and vertical alliances (Bogers et al., 2010; tinyurl.com/nxdeyb6). Beyond creating product innovation, co-creation can also be a way to create value more generally (Prahalad and Ramaswamy, 2004; tinyurl.com/m283r7v). Living labs – an innovation approach that has gained a lot of attention from European policy makers as well as innovation scholars since the mid 2000s – rely on co-creation as a central process for value creation (Levén and Holmström, 2008; tinyurl.com/pas5rmf). Therefore, as Figure 1 shows, we propose living labs as a potential bridge between open innovation and user innovation, two largely separate literature streams that are rooted in distributed innovation processes.

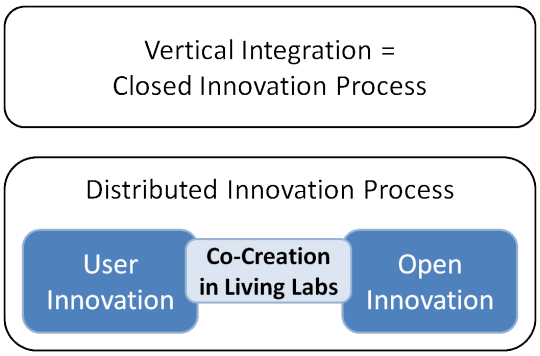

Figure 1. Positioning living labs amongst innovation paradigms

In this article, we focus on two specific types of living labs: i) living labs as extension to testbeds (tinyurl.com/yb75k6x) and ii) living labs that support context research and co-creation, as identified by Schuurman and colleagues (2013; tinyurl.com/ksl7ls7). These two types were selected because they are focused on innovation development relying on user involvement, whereas the "American-style" living labs and living labs focused on knowledge exchange are less about co-creation and more about exploration. This approach is in line with Almirall and Wareham (2011; tinyurl.com/lrz3dg2), who state that "Living labs are semi-partitioned spaces in the form of innovation arenas integrated in real-life environments but separated by means of an innovation project structure that cultivate user-led insights" and "living Labs are fundamentally infrastructures that surface tacit, experiential, and domain-based knowledge such that it can be further codified and communicated." This view suggests that the two types of living labs under our focus might be able to bridge the gap – identified by Bogers and West (2012; tinyurl.com/ba3gg3x) – between open and user innovation by facilitating the co-creation of innovation through connecting the innovative capacity of users (user innovation) with the innovative capacities of public and private stakeholders participating in living lab projects. We explore this hypothesis by means of a three innovation case studies, which take place in the LeYLab living lab (leylab.be) in Kortrijk, Belgium, and which examine the knowledge and technology flows between the involved stakeholders from an open innovation perspective.

Open Innovation Processes

Open innovation, conceptualized as a paradigm that assumes firms can and should use external as well as internal ideas and knowledge, was coined by Chesbrough (2003; tinyurl.com/d2l6bqx). He defined open innovation as a non-linear innovation process with more cooperation between internal R&D departments and the outside world, and with companies benefiting from the synergies associated with this collaboration. Factors that have favoured the shift towards an innovation model that is more open include an increased job mobility, the recognition of decentralized knowledge and shorter product lifecycles (van de Vrande et al., 2009; tinyurl.com/bqgk4t5).

From the perspective of a single firm – the usual level of analysis in open innovation research – the whole concept of open innovation is grounded on the premise that opening the internal innovation process of a firm yields extra value (Gassmann et al., 2010; tinyurl.com/mcx37tr). This opening results in inbound and outbound knowledge transfers: i) buying, which means internally acquiring external knowledge, ii) selling, which means externally exploiting internal knowledge assets, or iii) the simultaneous occurrence of both, a phenomenon referred to as the "coupled process" of open innovation (van de Vrande et al., 2009; tinyurl.com/bqgk4t5). Besides immaterial knowledge, materialized knowledge in the form of technologies can also be the subject of inbound or outbound movements, processes referred to as "technology acquisition" and "technology exploitation" by Lichtenthaler (2011; tinyurl.com/kbwtqom). He further highlights that knowledge and technology transfers are key processes being studied in open innovation literature. In Table 1, we summarize the three main goals for open innovation – exploitation, exploration, and retention – as identified by Lichtentahler and Lichtentahler (2009; tinyurl.com/llmdl3v), and we list the three corresponding firm capabilities required to pursue each of them.

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Initially, in open innovation research, these processes were studied within firms (inter-firm) or between firms (intra-firm), whereas later studies with a user innovation perspective examined how firms can collaborate with users to facilitate a process of external exploration beyond intra-firm processes (West and Lakhani, 2008; tinyurl.com/bas35oa). However, both processes have different hypothesized spill-overs: within open innovation research, these knowledge and technology spill-overs are situated amongst firms in an exchange or monetary modus (i.e., trading knowledge or technology for money or other knowledge or technology), whereas in user innovation research, these spill-overs from users to producers are not financial in nature (Bogers and West, 2012; tinyurl.com/ba3gg3x). There has been less research into retention processes, other than the literature on innovation intermediaries (Schuurman et al., 2012; tinyurl.com/okmz3cy).

This overview stresses the importance of external networking, including all activities to acquire and maintain connections with external sources of social capital, including individuals and organizations (Chesbrough, 2006; tinyurl.com/8x8byvv). Open innovation networks, which can range from informal links over collaborative projects to formal R&D alliances, allow firms to rapidly fill in specific knowledge needs without having to spend enormous amounts of time and money to develop that knowledge internally or acquire it through vertical integration (van de Vrande et al., 2009; tinyurl.com/bqgk4t5). Almirall and Wareham (2008; tinyurl.com/mkq7aql) identify a living lab as a specific type of open innovation network that acts as an innovation intermediary between users, public organizations, and private organizations to capture and codify user insights in real-life environments. By making this tacit user knowledge explicit and actionable for the different stakeholders, these innovation intermediaries seem perfectly fit to facilitate the identified open innovation processes. However, Almirall and Wareham (2011; tinyurl.com/lrz3dg2) only mention exploration and exploitation processes in their study of living labs from an open innovation perspective. We will complement their efforts by also looking at retention processes within our own case study analysis.

Table 1. Open innovation processes and corresponding firm capabilities

Goal	Definition	Corresponding Capability
Exploitation	Purposive outflows of knowledge or technology, implying that innovation activities to leverage existing technological capabilities lie outside the boundaries of the organization	Desorption
Exploration	Purposive inflows of knowledge or technology, aimed at capturing and benefiting from external sources of knowledge to enhance current technological developments	Absorption
Retention	The storage, maintenance, and reuse of knowledge over time	Connectivity

Defining Elements of Living Labs

In the literature, there is an abundance of definitions for living labs. For an overview of these definitions and of the most influential bottom-up and top-down conceptualizations, see Schuurman and colleagues (2012; tinyurl.com/mhjzhmh). Instead of building our own definition of living labs, we will start from a general model of living lab constellations, which is derived from Schuurman and colleagues (2013; tinyurl.com/lsxdkqo). In this view, the living lab infrastructure as a whole forms the centre of the living lab, with five general living lab characteristics depending on this infrastructure, as illustrated in Figure 2.

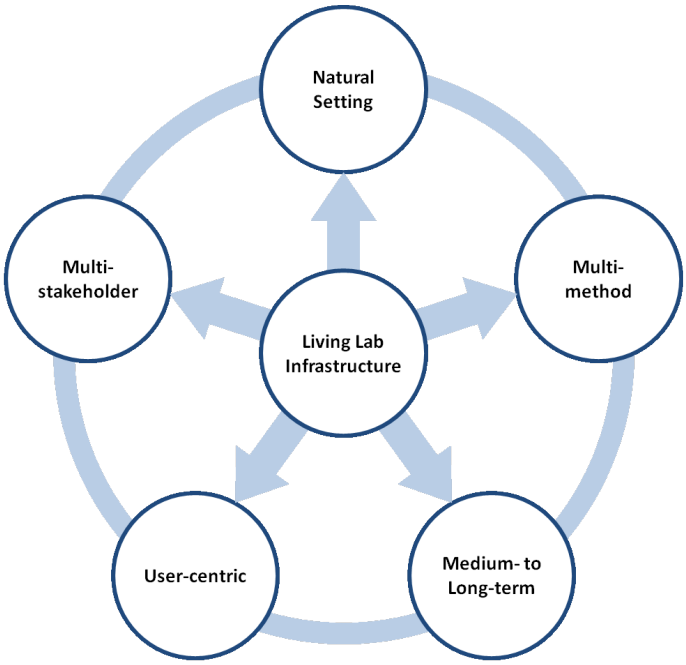

Figure 2. Defining elements of a living lab

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The *natural setting* in which at least part of the innovation process in living labs takes place is an obvious and widely discussed element of living labs. Pierson and Lievens (2005; tinyurl.com/9t9sylo) summarize the importance of this element by stressing that the uncontrollable dynamics of everyday life are accepted as part of the innovation environment which enables a "thick" understanding of innovation. The *multi-stakeholder* aspect of living labs is discussed by Leminen and Westerlund (2012; tinyurl.com/orlnfh5), who take an open innovation perspective on living labs and identify the four roles – user, utilizer, enabler, and provider – amongst the different stakeholders participating in living labs. These partnerships are more commonly referred to as public-private-people partnerships (4 Ps), or as quadruple helix models by Arnkil and colleagues (2010; tinyurl.com/koczuws) in their study on innovation networks.

Almirall and Wareham (2008; tinyurl.com/mkq7aql) further elaborate on the user as an equal collaborator in living labs, stressing a *user-centric innovation approach*: users are not considered passive respondents but active co-producers. Living labs also depend upon a *multi-methodological approach*, with different research methods aimed at accessing the ideas and knowledge of these users (Eriksson et al., 2005; tinyurl.com/8fv3jkp). This approach consists of *medium- to long-term research* (Følstad et al., 2009; tinyurl.com/okv7ott).

Last but not least, we see the *living lab infrastructur*e as an element that is essential in living labs, although this concept is used in multiple ways in the literature. In its most narrow sense, infrastructure refers to the information and communications technology that facilitates co-operation and co-creation among stakeholders (Bergvall-Kåreborn et al., 2009; tinyurl.com/lthwjpl). In its broadest sense, infrastructure refers to the distributed, networked living lab environment, the users and user communities involved in the living lab, the physical technical facilities (e.g., devices, networks, sensors), and the methods and tools used during living lab operations (Schaffers et al., 2009; tinyurl.com/kxhhnnx). We opt for a position in between these two extremes by making a distinction between the *material* and the *immaterial* infrastructure. The material infrastructure consists of the tangible assets that are brought into the living lab, such as physical networks, user devices, and research equipment. The immaterial infrastructure consists of the non-tangible assets of the living lab, such as end users, stakeholders, and the environment (see also Schuurman et al., 2013; tinyurl.com/lsxdkqo).

In theory, a living lab can be created and used only for one living lab innovation case, which is a specific type of living labs as defined by Ståhlbröst (2012; tinyurl.com/l8ur4cu). An example is provided by Schuurman and colleagues (2011; tinyurl.com/lj39xsk), where an entire living lab infrastructure was put in place for a mobile television trial and then it was disbanded after the project. However, most living labs are used for multiple innovation cases.

Three Case Studies of Innovation in the LeYLab

We examined three cases of innovation from the LeYLab living lab (leylab.be) in Kortrijk, Belgium. The LeYLab consists of a fibre-to-the-home network deployed to 115 addresses (98 households and 17 local companies and public organizations) within the city of Kortrijk. Users were connected and equipped with devices such as mini PCs connected to their main television screens and tablets (which were still a novelty in 2011). Optical fibre offered unprecedented test facilities in terms of bandwidth and quality of service. Therefore, the shared goal of the LeYLab was to stimulate innovation and to measure the relevance of new services for the personal lifestyle and living environment of the test users. Based on the goals and interests of the consortium partners, two main topics were chosen as focus for the living lab: innovative media and eHealth. All connected addresses received multiple surveys to profile the test-users for the relevant thematic domains, and all data and actions running on the LeYLab fibre network were monitored and logged. For a more in-depth description of the LeYLab living lab, we refer to our previous publication in this journal (Schuurman and De Marez, 2012; timreview.ca/article/606).

For our case study research, we looked into three concrete innovation cases that took place in the LeYLab: one internal case, consisting of the roll-out and usage of the fibre infrastructure, and two "external" living lab cases: Cloud Friends and Poppidups. One of the authors was directly involved in all cases as principal researcher, which enabled us to use the following data for our analysis: official meeting minutes of all project meetings, the project proposals, all deliverables and raw research data, and field notes of all formal and informal project meetings. The principal actors from our case studies together with their respective roles are summarized in Table 2. For a more in-depth exploration of stakeholder roles in living labs, we refer to Leminen and Westerlund (2012; tinyurl.com/orlnfh5).

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Table 2. Actors and roles in the LeYLab living lab

Actor	Role
City of Kortrijk kortrijk.be	Enabler of the roll-out of the infrastructure and link to citizens and local stakeholders
Alcatel-Lucent alcatel-lucent.be	Provider of the modems and monitoring of all network activity
Belgacom belgacom.be	Provider of the fibre network and the end-user devices (tablets and mini PCs)
Users leylab.be/innovators/test-panel	Testers of material infrastructure and innovative applications; participants in research (e.g., surveys, co-creation sessions)
iMinds iminds.be	Researcher and manager of test panels
Cloud Friends intenogroup.com/iopsys.aspx	External utilizer of living lab infrastructure with Cloud Friends application
Prophets prophets.be	External utilizer of living lab infrastructure with Poppidups application

Case 1: Fibre infrastructure

The first case involved the roll-out and usage of the fibre infrastructure itself (Table 3). The goals for both providers were twofold. First, by providing the fibre infrastructure and the devices to the panel members, the providers wanted to exploit these assets by allowing external parties to test applications and services on the infrastructure. This first goal, to attract a critical mass of external innovation cases to the infrastructure in order to generate a financial return for this exploitation of the network, was not very successful. After two years, only three external applications – including Cloud Friends and Poppidups – ran in the Living Lab, which cannot be considered a huge success. As of the beginning of 2013, the infrastructure was exploited through the participation in the European project Specifi (www.specifi.eu), where it serves as a testing area for the use cases that are given shape in the project.

As a second, long-term goal, both companies wished to exploit their infrastructure through a large commercial roll-out of fibre-to-the-home. This roll-out involved recruiting panel members, obtaining legal permits, and carrying out field work to effectively connect the test users. By surveying the end users before they were connected to the fibre network and at the end of the living lab, differences in attitude and usage could be assessed, as well as interest in the technologies. During the project, surveys were launched specifically aimed at panel members owning a tablet and at those owning a mini PC. In between these surveys, panel members were involved in various informal offline activities, and they could also provide spontaneous feedback by contacting the panel manager or by posting on dedicated online forums. All this research was facilitated and carried out by iMinds (iminds.be), an independent research institute founded by the Flemish government.

By having this data from a real-life panel of end users utilizing the fibre network, the devices, and the applications, both providers of the infrastructure could explore usage patterns and people's reactions to the offering, which were rather positive. This case also showed how this roll-out and exploitation could be organized and carried out in practice. Through the monitoring facilities of Alcatel-Lucent, all self-reported data could be contrasted with log files that contained all activity on the fibre connection at a household level, which allowed researchers to explore how these data sources might be combined. These efforts resulted in a segmentation of the households based on actual usage, and a model was developed to predict Internet usage, which was presented and published as a conference paper by Pianese and colleagues (2013; tinyurl.com/kjptyv7).

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Table 3. Open innovation processes in Case 1: the fibre roll-out

Exploitation	Exploration	Retention
• exploiting infrastructure as testing environment for innovators and in European project for use cases	• exploring future roll-out and exploitation of fibre-to-the-home • usage patterns and user reactions on devices and network • research possibilities with objective and self-reported data • policy exploration (smart city)	• model for predicting Internet usage • follow-up project application

This outcome is a tangible form of retention of the knowledge generated from the exploration of the datasets. Another example of a retention process took place at the end of the project, when five of the consortium partners started a joint effort to apply for a follow-up project attempting to retain the material as well as immaterial infrastructure. Last but not least, the City of Kortrijk, as a public stakeholder, was able to explore the effect of this kind of innovative information and communications technology project on the city ecosystem in the context of its goal of establishing Kortrijk as a "smart city" (tinyurl.com/pwmehou). In this way, the involvement of the City of Kortrijk and some of its citizens could be regarded as a form of policy exploration.

Case 2: Cloud Friends

Cloud Friends is a network-optimization application that also includes easy WiFi access management, developed by the start-up company Cloud Friends. From the start of the innovation project, it was clear that Cloud Friends was willing to exploit their technology, because they looked at the living lab project as an opportunity to get noticed by the providers of the infrastructure (Table 4). This case started with a co-creation session, facilitated and led by iMinds, with a group of tech-savvy panel members that were selected based on the results of the general surveys that were held amongst all LeYLab panel members. This outcome can be seen as a form of retention of the data obtained from the fibre roll-out case. During the session, the selected panel members discussed their current habits and practices regarding their home network configuration and the opportunities and threats of the Cloud Friends offering. The topic of easy WiFi access surfaced during this session, triggered by a discussion between a father and his son. This input was used in the further development of the application, as more emphasis was put on this specific feature.

After the co-creation session, the Cloud Friends application was installed on the modems of the fibre infrastructure in the households of the participants of the co-creation session. This outcome can be seen as an exploitation of the infrastructure by the providers, as mentioned in the previous case. Cloud Friends chose LeYLab as a living lab because, potentially, a lot of network conflicts could occur given that most connected households also had their own Internet connection besides the fibre infrastructure, which was an ideal test setting because the application deals with network problems. During the roll-out, it became apparent that the technical integration with the infrastructure was

Table 4. Open innovation processes in Case 2: Cloud Friends

Exploitation	Exploration	Retention
• intention to exploit technology to infrastructure providers • actual exploitation to external company based on user feedback	• insight into user needs and wants (e.g., WiFi guest access) • insight into technical performance in real-life setting • generated knowledge from technical integration with network	• data from general panel surveys used for user selection • extending duration of trial

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not as straightforward as expected, which required a lot of time and effort both from Cloud Friends and from the providers of the infrastructure. However, this problem provided an opportunity for exploration in terms of the technical feasibility of the solution. These efforts also had a direct impact on the eventual exploitation of the technology, because Cloud Friends were contacted during the project by Inteno (intenogroup.com), a large Swedish company that decided to buy the Cloud Friends solution in a licensing model, and later acquired the company in its entirety. The application kept the Cloud Friends logo, but its name was changed to Iopsys (intenogroup.com/iopsys.aspx). However, even after exploiting the technology, the actual field trial continued. By having a small but dedicated panel of test users, new features, issues, or ideas could be quickly validated, which can also be seen as a form of retention of the immaterial infrastructure (test users).

Case 3: Poppidups

Poppidups is a virtual puppetry application that is playable online with cards containing a unique quick-response (QR) code. The application was created by Prophets (prophets.be), a small online marketing agency based in Antwerp, Belgium. This innovation case started with an intake survey of over 200 respondents from the LeYLab panel, but also beyond the LeYLab test users, because Prophets wanted a broader validation of the Poppidups concept. After this quantitative assessment of user interest in Poppidups and its features, a co-creation session was held with a selection of respondents from the intake survey. This session was held in Kortrijk because a large proportion of the users willing to participate in this session were LeYLab panel members.

Before the field trial, a paid usability review was done by one of the original consortium partners of LeYLab, which can be seen as an instance of exploitation of its usability expertise, given that this partner was not involved in any other aspect of this case. After these preparatory research steps, a field trial was held with 40 testing households, which were selected from the intake survey and co-creation session. All testers received two feedback surveys during and after the field trial. The surveys revealed that user interest was low and that users especially were not willing to pay for the application; therefore, a separate field trial and co-creation session was conducted in a primary school situated in the LeYLab, because this setting was identified as a potential alternative market (Table 5).

The research carried out in this living lab case is a typical example of a company exploring the market potential, usability, and user reactions to a company's new offering. Because Prophets, an online marketing agency, lacked expertise and experience in the field of (digital) toys and consumer applications, they required an exploration of their envisioned market. A video with user reactions during the field trial was also made and put online as a tangible result of the research results. The test users could also keep the playing cards for the application, but the login accounts were suspended after a while and no additional feedback was requested from the test users. This winding-down of the field trial is related to a strategy shift regarding Poppidups. Prophets initially envisioned Poppidups as a business-to-consumer service, but based on the results of the field trial, the company decided to exploit the Poppidups service with a licensing model in a business-to-business setting.

Conclusion

In this article, we have considered living labs as innovation networks characterized by six defining elements: a natural setting, multiple stakeholders, multiple methods, a medium- to long-term view, user centricity, and some kind of living lab infrastructure. The potential of this living lab was put in practice by running innovation cases using this infrastructure. By means of an open innovation perspective, we analyzed the know-

Table 5. Open innovation processes in Case 3: Poppidups

Exploitation	Exploration	Retention
• paid usability expert review • Poppidups as license model to other companies	• exploration of market potential and user experience for new-to-the-company service • extra exploration by field trial in primary school	• some panel members from the LeYLab were active in co-creation and field trials • movie with user reactions as marketing tool

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ledge and technology transfers within three innovation cases in the LeYLab living lab. All three basic open innovation processes – exploitation, exploration and retention – occurred in the studied cases. Based on previous research (Almirall and Wareham, 2011; tinyurl.com/lrz3dg2), we expected that the exploration and exploitation processes would be balanced. However, they did not occur in equal amounts; the main processes from the case studies seem to be exploratory in nature. Stakeholders participating in a living lab want to access new knowledge in order to extend or optimize their technologies, services, or processes, or even policy in the case of the City of Kortrijk. Exploitation was less common and could be associated especially with consortium partners that act as providers of infrastructure and services, because the different cases allow them to exploit the assets they bring to the living lab. An unexpected result arose from the Cloud Friends case where an external utilizer of the living lab infrastructure started an innovation case for exploitation purposes. Smaller companies are confronted with the sharing paradox (Bogers, 2011; tinyurl.com/k6lwkyw), or the fact that in order to exploit their innovation, they have to (partly) reveal it to other companies who might "steal" the idea. However, Poppidups reached their goal without their ideas being stolen, but the actual exploiting of the innovation occurred outside of the living lab case. The Poppidups case also demonstrated a close interaction between the processes of exploration and exploitation, because the results of the exploration process led them to pursue an exploitation strategy rather than bringing their innovation to the market themselves. The retention process appeared to be the least frequent and could be mainly ascribed to the researchers who documented and disseminated their findings, including case-based findings as well as more general findings and adjustments to the methodological approach. These efforts can be reused in subsequent innovation cases running in the living lab, as was the case with Cloud Friends where, based on previous knowledge, an optimal selection of test users could be provided. There were also attempts to involve test users for a longer period of time for retention purposes, but the timeframe of our case study does not allow us to conclude anything regarding the success of this approach.

In general, these results suggest that running multiple innovation cases with a given set of test users and stakeholders with various external parties involved offers opportunities to accumulate knowledge and data over a longer period of time, which could benefit the stakeholders involved in the living lab as well as external parties. The model that was constructed out of the log files of the fibre infrastructure serves as a good example of this kind of knowledge retention and illustrates that not only the researchers should fuel the process of retention.

The sustainability of a given living lab is however a precondition to allow these retention processes. Because of the small amount of cases, this should be the subject of study in other living labs running over a longer period of time and having more cases to study.

An interesting solution in the case of the LeYLab was the exploitation of the living lab infrastructure in a large European project, which allowed the living lab to retain a minimal level of activity while trying to secure additional funding. Networking between living labs, as in this European project, is not only desirable for encouraging sustainability and fostering further retention processes, but would also facilitate the exploration and exploitation processes, such as assessments of technologies with larger user groups (as was the case with Poppidups) or external contacts in order to find a party for licensing or selling the innovation (as was the case with Cloud Friends). These living lab "suprastructures" might also be a fruitful avenue for further research.

From our study, a key takeaway can be abstracted for innovation managers and others involved in living labs: within living lab projects, it is possible to simultaneously improve a product or service and create a process of demand in envisioned use contexts and potential markets that confront real adoption barriers. This observation coincides with simultaneous processes of exploration and exploitation as suggested by Almirall and Wareham (2011; tinyurl.com/lrz3dg2), although it appears that living labs are particularly good for exploration purposes. However, living labs also hold a lot of potential in terms of retention of generated knowledge, especially when successive cases run on the same living lab infrastructures. Therefore, a clear thematic focus, a match between the innovations in development and the living lab infrastructure, and stakeholder goal alignment are factors that enhance the chance of knowledge being generated that can be re-used over time.

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