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The Evolution of Intermediary Activities

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The Evolution of Intermediary Activities: Broadening the Concept of Facilitation in Living Labs

Louna Hakkarainen and Sampsa Hyysalo

> *"It is hardly possible to overrate the value… of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar. … Such communication has always been… one of the primary sources of progress."*
>
> John Stuart Mill (1806–1873)
> In *Principles of Political Economy*

Innovation intermediaries play an important role in open innovation endeavours. In living lab projects, where different professional identities and organizational cultures are at play, intermediary actors facilitate learning between stakeholders and manage tensions and conflicts of interest. The current living lab literature recognizes the importance and multifacetedness of these actors, but does not shed light on the work they do at a more practical level. Our study seeks to capture the variety and evolution of work tasks of user-side innovation intermediaries during and after a four-year technology project in a living lab. The study explores how these mediating actors tackle the everyday challenges of a living lab project. This article is grounded on a longitudinal qualitative case study of a innovation process for a floor monitoring system for elderly care – the "smart floor".

Introduction

Living labs are real-life experimentation environments in which new products and services are given shape through collaborative efforts of users and developers. They aim to extend co-design and open innovation activities from mere concept design and ideation to design-in-use, which is often requisite for co-realizing the true value points of new technologies and services (Botero & Hyysalo, 2013; Hartswood et al., 2002; Hillgren et al., 2011; Hyysalo, 2010; Leminen et al., 2015; Voss et al., 2009).

The success of such real-life collaboration, which aims to promote learning between different stakeholders, hinges on how the co-design process has been orchestrated, facilitated, and managed. In discussions about living labs notions such as "quadruple helix" and "public–private–people partnerships" flag the issue prominently. However, research on collaboration dynamics in living labs remains nascent, and it seems that often the complex knowledge exchange tends to be taken for granted, overlooked, or simplified beyond what, for instance, the kind of guidance practitioners would benefit from the most.

This article on intermediation work in a living lab project is based on a longitudinal qualitative study of a four-year (2005–2009) living lab project that took place in four units of a large public nursing home in Finland. The data allows us to describe and analyze how the user-side innovation intermediaries facilitated learning between developers and users during a long-term co-design project. We focus on the intermediation work done by three living lab project workers, whose educational background was in nursing and elderly care. After the four-year living lab project, the developer company hired the key project worker as a customer

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care specialist. This made it possible to extend the scope of our research to a total of eight years and to include the after-market launch period, when the locally tailored product was "generified" to serve a widening clientele (Hyysalo, 2010; Pollock & Williams, 2008).

In order to address the variety of intermediation work in the case, we have turned to research on innovation intermediaries. Innovation intermediaries have been central in social learning processes in technological innovation (Stewart & Hyysalo, 2008; Williams et al., 2005). In innovation studies, these mediating actors have been studied for some time. Howells (2006) describes an innovation intermediary as "[a]n organization or body [or an individual] that acts an agent or broker in any aspect of the innovation process between two or more parties".

For a long time, research around the topic focused on supply-side actors, such as industry associations and knowledge-intensive business services, but lately, work has been done to highlight the significance of innovation intermediaries in the user-side activities and processes of social learning: "The highly visible supply-side intermediaries […] and the easily identifiable middle-ground agencies […] tend to overshadow the often more informal yet just as crucial intermediaries at the user-end of the supply-use relation. Intermediate users, local experts and 'tailors' facilitate, configure and broker systems, usages and knowledge about systems and their deployments, helping users to domesticate them and suppliers to respond to actual, realised uses." (Stewart & Hyysalo, 2008). Our present study focuses on the role of public sector user-side innovation intermediaries in a collaborative innovation process.

Theoretical Framework

Our understanding of living labs relies on findings from science and technology studies – especially around social learning (Hyysalo, 2009; Williams et al., 2005) and domestication of technology (Berger et al., 2006; Silverstone et al., 1992; Sørensen, 1996).

The social learning in technological innovation approach (Williams et al., 2005) grew out of research on the social shaping of innovation (MacKenzie & Wajcman, 1999; Williams & Edge, 1996). The concept of social learning places particular emphasis on the activity of the users during the appropriation of new technology and highlights the importance of simultaneously studying processes of design, implementation, and use. Social learning refers especially to two simultaneous, complementary, and intertwined processes: innofusion (Fleck, 1988) and domestication of technology (Sørensen, 1996). Innofusion (innovation that takes place during diffusion) refers to "processes of technological design, trial and exploration, in which user needs and requirements are discovered and incorporated in the course of the struggle to get the technology to work in useful ways, at the point of application" (Fleck, 1988). The concept of domestication has its origins in cultural consumption studies, and it refers to the work users go through in "fitting [technologies] into the pre-existing heterogeneous network of machines, systems, routines and culture" (Sørensen, 1996).

From these perspectives, we see living labs as a co-design infrastructures in which users' creativity around technology use and their efforts to fit technology to cultural, organizational, and material contexts become resources for product development. However, the potential of this kind of collaboration does not realize automatically, which is why we focus on the crucial work done by innovation intermediaries in living lab networks.

Innovation intermediaries

Stewart and Hyysalo (2008) define user-side innovation intermediaries as organizations or individuals that "attempt to configure the users, the context, the technology and the 'content', *but they do not, and cannot define and control use or the technology*". They are thus actors who seek to influence users and developers, but do not have final say over how the technology is eventually used (this is what users and managers at user organizations do) nor do they hold decision-making power, or necessary skills, to alter the form of the technology at the developer end.

In their seminal studies, Howells (2006) and Bessant and Rush (1995) have listed functions and bridging activities of innovation intermediaries (Box 1). Shortcomings of these kinds of listings are that they leave aside the common types of engagements that these actors are involved in during their "bridging activities".

Stewart and Hyysalo (2008) have attempted to move from a mere ordered list of functions to an analytically ordered set of concepts that describe how intermediaries act and what are the different facets of their work in innovation. They have recognized three user-side innovation intermediary roles with respect to social learning: facilitating, configuring, and brokering.

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Box 1. Functions and activities of innovation intermediaries

Intermediary functions (Howells, 2006)
1. Foresight and diagnostics
2. Scanning and information processing
3. Knowledge processing and (re)combination
4. Gatekeeping and brokering
5. Testing and validation
6. Accreditation
7. Validation and regulation resources; organizational development
8. Protecting the results
9. Commercialization
10. Evaluation of outcomes

Bridging activities (Bessant & Rush, 1995)
1. Articulation of needs; selection of options
2. Identification of needs; selection training
3. Creation of business cases
4. Communications; development
5. Education; links to external info
6. Project management; managing external resources; organizational development

Facilitating means providing opportunities to other *people,* by educating, gathering and distributing resources, influencing regulations, developing the local rules, and creating "spaces" for others to act. Configuring means material and symbolic alteration of *technology,* adjusting its form and content (often in minor ways), as well as how it is interpreted and used. Brokering refers to the establishing, nurturing, adjusting, and altering of *connections* between different actors. This work on connections is not just neutral bridging, but is often selective and occasionally self-serving to the position of the intermediary actor itself.

Intermediation work in living labs

In recent years, living labs also have been analyzed as innovation intermediaries (e.g., Almirall & Wareham, 2011; Baltes & Gard, 2010; Katzy et al., 2013). Almirall and Wareham (2011) define living labs as "[…] open innovation intermediaries that seek to mediate between users, research, public and private organisations, advance our concept of technology transfer by incorporating not only the user based experimentation, but also by engaging firms and public organisations in a process of learning and the creation of pre-commercial demand."

Some attempts have been made to shed light on the interaction dynamics inside living labs on a more detailed level. Such research has focused on communities of practice and boundary objects (Johansson & Snis, 2011), living lab actors' roles and role patterns (Nyström et al., 2014; Box 2), living lab networks' modes of coordination and participation (Leminen, 2013), functions and roles of public open innovation intermediaries (Bakici et al., 2013), strategic capabilities of living labs (Katzy et al., 2013), paradoxical tensions in living labs (Leminen et al., 2015), complexity in the stakeholder interactions (Pade-Khene et al., 2013), and possibilities of social and cognitive translation between stakeholders (Svensson & Ebbesson, 2010). Part of this work has been attempts to also identify the roles of intermediary actors in living labs (Heikkinen et al., 2007; Nyström et al., 2014; see Box 2).

Although helpful in gaining a sense of what functions actors perform in collaborative innovation, empirically derived listings and classifications bear close similarity to previous empirically derived listings of innovation intermediaries such as those of Howells (2006) or Bessant and Rush (1995) (see Box 1).

Gregor (2002) has characterized such listings as "naming theory", the most rudimentary form of theory within a research domain, a stepping stone on which more analytically ordered typologies and gradually more explanatory theory building can take place. One of the steps needed to move beyond naming and answering simple "what" questions is to conduct empirical studies that expose the situatedness and context-specific aspects of the innovation process and can shed light on "how" questions. This is important also for gaining practical sense of what works (Gregor, 2002; Woolrych et al., 2011)

Thus, with regard to actor roles in living labs, further work is called for, particularly in two respects. First, there is a need to empirically gain better specificity in what kinds of engagements the roles relate to. The current lists of actor roles by Nyström and colleagues (2014) have been derived from multiple projects and multiple different actors and beg for further clarification, as do the contents of the different roles. Furthermore, only some of the roles are present in different projects and, at that, different *phases* of projects. Existing analysis of processes of intermediation in or by living labs address the systemic or organizational level, but fail to describe in detail how individuals tackle the challenges posed by everyday life in living labs.

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Box 2. Identified actor roles

Previously identified actor roles (Heikkinen et al., 2007)

1. Webber: Acts as the initiator; decides on potential actors
2. Instigator: Influences actors' decision-making processes
3. Gatekeeper: Possesses resources
4. Advocate: Background role; distributes information externally
5. Producer: Contributes to the development process
6. Planner: Participates in development processes; input in the form of intangible resources
7. Accessory provider: Self-motivated to promote its products, services, and expertise

Newly identified roles (specific to living labs) (Nyström et al., 2014)

8. Coordinator: Coordinates a group of participants
9. Builder: Establishes and promotes the emergence of close relationships between various participants in the living lab
10. Messenger: Forwards and disseminates information in the living lab network
11. Facilitator: Offers resources for the use of the network
12. Orchestrator: Guides and supports the network's activities and continuation; tries to establish trust in the network to boost collaboration to further the living lab's goals
13. Integrator: Integrates heterogeneous knowledge, development ideas, technologies, or outputs of different living lab actors into a functional entity
14. Informant: Brings users' knowledge, understanding, and opinions to the living lab
15. Tester: Tests innovation in (customers') real-life environments (e.g., hospitals, student restaurants, and classrooms)
16. Contributor: Collaborates intensively with the other actors in the network to develop new products, services, processes, or technologies
17. Co-creator: The user co-designs a service, product, or process together with the company's R&D team and the other living lab actors.

Second, although the more detailed empirical examination of roles and their prevalence in actual living lab projects is in order, the research on actor roles in living labs would also benefit from seeking to move beyond mere naming towards better understanding of the interrelations of different roles, as was done with innovation intermediaries previously (Stewart & Hyysalo, 2008). Our focus on living lab facilitators happens to reside within the broader notion of innovation intermediary, and hence we shall examine whether our previously developed typology of configuring, brokering, and facilitating would be fit for further organizing the findings in the present article.

Research Approach

Our work enriches the previous research by focusing on the innovation intermediaries' work on the level of tasks and activities. We map the evolution of the intermediation work during and after the living lab project, covering almost eight years' time on the biography of the maturing artefact.

The study continues an analysis started in licentiate study by Hakkarainen (2013) and continued during the follow-up phase of study (Hakkarainen & Hyysalo, 2013; Hyysalo & Hakkarainen, 2014). The living lab project workers documented nearly all the collaboration meetings held with different assemblies over the course of the four-year project. In addition to memos, the data included project reports, plans, and marketing material – altogether 151 different documents related to the development and use of the "smart floor", which we describe later in the article. The overall number of qualitative in-depth interviews is 21: 16 during the living lab project and five after it. Four of the latter interviews were conducted with the developer company's sales manager and customer care specialist (who was previously a living lab project worker), and one was conducted with the customer care specialist alone. The last interview was conducted after the both interviewees had quit working for the company.

The units of analysis are *intermediary activities and tasks* of the living lab project personnel. By task, we

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mean an organized set of actions that can be either a one-time effort or a repeated pattern in the practices of the mediating personnel – in any case, a set of actions that formed a mutually recognized whole by both the mediating personnel and their colleagues (Strauss, 1993).

The coded tasks were ordered chronologically and reorganized under higher-level activities. The result of the analysis were 31 different tasks, which were categorized under 13 activities. The results were organized in a matrix (see Table 4) that shows how the activities and tasks evolved over time in different phases of the innovation process.

The smart floor innovation process has been divided in four phases (Figure 1). The division is based on empirical work done by Van de Ven and colleagues (1999) on innovation journeys and by Pollock and Williams (2008) on biographies of artefacts as well as process dynamics observed in the study by Hakkarainen (2013). Each transition represents significant changes in the innovation network as well as in the smart floor artefact.

In the final step of the analysis, we structured the tasks according to facilitating, configuring, and brokering (Stewart & Hyysalo, 2008) to see if there are changes in the broader-level orientation of the intermediaries in the course of the innovation project.

Case Study: A Smart Floor System

The origins of smart floor system are in the Helsinki University of Technology (now Aalto University), where the motion-tracking technique behind it was discovered in the early 1990s. Years later, a group of researchers and students created the first version of the smart floor – a simple floor monitoring system – and a company was founded around it in 2005. The idea for creating a gerontechnological device originally came from the user side: a well networked, innovation-oriented nursing home manager became aware of the discovery and encouraged the engineers to advance the technique into a system for elderly care.

The technology was next developed in an enabler-driven living lab (Leminen et al., 2012), which was established in 2006 as part of Helsinki Living Lab, an early member of the European Network of Living Labs. The lab focused on a large public nursing home. The public-sector actors were the initiators of the collaboration and were also responsible for applying funding and hiring of the project personnel that acted as innovation intermediaries. The nursing home manager later became the head of the innovation undertaking, wherein the smart floor was one of the four sub-projects. The main stakeholders of the project are presented in the Figure 2. The number of project workers varied between two and three fulltime workers in different stages of the project.

The smart floor system – the outcome of the collaboration – consists of a sensor foil, which is installed under the flooring material; a user interface, which is accessed on a computer situated in the office; and cell phones, which the nurses carry with them during their work shifts. The movements of the residents generate alerts, which the nurses receive through the cell phones. The system can inform the nurses about, for example, a situation where a frail elderly person is getting out of bed, entering or leaving the room, entering the toilet, or occupying the toilet for an unusually long time. The alarms are tailored individually to each person.

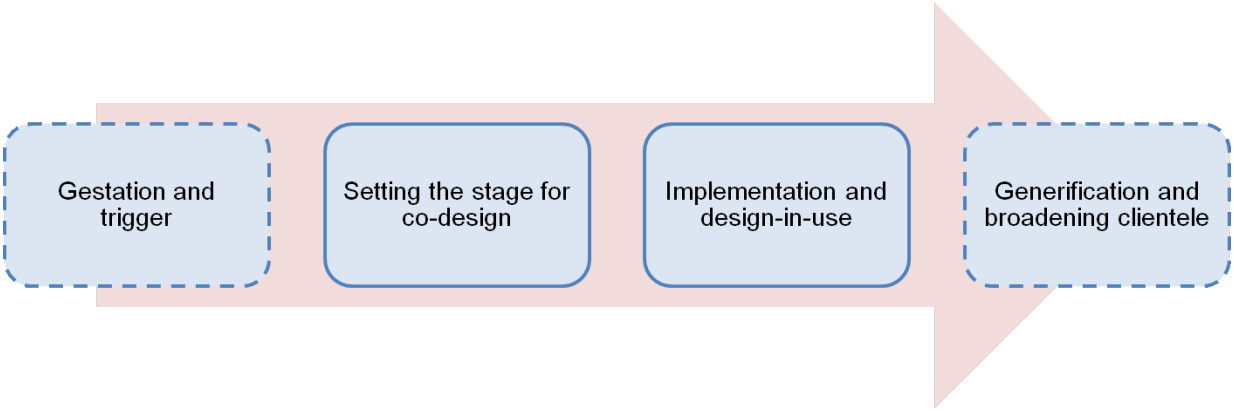

Figure 1. Phases of the smart floor innovation process

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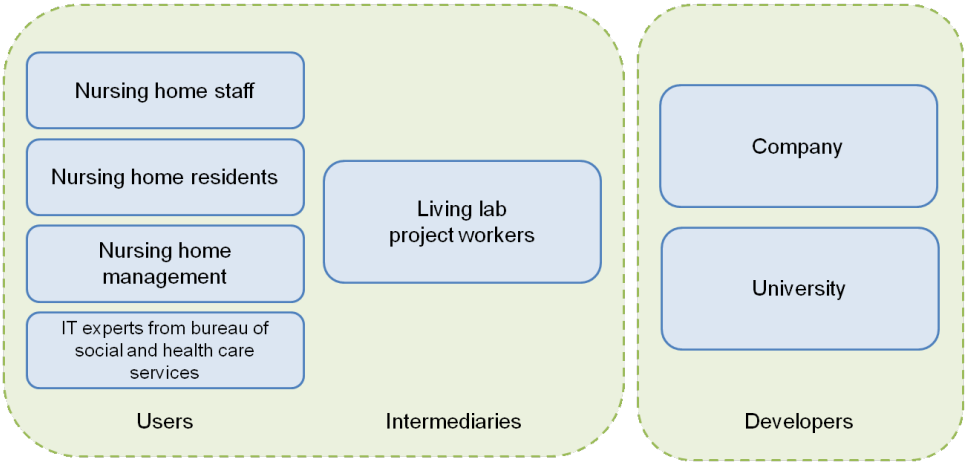

Figure 2. Stakeholders in the smart floor living lab

Setting the stage for co-design

Technology development was not the purpose of the collaboration project from the beginning. The initial plan was to explore ways to efficiently utilize the smart floor technology in the everyday life of the nursing home. However, due to the immaturity of the product, the focus of the collaboration changed to technology development.

The project workers had background in care work and, during the first months of the project, they participated in regular care duties in the units. This meant that the project workers had a profound understanding of the users, their work practices, and the context of use. However, they were not familiar with formal co-design or participatory design methods.

The collaboration started officially with a workshop in which the intermediaries, developers, and care workers defined the first user requirements for the system. After this, the information exchanges took place mostly in regular meetings. The project workers could organize the collaboration as they saw best, and the goals and methods were reassessed regularly and adjusted to the needs of the project.

The project was formally divided in two sub-projects: the main purpose of the first part was to test the smart floor in two rooms and to develop it further, especially by fixing technical bugs and getting rid of false alarms, so that the second part, a larger-scale implementation, was possible. The project workers had significant responsibility in diagnosing and weeding out technical problems.

From the beginning, the engineers and the nursing home staff and management – project workers included – had strongly differing understandings about the maturity of the product and each other's roles in the collaboration. The company was in a hurry to launch their product, but from the users' perspective, the smart floor was not even ready for the test implementation. The client – as represented by nursing home staff and project workers – was frustrated with the functioning of the system and severity of its bugs; they saw the engineers as arrogant and indifferent to the welfare of the residents and nursing home staff. The developers, for their part, saw the users' requests as unreasonable and unrealistically scheduled. The goal of the company was to create a generic product instead of a tailored system, and they were sceptical about the representativeness of the client's demands.

Finally, the nursing home management and project workers refused to proceed with the implementation unless their demands were met. At the end of 2007, two out of three members of the living lab project staff – including the project manager and project co-ordinator – resigned, as did technology company's CEO, bringing the whole undertaking to the verge of collapse.

A summary of intermediary activities and tasks in the first phase is presented in Table 1.

Implementation and design-in-use

Changes in staff eased the tensions, and the collaboration continued, after the developers, two project workers (one newly hired), and management of the nursing home found common ground prior to the implementa-

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Table 1. Intermediary activities and tasks in the stage-setting phase

Activity	Task	
Technical tinkering	Diagnosing and fixing bugs with the engineers	C
	Taking part in the installation and testing	C
Co-designing	Defining preliminary user requirements with the users	C
	Formulating project plan and choosing methods of collaboration	C/B
	Documenting the co-design process	F
User research	Studying the users, their work, and context of use	F
Advocating	Communicating the user perspective to the developers	B
	Pressuring the developers to realize users' wishes	B

C = Configuration; F = Facilitation; B = Brokering

tion phase. At the end of 2007, the smart floor was installed in two rooms as a pilot and then rolled out to three other units (each with around 20 residents), where the sensor foil was installed in all the rooms and public spaces.

The hiring of a new project worker was pivotal for the new consensus. At this point, the project management had better understanding of the requirements of the intermediary position. This time, they were looking for an independent and innovative negotiator, someone who would be technology-oriented and able to change perspectives when needed. In a delicate situation, the project workers needed to convince different stakeholders of each other's good intentions, recognize shared interests, and react quickly to changing circumstances. Nevertheless, they had to be practical enough to push through the demanding implementation phase and support the care workers by taking part in the regular care duties.

The implementation phase invoked a new kind of division between the living lab project stakeholders: many of the end-users – the nursing home staff – reacted negatively to the smart floor. The nursing staff was unwilling to study new things alongside their normal workload or to change their work routines. Their job was demanding enough on its own. In addition, the nurses saw themselves as caregivers, not machinists, and were generally reserved about complex gerontechnological devices. Many care workers boycotted the project and the system, for example, by not carrying cell phones with them during their shift and continuing to work as they used to. Pushing forward with the rollout of the system required developers, project workers, and nursing home management to ally themselves against the care personnel, among who many were reluctant to put the system to use let alone participate in its improvement and to make the use of the system. Attendance at the feedback meetings was made obligatory for the nurses.

During the implementation, the strict discipline was counterbalanced by the devotion of the project workers, who were also care professionals by education. They spent time in the living lab units on a daily basis and helped the nurses in the implementation of the system, even occasionally assisting them with normal care duties. The weekly (later monthly) feedback meetings provided the care personnel an opportunity to speak out, comment on the system, and express new development ideas. The project workers and the nurses discussed how the system had been utilized, what its benefits were, and how it affected the care practices and the elderly people. This feedback was complemented by observing the smart floor's daily use, which the project workers valued as the most important way to collect information for the improvement of the system. Their background as care workers helped them to make sense of the daily work in the units, which was needed because the burden of developing the system further was placed on their shoulders. The project workers ob-

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served use, identified problems and solutions with the engineers, and thought of ways to utilize different functionalities and properties of the system with the care personnel. Another important area was how the system should be used in order to produce optimal results: for example, how to determine the right mix of alarms for each resident, how the system affects elderly people in the long term, and what should be done when a nurse receives overlapping alarms. They also had to think about the challenges that the living lab project created, for example, what practical actions to take when the system does not work the way it is supposed to.

In addition, the project workers were active in planning, organizing, and executing effectiveness research of the impact of the smart floor on, for example, resident safety and nursing work. The work was done primarily for the client (the City of Helsinki), but the results were highly valuable for the company as well. Later in the project, the project workers were also active in showcasing the system and the project to numerous potential customers from all over the world.

A summary of intermediary activities and tasks in the design-in-use phase is presented in Table 2.

After the living lab project: Generification and broadening the clientele

In the course of the living lab project, the startup company had merged with an established electronics company. When the living lab project was coming to an end, the company hired, as a customer care specialist, the key project worker – the one that had started in the middle of the project and who managed to turn the confrontation into fruitful cooperation.

After the market launch of the product, the clientele of the company grew, and new contextual problems arose, for example, in new buildings where the concrete was more humid and disrupted the normal functioning of the system. There were also minor differences in work practices at different institutions, which required some changes to the system.

From the onset, the company adopted a tailoring strategy, which meant that the system was customized to each customer organization's needs. After a while, this strategy was found to be unviable, and a more generic product was needed. Hence, the company sought to repackage its offering as a more standard product and servicing, where the customer care services, that previously were offered freely, were billed separately.

The customer care specialist organized user training and took care of the customer concerns, but she also continued to participate in the R&D activities by collecting user feedback, ideating improvements in the system, and networking with potential partners. She acted as a link between the customers and the company, and for this reason she had a very realistic understanding of the customers' reactions, concerns, and preferences. Her technical know-how, which had accumulated during the living lab project, allowed her to participate actively in the technical installation, testing, and problem solving in new client organizations. She also had credibility and the ability to consult management of the client organizations in renewing their care practices in order to get the biggest benefit out of the system.

Committing the client organizations to the use of the system remained as one of the biggest challenges for the company. The use of a complex system such as the smart floor can easily degenerate in new client organizations, because the end users and mid-level managers are usually not the ones making the purchasing decision.

The customer care specialist also participated in the marketing and sales negotiations. Because of a shared professional identity, she was able to ally herself with the client organization and even make some critical comments if the sales manager's pitch was too direct.

In 2013, the company was sold once more and the sales manager was laid off. At this point, the customer care specialist also decided to resign, because she was expected to assume the sales manager's responsibilities in addition to her existing responsibilities. By the start of 2016, the smart floor had become a stable product in the market and it has been installed in over 2000 apartments, mostly in northern Europe.

A summary of intermediary activities and tasks in the design-in-use phase is presented in Table 3.

Evolution of Intermediary Activities

The mapping of the responsibilities of the project personnel shows how intermediary activities and tasks are spread out through the course of the innovation process, and how they continue and change along with the project (see Table 4). Above all, it reveals the diversity of responsibilities undertaken by the intermediary actors.

The most intensive engagement took place at the implementation and design-in-use phase, during which the

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Table 2. Intermediary activities and tasks in the design-in-use phase

Activity	Task	
Technical tinkering	Diagnosing and fixing bugs with the engineers	C
	Documenting technical problems and false alarms with the users	C/F
Co-designing	Formulating project plan and choosing methods of collaboration	C/B
	Documenting the co-design process	F
	Collecting, filtering, and transferring end users' ideas to the developers	B
	Coming up with development ideas and evaluating them with the users	C/F
User research	Studying the users, their work, and context of use	F
	Observing use and spotting usability problems	F
Advocating	Communicating the user perspective to the developers	B
	Pressuring the developers to realize users' wishes	B
Developing work practices	Developing new work practices which the system supports	C
User training	Creating and carrying out a training program for the users	F
Implementing	Making and carrying out an implementation plan	C
	Supporting users during the implementation phase	F
Developing uses	Discovering optimal ways to use the system with the users	C/F
	Defining codes of conduct for problematic situations with the users	C
	Encouraging the users to actively discover new ways to utilize the system	F
Studying effectiveness	Planning and carrying out studies to assess the effectiveness of the system	F/B
	Documenting the benefits of the system with the users	F/B
	Evaluating how the system affects the residents with the users	F/B
Negotiating	Recognizing and mediating interests of different stakeholder groups	B
	Pushing the end users and mid-level managers to use the system	B
	Building trust with the users	B
Marketing and sales	Demonstrating the system to potential customers	B
Customer service	Receiving and resolving customer concerns	B

C = Configuration; F = Facilitation; B = Brokering

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Table 3. Intermediary activities and tasks after the living lab phase

Activity	Task	
Technical tinkering	Diagnosing and fixing bugs with the engineers	C
	Taking part in the installation and testing	C
Co-designing	Collecting, filtering and transferring end users' ideas to the developers	B
	Coming up with development ideas and evaluating them with the users	C/F
User research	Observing use and spotting usability problems	F
Advocating	Communicating the user perspective to the developers	B
Developing work practices	Developing new work practices which the system supports	C
User training	Creating and carrying out a training program for the users	F
	Assessing the need for user training	F
	Monitoring the use of the system	C/F
Negotiating	Pushing the end users and mid-level managers to use the system	B
	Building trust with the users	B
Networking	Negotiating finance and partners for the R&D activities	B
Marketing and sales	Demonstrating the system to potential customers	B
	Taking part in sales negotiations	B
Customer service	Receiving and resolving customer concerns	B

C = Configuration; F = Facilitation; B = Brokering

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Table 4. Evolution of intermediary tasks and activities

Activity	Task	I	II	III
Technical tinkering	Diagnosing and fixing bugs with the engineers	C	C	C
	Taking part in the installation and testing	C		C
	Documenting technical problems and false alarms with the users		C/F	
Co-designing	Defining preliminary user requirements with the users	C		
	Formulating project plan and choosing methods of collaboration	C/B	C/B	
	Documenting the co-design process	F	F	
	Collecting, filtering and transferring end users' ideas to the developers		B	B
	Coming up with development ideas and evaluating them with the users		C/F	C/F
User research	Studying the users, their work, and context of use	F	F	
	Observing use and spotting usability problems		F	F
Advocating	Communicating the user perspective to the developers	B	B	B
	Pressuring the developers to realize users' wishes	B	B	
Developing work practices	Developing new work practices which the system supports		C	C
User training	Creating and carrying out a training program for the users		F	F
	Assessing the need for user training			F
Carrying out implementation	Making and carrying out an implementation plan		C	
	Supporting users during the implementation phase		F	
	Monitoring the use of the system			C/F
Developing uses	Discovering optimal ways to use the system with the users		C/F	
	Defining codes of conduct for problematic situations with the users		C	
	Encouraging the users to actively discover new ways to utilize the system		F	
Studying effectiveness	Planning and carrying out studies to assess the effectiveness of the system		F/B	
	Documenting the benefits of the system with the users		F/B	
	Evaluating how the system affects the residents with the users		F/B	
Negotiating	Recognizing and mediating interests of different stakeholder groups		B	
	Pushing the end users and mid-level managers to use the system		B	B
	Building trust with the users		B	B
Networking	Negotiating finance and partners for the R&D activities			B
Marketing and sales	Demonstrating the system to potential customers		B	B
	Taking part in sales negotiations			B
Customer service	Receiving and resolving customer concerns		B	B

I = Setting the stage for co-design; II = Implementation and design-in-use; III = After the living lab project

C = Configuration; F = Facilitation; B = Brokering

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largest number of tasks were performed. The case history underscores, however, that despite fewer tasks in other phases, they are equally crucial for success: effective collaboration in the design-in-use phase requires great effort, and achieving the goal of a profitable, widely applicable technology after the living lab phase was equally crucial for the innovation projects' success.

With respect to our analysis considering facilitation, configuring, and brokering, we can see three patterns emerging: i) all three engagements are quite evenly distributed in the first part of the living lab project; ii) the design-in-use phase is dominated by facilitation and brokering; and iii) brokering played the most important role after the project.

The three types of engagement do indeed appear to characterize the tasks of living lab intermediaries – none of these more abstracted roles appear redundant or absent. They underscore how the common way to denote such people as living lab "facilitators" seems to be a misleading way to characterize what such people do as innovation intermediaries: this role comprises only one third of their engagements and is strongest only in the design-in-use phase of collaborative innovation in living lab. Without a longitudinal perspective that reaches beyond the design-in-use phase, the illusion of the centrality of facilitation would prevail in our data as well.

Conclusions

Our study shows that the nature of intermediation in living lab projects cannot be reduced to facilitation. Intermediation work in a living lab project consists of a range of tasks, including configuring of technology and use practices, brokering contacts and interactions between different actors, as well as facilitating their work, learning, and interactions. Furthermore, the content and form of intermediary work evolves in the course of successful living lab project. Altogether, we recognized the intermediaries participating in 13 different intermediary activities and 31 tasks. Engagements that are typically thought of as "facilitating" comprise only a third of what these mediating personnel need to handle and comprise the most common form of engagement only in the phase after implementation, when design-in-use efforts are most active.

Previous research has approached the topic of intermediation in living labs mostly through cross-case comparisons of multiple organizations participating in multiple projects and networks (e.g., Heikkinen et al., 2007; Nyström et al., 2012). Because of this approach, the granularity of the findings has remained coarse and has resulted in "naming theory" of identifying lists of "actor roles". Following Gregor's (2002) framework for theory development, this is the most rudimentary form of theory in a given area that merely answers "what" questions. In the present article, we have shown how moving to longitudinal in-depth case studies of particular projects conducted in living labs helps to reveal process descriptions and answer "how" questions: both how living lab projects are shaped over time and how actor roles play out. This approach offers a richer understanding of the tasks and actions of particular actors as well as how they evolve over the course of an innovation project, allowing us to further connect living lab actor roles to wider theoretical development within innovation studies on innovation intermediaries (Bessant & Rush, 1995; Howells, 2006; Stewart & Hyysalo, 2008), as well as in-depth process studies on innovation (e.g., Hyysalo, 2010; Van de Ven et al., 1999; Williams & Edge, 1996; Williams et al., 2005).

Considering the pivotal role that the intermediary actors play in open innovation processes, such as those using living labs, we are surprised how under-researched the topic is to date. Recent living lab research has actively focused on the network composition and different methods that are used in living labs, but we want to highlight the importance of focusing, in detail, on the active engagements between different stakeholder groups and between people and technology.

The complexity of the intermediary work also reveals important practical insights for living labs: in a real-life context with multiple stakeholders, the direction of the innovation and challenges the project has to face are very difficult to predict. Thus, the capability of intermediaries to adjust their role and actions to changing circumstances is essential. This view holds implications for the recruitment of employees to living lab projects and for the management of living lab activities. Intermediaries hired in a living lab project need to engage in technical configuration and substance issues of the user domain, and not only in the brokering and facilitating tasks. Our study also lends support to the findings by Nyström and colleagues (2014) regarding the need for role ambidexterity, temporality, and multiplicity – an actor's capability to flexibly change, create, adjust, and adapt to roles with respect to the evolving network structure as well the ability to hold multiple roles at the same time.

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