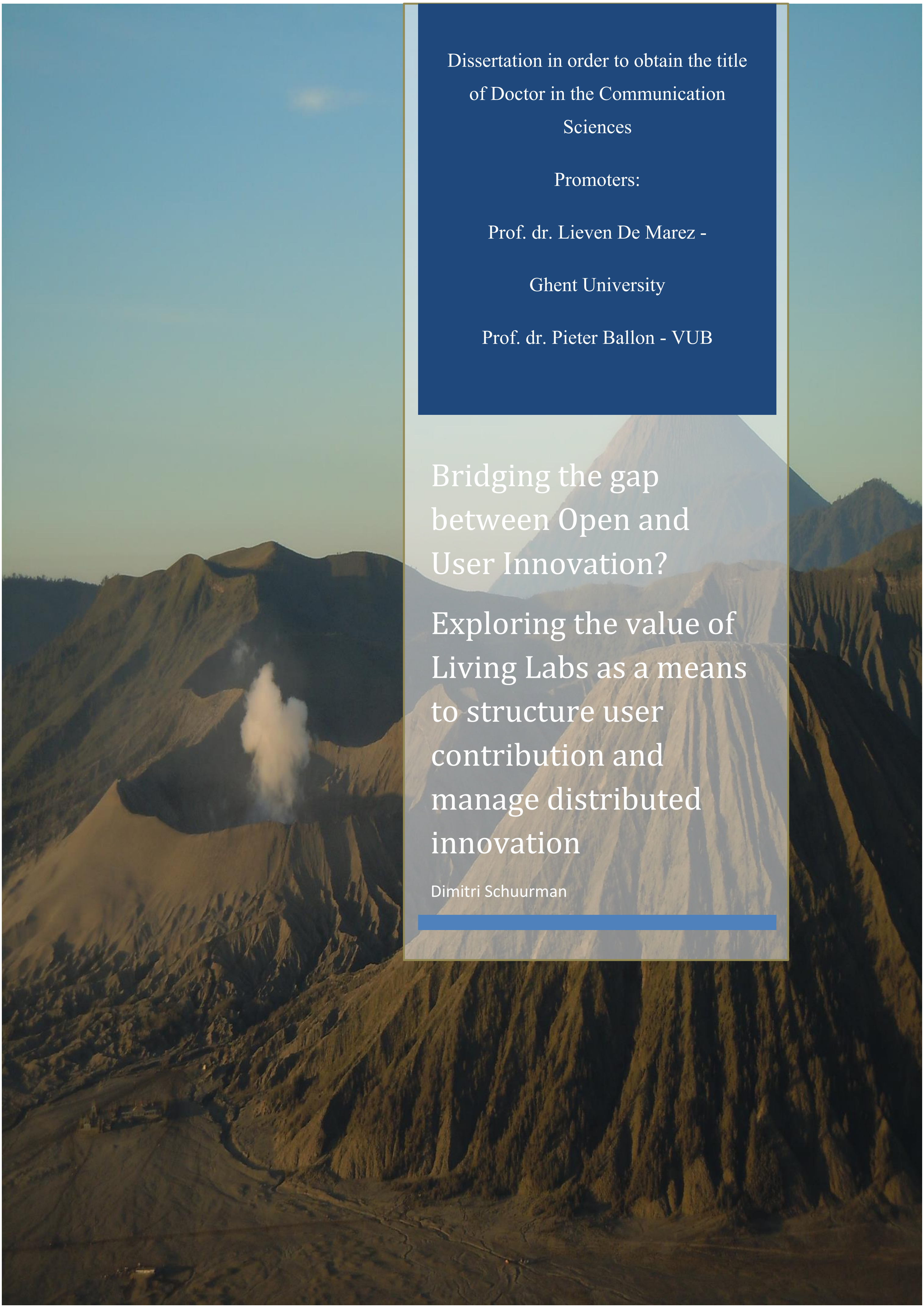

Dissertation in order to obtain the title of Doctor in the Communication Sciences

Promoters:

Prof. dr. Lieven De Marez - Ghent University

Prof. dr. Pieter Ballon - VUB

Bridging the gap between Open and User Innovation?

Exploring the value of Living Labs as a means to structure user contribution and manage distributed innovation

Dimitri Schuurman

Contents

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1. INTRODUCTION

Ever since the industrial revolution started near the end of the 18th century, and especially with the advent of the so-called Fordism at the beginning of the 20th century, the dominant production and innovation logic aimed at vertical integration within the boundaries of a firm or company (Chandler, 1962). Only near the end of the 20th century, in terms of innovation, this dominant view was challenged in favor of a more distributed view. This 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 for knowledge and technology to complement internal assets. This shift in the dominant mode of innovation not only required organizations 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 (Lakhani & Panetta, 2007). In academic theory, this shift has already taken place, but in practice, a lot of companies and innovation practitioners are still struggling with the concrete implementation of strategies to cope with these distributed innovation processes (Chiaroni et al., 2011). Within this PhD, we will look at a specific approach, promoted and supported by the European Commission, that tries to facilitate and manage distributed innovation processes through a Public-Private-People partnership with a central role for the end-user: Living Labs. Following Almirall and Wareham (2011) and Leminen et al. (2014), we define **Living Labs** as an organized approach (as opposed to an ad hoc approach) to innovation consisting of **real-life experimentation** and **active user involvement** by means of **different methods** involving multiple stakeholders, as is implied in the **Public-Private-People** character of Living Labs. Regarding these Living Labs, we take the European Network of Living Labs (ENoLL) as starting point with a self reported 345 affiliated member Living Labs[1]. However, studies have indicated that Living Labs as a concept have been used to identify a (too) wide variety of approaches and projects (Shamsi, 2008), are used interchangeably to refer to different aspects of Living Labs (Følstad, 2008; Dutilleul et al., 2010), and are not backed up by a consistent research stream or supporting theories (Eriksson et al., 2005; Schaffers & Kulkki, 2007; Ståhlbröst & Bergvall-Kåreborn, 2008; Westerlund & Leminen, 2014). Therefore, our first goal is to critically assess the Living Lab concept and situate the emergence of Living Labs practice within this more general shift towards distributed innovation, as we see this shift as the starting point and underlying phenomenon of most of the more established innovation theories.

[1] http://www.openlivinglabs.eu/

Basically, there are two distinct modes of distributed innovation differing in terms of the nature of the external input. First, firms (innovators) can rely on external actors/parties to supply **knowledge** that serves as an input for the creation of their own innovations. For example, firms can collaborate with a research group from university to gain new technological insights to incorporate in new products. Second, firms can also rely on external actors/parties to supply **innovations** that are used or commercialized by them. For example, firms can license the innovative new product or service from a start-up company in order to bring it to the market under the buying firm's brand name.

A lot of research has been devoted to the study of these distributed innovation processes, such as the literature on innovation networks (Klerkx & Leeuwis, 2009), innovation clusters and systems (Smits & Kuhlmann, 2004), systemic innovation (Wieczorek & Hekkert, 2012), or the resource-based view of the firm (Wernerfelt, 1984). However, following Bogers and West (2012), we will focus on two major research streams that study the phenomenon of distributed innovation each from a different perspective. The **Open Innovation** paradigm takes the firm's perspective and examines the financial benefits of engaging in distributed innovation (Chesbrough, 2003; West & Bogers, 2013). In contrast, the **User Innovation** stream looks at distributed innovation processes from the perspective of the user (von Hippel, 1976; 2009). The focus of the analysis lies mainly on the circumstances in which users innovate themselves or can have a valuable contribution in innovation. Although these perspectives seem perfectly compatible with each other, the occasions where they explicitly come together remain sparse, with the case of user entrepreneurs, where users innovate and decide to commercialize their innovation themselves (Shah & Tripsas, 2007), as a rare example. Therefore, extending the first research goal, within this PhD we will **explore whether Living Labs relate to these two literature streams that build further upon and can be situated within the larger domain of distributed innovation.**

As a distributed innovation process deals with different inputs from different actors being used in innovation, two basic innovation modes can be distinguished: cumulative innovation and co-creation. **Cumulative innovation** is a specific form of distributed innovation where business and/or individual users incrementally improve upon the work of producers and other users (Murray & O'Mahony, 2007). This form of innovation often takes place in the context of a radically new innovation that is being refined to become useful (Nuvolari, 2004). A prototypical example of cumulative innovation is the smartphone, a device that is incrementally enhanced with additional features and functionalities originating from different companies and innovators (e.g. different sensors, touchscreen, battery,…). A fundamentally different mode of innovation is the act of **co-creation**. The innovation process is no longer seen from a single-inventor perspective or a serial-single-inventor perspective (cumulative innovation) but considers innovation as the collaborative development of two or more actors. This process involves knowledge inflows and outflows between complementary partners, including horizontal and vertical alliances (Bogers et al., 2010). Through the multi-stakeholder character of Living Labs aimed at innovation development through active user involvement, Levén and Holmström (2012) regard co-creation as the core value creating activity between the public, private and people stakeholders. **Therefore, within this PhD, we focus on co-creation as a central process in Living Labs.**

Moreover, we also regard co-creation as a link between the Open and User Innovation perspectives, as beyond creating product innovation, co-creation is also used to point out to other activities where shared value creation takes place between two or more actors (Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004). Within the context of distributed innovation, the process of co-creation can be seen as a bridge between the Open and User Innovation perspectives when this occurs between users and firms. For firms, co-creation is a strategy for them to tap into user innovativeness and to extend their own knowledge base, whereas users engage in co-creation to better satisfy their own needs, to influence the innovation process, but also out of intrinsic motivations (Kristensson et al., 2008). A classic example of co-creation can be found with the company Netflix who involved end-users in the search for a better algorithm for their recommendation engine by means of an innovation contest, resulting in a 10% gain[2]. However, the winning solution was never fully implemented, as by the time the innovation contest ended, the underlying technology of Netflix had already evolved which made the winning solution redundant. This example also demonstrates the need for methods and tools that optimize the generated value both for the manufacturing company as for the participating users. The following figure shows how we position Living Labs against the more established theories on distributed innovation. Next to investigating whether Living Labs are an emanation of User and Open Innovation, we will also assess whether Living Labs can play a role in bridging the gap between Open and User Innovation through the act of co-creation.

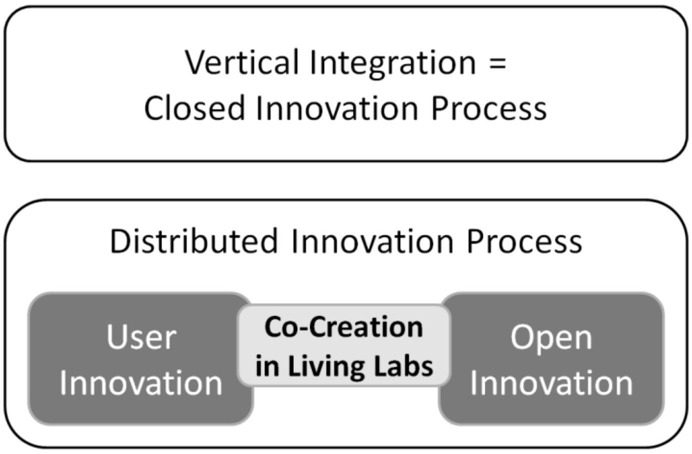

Figure 1 Positioning Living Labs amongst innovation paradigms

[2] http://www.innovationexcellence.com/blog/2012/04/23/innovation-lessons-from-the-outcome-of-the-netflix-prize/

The attention towards co-creation as an important value-creating activity within the innovation process came in parallel with more emphasis on the role of the end-user in the different stages of the innovation process. From a social sciences point of view, around the turn of the century the role of the user was predominantly studied after the market introduction of an innovation with the adoption diffusion (Rogers, 1962) and domestication (Silverstone & Haddon, 1996) paradigms looking into the adoption process of end-users. However, the distributed nature of innovation also calls for an extension of this kind of user research during the development process of an innovation. Moreover, within this distributed view on innovation processes, the creation, transformation and integration of knowledge from different sources into innovation became a crucial element. This also required different approaches with regards to innovation management and innovation conceptualization, but also better ways of capturing user feedback and generating user contributions, which calls for a connection between management and business oriented research on the one hand and social sciences and user research on the other. Moreover, next to some widely cited success stories, there are as many failed or defunct user involvement initiatives (e.g. the Philips leaduser.nl site that was launched with a lot of noise, but disappeared silently[3], numerous examples where crowdsourcing led to disastrous consequences for the initiators[4], or the 3M Lead User case[5] which was successful but eventually resulted in the Lead User programme being abandoned because it was too costly,…). A major criticism on User Innovation literature is the absence of a more encompassing and structuring framework for (lead) user involvement, while tending to focus on successful case studies only (Trott et al., 2013). **Therefore, within this PhD we will assess whether Living Labs have value as structuring mechanism for user involvement in innovation development.**

Dealing with distributed innovation processes has manifested itself on different levels, which also led to different areas of research. When multiple actors engage in Open Innovation in order to establish connections between the demand and supply side of the knowledge infrastructure, these constellations are referred to as innovation networks (Klerkx & Leeuwis, 2009). These innovation networks operate in larger innovation systems. These innovation systems are defined as all parts and aspects of an economic structure, together with the institutional set-up affecting learning, searching and exploring, which includes the production, marketing and finance system, and they manifest themselves in national or regional innovation systems, sectorial innovation systems, and technological innovation systems (Wieczorek & Hekkert, 2012). Research into these overarching innovation systems looks into the relationships and impact of the different actors involved in these systems, including users, producers, intermediary organizations and supportive organizations (Smits & Kuhlmann, 2004). Some authors have focused on the peculiarities of national and regional

[3] http://www.emerce.nl/nieuws/philips-experimenteert-met-consumentgeleide-innovatie
[4] http://www.businessinsider.com/the-5-most-entertaining-crowdsourcing-disasters-2009-9?op=1&IR=T
[5] https://hbr.org/1999/09/creating-breakthroughs-at-3m

innovation systems, trying to link economic success with organizational aspects of distributed innovation, such as the success of German SMEs (Sternberg, 1999), knowledge dynamics of Silicon Valley as entrepreneurial region (Brown & Duguid, 2000) or the innovation systems of the Nordic clusters (Asheim & Coenen, 2005). Where these studies focused on the relationship between private actors and policy makers, other authors have taken a more 'macro' perspective, looking into the role of other knowledge institutions within the innovation system. Especially the evolving role of the university in technology and knowledge transfers has been the subject of debate and analysis, resulting in the so-called Triple Helix model (Leydesdorff & Etzkowitz, 1996). The Triple Helix conceptualizes innovation as inherently dynamic and driven by various forces interacting with each other (Etzkowitz & Leydesdorff, 2000). An overview of the research in the field of industry-university links and relationships can be found in the work of Perkmann and Walsh (2007). This research stream is also closely connected to the European policy level, considering Europe as an innovation system in which systemic instruments are created and stimulated by means of European policy measures to cope with systemic failures and imbalances.

One of the imbalances that has received a significant amount of attention is the so-called **'European Paradox'** or the gap between research leadership and the commercial success of innovation (European Commission, 1995; Dosi et al., 2006). Almirall and Wareham (2011) rephrased this 'European Paradox' in terms of Open Innovation concepts and stated that Europe scores high in terms of research (= exploration), but underperforms in terms of market success (= exploitation). In order to overcome this paradox, several initiatives were started at the European policy level, among which Living Labs (Bergvall-Kåreborn et al., 2009). In the 1990s the concept of Living Labs already appeared in academic discussions, but this policy support by the European Commission in 2006, stimulating projects to advance, coordinate and promote a common European innovation system based on Living Labs, provided a boost to Living Lab practice (Dutilleul et al., 2010). The most noteworthy policy support came with the establishment of the European Network of Living Labs (ENoLL), an organization aimed at connecting Living Labs for knowledge exchange, networking purposes and the development of a shared innovation concept with to date, according to their website, 345 Living Labs being linked to the ENoLL, mainly in Europe but also in the rest of the world (European Commission, 2013b).

With 2006 as the starting point of the European Living Lab movement, **we will also assess whether Living Labs have value in potentially solving this European Paradox** in their role as systemic instruments operating in the European innovation system.

However, some recent developments and studies do not paint on overtly positive picture regarding the influence of Living Labs within the European innovation system. First, when looking at recent statistics both the EU and the US showed a similar growth in R&D

investments in 2012, but the US economy reached twice as much growth in sales and more than three times as much growth in profit than companies in the EU (European Commission, 2013a). This difference is especially pronounced in the sectors that are highly R&D intense, such as the Information and Communication Technology (ICT) sector. When taking this sector into account, there is a big gap between Europe and the US: while in the US more than one third of total R&D investments are in the ICT industry, for the EU this is less than one sixth (European Commission, 2013a). However, at the same time, the European countries together filed more patents than the US, although Asian countries outperformed both in terms of the growth rate of patents filed (European Patent Office, 2013). These developments are regarded by Europe as alarming, as the ICT industry is such a fast growing industry and ICT innovations have the potential to increase efficiency and are fundamental to other industries and society (INSEAD eLab, 2013). One reason for this is the very heterogeneous market in Europe with local differences in culture and consumer behavior. Additionally, research has indicated that public measures to support innovation collaboration between SMEs and external technology providers such as universities and large resource intensive companies should not be uniformed and need to be adapted to the practice of knowledge management of local firms (Liu, 2013). Moreover, despite a positive evolution (European Commission, 2013a), there still is a lack of cooperation between large resource intensive companies and small entrepreneurial companies, mostly because this type of collaboration is difficult due to the unequal and asymmetrical power relations (Vanhaverbeke et al., 2012; Laperche & Liu, 2013). Generally, there is a low amount of interaction between companies and a common physical or virtual place to meet innovation partners is lacking. Especially small companies face barriers to innovate, as financing models such as venture capitalism and business angels are less prevalent in Europe, concerns about intellectual property (IP) protection remain, and a common culture and identity that could counterbalance these barriers is not in place (European Commission, 2013b). **This indicates there still is a need for measures and instruments within the European innovation system to overcome these barriers to innovation for European companies that create a bridge between knowledge and market.** Living Labs are still explicitly regarded as potential solutions (European Commission, 2013b; Curley & Salmelin, 2013), but the fact that almost a decade of Living Lab activity all over Europe does not seem to have had a significant impact, is not a positive sign.

When looking at the general evolution of Living Labs practice as well as theory, we can distinguish two issues. First, there is also an indication in terms of practice that Living Labs have passed their initial hype. There is a remarkable trend when we analyze the growth of ENoLL during the eight waves since its inception (cf. chapter 5) which is depicted in the following graphic on the growth of the network.

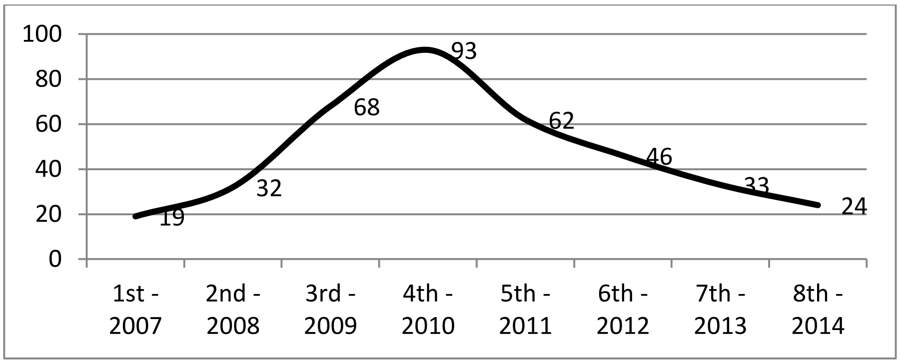

Figure 2 : Evolution of ENoLL Living Labs entries

From 2011 onwards, the number of new Living Labs entering the ENoLL starts to drop. Moreover, based on a high level analysis of all ENoLL affiliated members carried out in January-February 2014 (cf. chapter 5), it appears that 40% of all Living Labs is currently inactive. This indicates that the Living Lab-concept has passed its *peak of inflated expectations*, when talking in terms of Gartner's hype cycle, and is now entering the *through of disillusionment* (Fenn & Linden, 2000). Crossing this 'chasm' towards the so-called *slope of enlightenment* and *plateau of productivity* is currently a major challenge for Living Labs, and this ironically shows a lot of parallels with the more general challenge for innovations in today's ICT environment (Moore, 1999; De Marez, 2006), as Living Labs can be regarded as a means for innovations to overcome this chasm. The fact that more than 40% of the ENoLL Living Labs is currently inactive also raises questions regarding the sustainability of the concept. Moreover, this analysis also revealed that in terms of scope, approach and thematic focus, there is a (too) large variety among the ENoLL Living Labs[6], which also resonates with available research into Living Labs that illustrate their conceptual unclarity (Eriksson et al., 2005; Schaffers & Kulkki, 2007; Shamsi, 2008; Følstad, 2008; Ståhlbröst & Bergvall-Kåreborn, 2008; Dutilleul et al., 2010; Westerlund & Leminen, 2014). This is another indication that there is a **need to investigate the current state-of-the-art in terms of Living Labs practice**.

Second, there are also issues regarding Living Labs on the level of theory and research. A Google Scholar search query for "Living Lab" shows more than 6.500 entries (in October 2014), there are separate Living Lab tracks being held at established conferences such as the International Society of Product and Innovation Management[7] (ISPIM) and at the European Academy of Management[8] (EURAM), and some academic journals have devoted special issues to the topic of Living Labs such as the Electronic Journal of Virtual Organisations, Technology Innovation Management Review[9] and the International Journal of Product

[6] http://openlivinglabs.eu/livinglabs
[7] http://ispim.org/groups-communities/living-labs/
[8] http://www.euram2013.com/userfiles/file/33_3_Living_Labs.pdf
[9] See http://timreview.ca/article/601 and http://timreview.ca/article/739

Development[10]. This indicates a lot of research activity, but when we look at the graph below, there seems to be a lack of academic impact among these publications (cf. chapter 6).

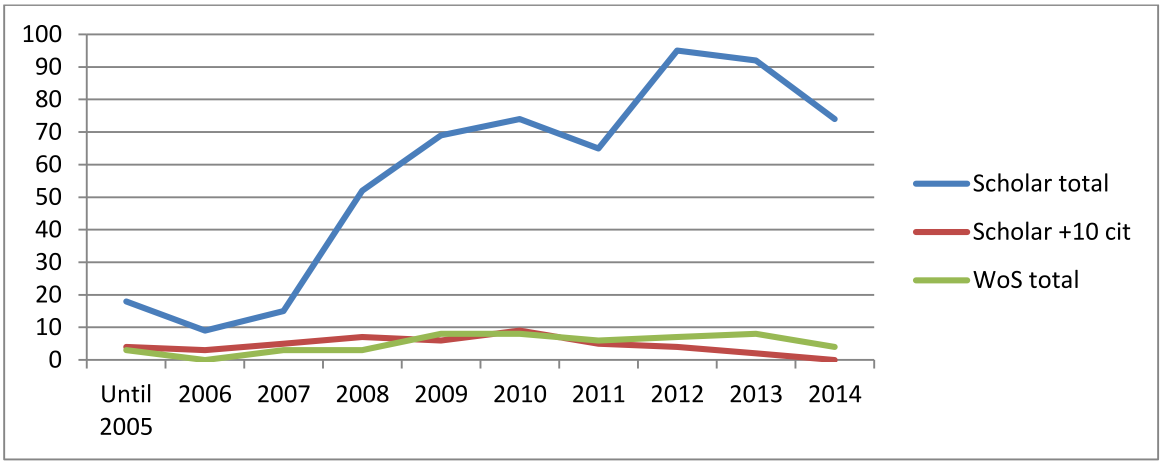

Figure 3: Evolution of Living Labs papers

We see that the total number of articles on Living Labs witnessed a strong increase since 2006, the birth year of ENoLL. However, if we look at the red curve, which indicates the number of articles with more than 10 citations, there are no signs of an increase, with no single year producing more than 10 of these articles, and with a total of only 45 articles having more than 10 citations. These articles will constitute our sample of papers to be studied in chapter 6. For the entries with "Living Lab" in the title in the Web of Science-database, the situation looks similar, with only 50 articles in total being abstracted in this database. Moreover, when we look at the citation count of these 50 papers, only 2 have more than 10 citations (cf. chapter 6). This suggests that there is a lack of reference works and influential papers in highly ranked journals, something which was also suggested in the foreword of the special issue in the International Journal of Product Development (Katzy et al., 2012). Moreover, Katzy et al. (2013) indicate that there is a lack of research into the measurement of the efficiency of Living Lab processes and structures, and that this kind of research would be needed in order to legitimate the (EU) research budget that has been used to stimulate the establishment of Living Labs, and also for potential modifications of the concept. This stresses the **need for a clear and encompassing model that allows to conceptualize Living Labs** and at the same time link and embed them within existing, more established innovation theories.

Therefore, within this PhD, we wish to tackle the two main problems associated with Living Labs that can be deducted from the above. A **first problem**, in terms of Living Lab *practice* and activity, is that there seem to be too many initiatives, without enough noticeable results or impact. Moreover, there is a remarkable decline in the growth of the number of active labs, as well as no clear picture of the current activity level of the previously established Living

[10] http://www.inderscience.com/info/inarticletoc.php?jcode=ijpd&year=2012&vol=17&issue=1/2

Labs. The large amount of Living Labs also does not seem to have a consistent *modus operandi* and shows a (too) broad diversity of approaches and thematic goals, all without a clear picture of the added value they generate. This is linked to the **second problem**, dealing with Living Labs *theory*. To this date, there have been a lot of Living Lab publications, but there is no consistency in terms of connection to larger research paradigms and frameworks, and there is a lack of papers with a significant academic impact as well as research clearly illustrating their (added) value. Living Labs have been recognized as an interesting phenomenon, but they have not been able to find a true connection within the various academic disciplines and fields. Moreover, in this introductory chapter we also witnessed that the connection and relation between different distributed innovation paradigms remains problematic.

Thus, the focal point of this PhD thesis is framing the Living Labs phenomenon within a broader evolution of innovation management dealing with distributed innovation by engaging in User and Open Innovation practices, with specific attention for the role of Information and Communication Technologies (ICT) as they have played the dual role of enabler of these evolutions as well as being the subject of studies looking into these phenomena. We will explore their potential value as bridge between Open and User Innovation, as structure and governance mechanism for user involvement, and as part of the solution for this 'European paradox'. In order to facilitate this, and taking into account the apparent conceptual diversity and unclarity from which Living Labs still suffer almost a decade after the initial European support for the concept, we also propose to develop an analytical lens that is capable of clearly distinguishing and delineating the different elements of which compose Living Labs. We iterate the basic elements that constitute a Living Lab: an organized multi-stakeholder approach to innovation (facilitating university-industry relationships, but also relationships between large companies and SMEs, start-ups, entrepreneurs, and, last but not least, involving the end-users themselves, commonly referred to as public-private-people partnerships) (Westerlund & Leminen, 2011), based on co-creation, including active user involvement and experimentation in real-life settings.

Summarizing, within this PhD we want to approach the Living Labs phenomenon from both a **practice-based** and a **theoretical** perspective, which leads to four main research goals we wish to pursue.

First, from a theoretical perspective, we will investigate whether Living Labs relate to more established innovation theories. Therefore, we will review the literature on Open and User Innovation and gather relevant research concepts and frameworks for Living Labs. We will do this in order to assess whether Living Labs are an embodiment of both literature streams, and whether they are also a potential source for empirical research that is able to advance both paradigms. We will also investigate the current Living Labs literature and look whether these concepts and frameworks are already present in the current body of research.

Second, from a practice perspective, we want to explore the emergence and current state-of-the-art within the Living Labs field, and draw up a more clear picture regarding the apparent diversity of approaches and practices, and regarding the current activity level of the ENoLL Living Lab initiatives.

Third, based on the apparent diversity of Living Lab approaches and the conceptual unclarity regarding the different elements that constitute a Living Lab, we want to compose a general Living Lab framework that allows to clearly define Living Labs and that is consistent with the previous two research goals.

Fourth, we want to assess the (potential) value a Living Lab can generate for the three identified problems and gaps in the literature:

1. whether they can play a positive role in solving the 'European Paradox';
2. whether they are able to govern and structure user involvement and user contribution for innovation;
3. whether they might help closing the gap between Open and User Innovation.

All of the chapters are linked to these four research goals. Chapters 2, 3 and 4 form part I of this PhD thesis and deal with a focused overview of innovation studies and theories. This is needed to tackle research goal one, as we need research concepts and frameworks to study the Living Labs phenomenon and to make a connection with more established fields and research streams. First (chapter 2) we will give an overview of the conceptualization of innovation and the evolving visions on innovation management, culminating in a distributed view on innovation. We will also deal with the social sciences perspective on innovation and the role of ICT in this chapter, as these evolutions ran partly in parallel and had a mutual influence on each other, and this also clarifies our research interest and relevance as social scientists. We chose to make this chapter rather extensively in order to clarify the bigger picture of distributed innovation and the various challenges and academic discussions this has triggered in terms of innovation management and innovation conceptualization. In the following two chapters, we look into the two main theoretical paradigms that have emerged to study distributed innovation, albeit from an initially different perspective: Open and User Innovation. We will discuss the literature and abstract relevant concepts and frameworks in order to conceptualize Living Labs and to guide the empirical analysis in chapter 7.

The following three chapters form part II of this PhD and deal with Living Labs, the subject of this thesis. We start part II with a resume of the used methodology and research approach in the next chapters in order to clarify the research design and the empirical data that was used for the analyses. Chapter 5 deals with the second research contribution, as this chapter looks into the Living Labs phenomenon from a practice perspective. We dig into the history of the concept, look into the more practice-based definitions and conceptualizations, and trace the roots and predecessors of the current European Living Labs movement, which appears to be firmly entangled with the European policy level. Subsequently, we explore the rich diversity of Living Lab initiatives gathered under the banner of the European Network of Living Labs (ENoLL), a very important organization for the Living Labs movement, and draw up a current state-of-the-art regarding the active Living Labs in the network, which will unveil some of the current issues and caveats associated with a lot of contemporary Living Labs. Next, we specifically zoom in on the ICT Living Labs in the network and perform a four-way segmentation, which illustrates the rich diversity of approaches and practices within the Living Labs phenomenon, the connection to the predecessors and also a new type of Living Lab approach, but also the shortcomings associated with an analysis on this level.

In chapter 6, we deal with the third research goal as we look into the academic literature that has followed this enthusiastic adoption of Living Labs practice. Therefore, we construct a sample of the most cited Living Labs papers. Within this sample we analyze the used definitions of Living Labs, and assess whether the selected concepts and frameworks from Open and User Innovation have found their way in the current Living Labs literature. Based on the inconsistency with regards to the levels of analysis within the literature, we will construct our own conceptual model of Living Labs, taking into account three different, but interrelated levels of analysis, that are linked to the concepts and frameworks abstracted from the Open and User Innovation literature (Research goal 3).

In the final chapter of the second part (chapter 7), we use our own model of Living Labs and the associated concepts and frameworks from Open and User Innovation to analyze a sample of 4 Living Lab constellations, 21 Living Lab innovation projects and 107 methodological research steps. We start this chapter by giving an overview of the establishment, evolution and decline of the different Flemish (ICT) Living Labs that evolved around iMinds. We analyze the stakeholder roles and the value that was generated by the Living Lab constellation (macro-level), and look into the network paradoxes that occur. We continue our analysis on the meso and micro level by doing a comparative case study analysis of 21 Living Lab projects that ran within these Flemish Living Labs. This three level approach, zooming in on the Flemish Living Lab activity, allows to test and validate the key concepts and models from both the Open and User Innovation frameworks (research goal 1), as well as putting the developed models and definitions into practice (research goal 3). Based on these analyses, we assess the value that was generated by the Living Lab for the different stakeholders on these three levels, and whether the studied cases show potential solutions for the European Paradox and for structuring user contribution in distributed innovation processes (research goal 4.1 & 4.2).

In the final chapter 8, we summarize the main conclusions and result from this PhD thesis and reflect upon the contributions for the literature on Open and User Innovation (research goal 4.3), and for Living Labs theory and practice. Therefore, we also translate these insights and findings into concrete, actionable guidelines and lessons learned for Living Lab practitioners.

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I. INNOVATION THEORY

2. INNOVATION MANAGEMENT FOR DISTRIBUTED INNOVATION

Within this chapter, we will dig deeper into the nature and different conceptualizations of innovation and innovation management framed within the evolution towards distributed innovation. We will do this rather comprehensively as we want to situate our position as social scientist among the more management oriented innovation theories, which will allow to illustrate a lot of parallels further on in this PhD. We believe this will give the necessary context to understand the shift that has been made from user research post launch, over user research pre launch to (continuous) active user involvement. Moreover, this chapter contains a lot of concepts and ideas that show parallels with the main innovation theories we use within this PhD which allow to grasp the bigger picture. We feel that this helps to clarify the emergence of a distributed view on innovation which lies at the core of both the Open and User Innovation paradigms.

We start by looking at the innovation process from a social sciences perspective and expand on how post-launch user research was extended to user involvement during the entire innovation process. We will also argue that the evolving visions and approaches towards innovation and innovation management are rooted within a general shift from closed innovation towards distributed innovation. Precisely these evolutions have paved the way for more open and collaborative innovation approaches that are able to identify and connect distributed sources of knowledge, such as Living Labs. This way, we set the scene for the next two chapters dealing with two separate paradigms originating from this distributed notion of innovation and containing essential concepts and frameworks to investigate and describe Living Labs: Open and User Innovation.

2.1 ICT & innovation

The importance of innovation can hardly be overstated, as according to many the innovation process is the main engine of sustainable economic growth (Tidd & Bessant, 2013). Innovation is seen as 'general salvage' when companies or even entire economies can no longer compete on cost. One of the pioneers in this field is without any doubt Joseph Schumpeter who already in 1942 stated that: "[…] the fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forces of industrial organization that capitalist enterprise creates." This is also reflected in the well-established

OECD policy knowledge, which categorizes the world economies in three stages: from a critical, pre-industrial, basis in natural resources to cheap labor in industrial mass production to the innovation based stage (Katzy, 2005). Innovation has changed the business world and has practically become a prerequisite for long-term success, both commercially as societal (Braun & Herstatt, 2009). Ughanwa and Baker (1989) found that a decline in product innovation generally leads to a decline in market share. Moreover, technological change and innovation have become important factors in economic and policy debates. Marinova and Phillimore (2003) argue that the qualitative nature of socio-economic changes induced by innovation also translates into quantitative measures, such as increased company turnover, profits, market shares, exports and GDP. This argument is also reflected in the belief that renewed investments in innovation are necessary to counter the European crisis and to help the European economy recover (EIB, 2013). The European investments in Living Labs can be seen as an example of this strategy, which will be dealt with starting from chapter 5. The increasing importance of innovation for companies can also be witnessed in the Capgemini Consulting's Global Innovation Survey (2012) among 260 innovation managers where 43% indicated that there was an appointed innovation manager or chief innovation executive in their company, an increase with 10% compared to the 2010 survey. Also, 76% of the executives participating in this survey indicated that innovation was one of their top three priorities of their organization.

Three important environmental factors influence innovation and innovation success: the speed at which innovations are introduced has increased (shorter time-to-market), the intensity of competition has increased in some industries due to unexpected competitors (e.g. Spotify in music industry), and the increased availability and accessibility of information (Klokgieters & Chu, 2013). Therefore, they conclude that adapting to these fluctuating environmental factors is becoming more and more a prerequisite for companies to survive. How to cope with these differing circumstances will be dealt with later on in this chapter while discussing the different approaches towards innovation management. We will start by looking into the causes of the three mentioned environmental factors, influencing the innovation approach.

We believe this can be linked to the increased importance and the novel opportunities of information and communications technology (ICT). First, ICT has been a main driver in spreading knowledge worldwide among a variety of different actors as these technologies have dissolved a lot of time- and place-based bonds (Hendriks, 1999), which also led to increased globalization and a far reaching process of digitization (Antonelli et al., 2000). Second, these factors have in turn intensified competition by fostering convergence and dissolving bonds between previously separate markets (e.g. telecommunications providers versus content creators) which causes the shortening of the innovations' life cycles (Poiesz & Van Raaij, 2002; Lee et al., 2012). This has also led to new possibilities and alternative business models, resulting in intensified competition from unexpected competitors (Tidd & Bessant, 2013). Third, as it is necessary to accumulate and develop a wide variety of relevant knowledge to come to innovation (Dicken, 1998), ICT has also revolutionized and fostered knowledge transfers and increased the innovation possibilities for companies. This has also increased the notion of distributed innovation (Antonelli et al., 2000; cf. infra).

Paradoxically, the ICT-industry itself is one of the sectors where innovation currently plays a key role (Flew, 2002). The effects of ICT itself have induced a flood of innovations, causing a so-called 'innovation spiral' (Poiesz & Van Raaij, 2002). This ICT 'innovation spiral' leaves consumers with a 'too much, too soon'-feeling, resulting in a lot of failed ICT innovations, but with companies responding to these failures by introducing even more (incremental) innovations (Slater & Mohr, 2006; De Marez, 2006). This has induced scholars to research this duality between success and failure in the history of ICT-innovation, which Frissen and van Lieshout (2006) consider a constant battle between enormous market failures and spectacular innovations radically altering everyday routines. Another reason why ICTs are a 'special case' when studying the diffusion of innovations, is the role of network externalities (Katz & Shapiro, 1986) which means that for every extra adopter, the value of adoption increases, which leads to the fact that if a critical mass of adopters is achieved, universal adoption will occur, otherwise, the technology is likely to be abandoned (Markus, 1987). When going through the above, we can conclude that ICT is both an enabler and facilitator of innovation, but also heavily dependent on innovation and therefore a heavily studied subject of innovation studies. As we will discuss further on in this PhD, ICT also played an important role in the genesis of the Living Labs movement, as the social experiments with ICT, cooperative design with the implementation of ICT in the workplace, and the digital cities were European predecessors that laid the foundations. Moreover, a lot of the ENoLL Living Labs specifically deal with ICT innovation (Følstad, 2008), and in our empirical work in chapter 5 (Living Labs segmentation) and chapter 7 (case study analysis of Flemish Living Lab constellations and projects), we focus exclusively on ICT-related Living Labs. In the next section, we will look at innovation studies from a social sciences perspective.

2.2 Adoption diffusion versus use diffusion

When looking at ICT for residential markets as the subject of innovation studies, we can discern two major paradigms linked to a social/communication sciences perspective that are used to study ICT-innovation and which offer different views on the post-development stage of innovation: the **diffusion of innovations** and the **social shaping** of innovations, also sometimes referred to as 'use diffusion'.

The paradigm with the longest and broadest research tradition is the so-called 'diffusion of innovations'-framework (Mahajan et al., 2000). Founding father of this paradigm is Everett

Rogers, who formulated the main elements of his classical model in the following definition of his subject of study: the innovation, which is communicated through certain channels over time among members of a social system (Rogers, 1962). The most well-established generalizations of adoption diffusion-theory include (cf. Rogers, 2003; Fichman, 1992):

- Innovations have certain characteristics that ultimately determine the rate and pattern of adoption.

- Some potential adopters are more innovative than others and can be identified by personal characteristics.

- The adoption decision is conceptualized as a series of stages.

- The actions of certain individuals can influence the adoption decision of others.

- The diffusion curve is S-shaped because of a slow take-off, followed by a strong increase once the 'tipping point' is reached, and then saturating at a certain market level, causing a declining growth again.

This can be summarized in the assumption that the diffusion of innovations in a social system always follows a bell-shaped, normal distribution where five adopter-categories (innovators, early adopters, early majority, late majority and laggards) can successively be distinguished with fixed segment sizes (Rogers, 2003). When plotted in terms of market share, the bell-shaped curve takes an S-shaped pattern.

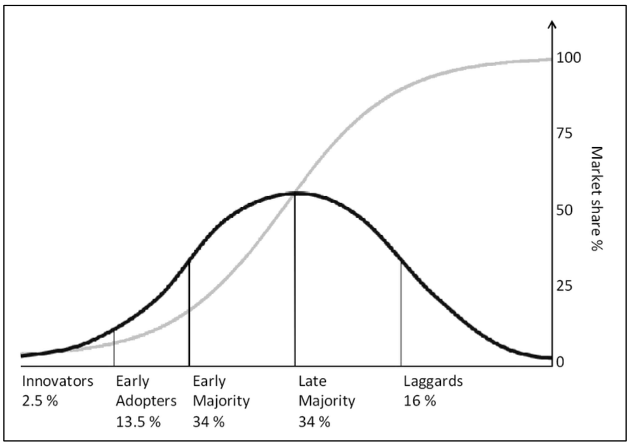

Figure 4: The Rogers curve, retrieved at http://upload.wikimedia.org/wikipedia/commons/thumb/1/ 11/Diffusion_of_ideas.svg/2000px-Diffusion_of_ideas.svg.png

Rogers himself formulated three main criticisms with regards to this original framework: the lack of a process orientation, a pro-innovation bias, and a psychological orientation (Rogers, 2003). This stimulated further research challenging some of the initial assumptions. For instance, it was argued that the percentage of adopters for the five categories is innovation specific (Mahajan et al., 2000), and the S-shape of the innovation curve was also challenged (cf. e.g. Geroski, 2000). In the case of ICT-innovation, this led to De Marez (2006) proposing and validating a methodology for estimating the size of the adopter segments for specific ICT-innovations, the so-called Product Specific Adoption Potential (PSAP)-scale (cf. also De Marez & Verleye, 2004). For ICT-innovation, the assumptions of classical diffusion research are most likely to hold when adoption is individual (and not organizational), and in the case of independent use of technologies that impose a small knowledge burden on would-be adopters (Fichman, 1992).

However, since the 1980s other criticisms such as the technological deterministic nature of this paradigm (‘technology shapes society’) and the lack of attention to the eventual usage of the innovation have led to the rise of a second stream of research: the so-called ‘domestication’ of innovations (Robertson, 1984; Silverstone & Haddon, 1996). This research tradition originated mainly in Europe with Roger Silverstone as an important author and ran in parallel with the social experiments and the digital city initiatives (cf. infra, chapter 5). This perspective is closely related to the ‘social shaping of technology’-paradigm which shifted attention away from the traditional deterministic approaches which took for granted the character and direction of technological advance (Bijker & Law, 1992; Williams & Edge, 1996). Instead, ‘social shaping’ refers to the way the usage of innovations in households is being socially negotiated, looking into the content of technology and the processes involved in innovation (Verdegem et al., 2009; Van den Broeck et al., 2004; Silverstone & Haddon, 1996). This paradigm shift challenged the view on technology as an independent variable influencing society, and looked at things the other way round, seeing society as a major influence for technology development. Within this context we can situate the ‘domestication’ research tradition. Building further on its metaphorical foundations, ‘domestication’ can be described as the process of ‘house training’ the ‘wild’ technological objects. Domestication deals with the cultural, social and technological networks of the everyday life of households. The meanings and significance of all our media and information products depend on the participation of the user (Silverstone, 1996). Domestication researchers look for the integration of technologies in the daily patterns, structures and values of its users, as by adapting or ‘taming’ the innovative, ‘savage’ technological objects, users integrate them within everyday routines and practices, granting them a ‘natural’ place in their micro-social context. Within this domestication-process, social factors (e.g. class, gender, culture or even lifestyle) are seen as shaping factors for ICT-innovation by some authors (Haddon, 2006; Van den Broeck et al., 2004; Verdegem et al., 2009). Four phases describe the concept of domestication: appropriation, objectification, incorporation and conversion.

1) **Appropriation**: When a technology leaves the world of commodity it is appropriated. Then it can be taken by an individual or a household and owned. From this perspective appropriation stands for the whole process of consumption as well as for that moment at which an object crosses the threshold between the formal and the moral economics (Miller, 1988).

2) **Objectification**: this is expressed in usage but also in psychical dispositions of objects in the spatial environment of the home (living room). It is also expressed in the construction as the environment as such. All technologies have the potential to be appropriated into an aesthetic environment. Many are purchased as much for their appearance of the home as for their functional significance.

3) **Incorporation**: The ways in which objects, especially technologies are used. Technologies are functional. They may be bought with other features in mind and indeed serve other cultural purposes in appropriation. They may indeed become functional in ways somewhat removed from the intentions of designers or marketers. Technologies also may have many functions.

4) **Conversion**: defines the relationship between the household and the outside world. It may happen that technologies pass the household confines and claims itself and it members in the 'wider society'.

Compared to the 'diffusion of innovations'-research, the focus shifted to more in-depth qualitative research that tried to assess the way people shaped technologies into their daily lives, such as ethnographic studies to capture contextual factors. This way, the 'domestication' research stream was initially rooted within a social deterministic point of view (Jankowski et al., 2001). This resulted in these two research traditions, 'domestication' versus 'diffusion of innovations', for a long time being considered as competing with each other and even opposite in terms of conceptual foundations.

However, as is the case in most dichotomous academic disputes, eventually a 'middle way' was suggested between the quantitative, technological deterministic 'diffusion of innovations' and the qualitative, social deterministic 'domestication' by scholars who argued that both can be seen as complementing each other (Boczkowski, 2004). Instead of thinking in terms of technological determinism or social shaping, the 'mutual shaping' or 'interactionism'-approach appeared in the late 1990s as a dynamic middle path between the two previous linear deterministic predecessors (Punie, 2000). This approach allowed to combine both the adoption diffusion and use diffusion perspectives, as the 'diffusion of innovations' looks into the adoption process, while 'domestication' further researches what happens after adoption takes place. This mutual shaping refers to the fact that technology has an influence on society, but that society also has an influence on technology, a stance that is seen as dominating new media and ICT research (Lievrouw & Livingstone, 2002). This interactionist approach led scholars to see the use diffusion-process as an essential complement to adoption diffusion-studies, completing the whole picture of the innovation process, something which is even more relevant in the case of complex and rapidly evolving consumer technologies (Robertson & Gatignon, 1986; Shih & Venkatesh, 2004). Interestingly, **at this point Living Labs were already seen as an opportunity to study this mutual shaping and reshaping of technology and society** (Frissen & van Lieshout, 2006). However, afterwards Living Labs largely disappeared from the discourse of social scientists, whereas this dialectical approach, which considers the development and diffusion of (ICT-) innovations as 'joint processes of technological construction and societal adoption', is more or less taken for granted in both adoption diffusion and domestication research (Lievrouw & Livingstone, 2002; Boczkowski, 2004). An example of the convergence between both is the use diffusion measurement model for consumer durables with multiple applications developed by Shih and Venkatesh (2004). They ground their fourfold typology, including intense, specialized, non-specialized and limited users, on the evolving nature of usage (rate and variety of use), sustained continuous usage or disadoption, and technology outcome considerations. The two key dimensions on which the typology of users is based consist of variety of use, for what purposes the technology is used, and rate of use, the time spent using the technology for a given purpose. These two dimensions, divided dichotomously into 'high' versus 'low'-categories, offer a fourfold typology when combined with each other that enables to measure the use diffusion of innovation in a quantitative way.

However, if we consider the innovation process, the discussed paradigms and frameworks look at the post-development phase of (ICT-)innovations. How are they diffused, adopted and implemented in the daily routines? What influence and impact do they have on society, and how do societal factors impact their adoption and embedding in daily routines? The insight that technology and society mutually shape each other, requires a broader look into the innovation process and the role of the end-user. As society can influence technology development, the role of the end-user has to be taken into account in the development stages of innovation as well. Moreover, as both influence one another, this paves the way for a more iterative, non-linear research approach regarding innovation, as both technological developments and breakthroughs, as well as societal changes and constellations play a role. This had an impact on both a macro level (innovation policy) as on a micro level (innovation management in companies). The **cooperative design movement** and **social experiments** that will be discussed in chapter 5 are examples of practice-based examples of this evolution. Therefore, we conclude that on a societal-economic level, as well as on a scientific level, more attention and emphasis were devoted to (ICT-) innovation development, the phases before market launch. This notion originates from the domestication scholars, who proposed design and domestication as two sides of the innovation coin, where "[d]omestication is anticipated in design and design is completed in domestication" (Silverstone & Haddon, 1996). They see domestication and design as acts to both constrain and enable sense making and relationship defining regarding the technologies they adopt or are confronted with. Silverstone and Haddon (1996) see commodification as the link between domestication and design. With commodification they mean the process through which objects and technologies emerge and are given a meaning in a public space of exchange values, between an array of competing images and claims that surround these objects and technologies. The supposed link between design (pre-launch) and domestication (post-launch), and the influence of both processes on each other, further stressed the need for pre-launch user research and user involvement, with attention for the broader societal implications an innovation could have.

As we have demonstrated the increasing impact of innovation on social sciences and on the society as a whole, we will first turn to innovation on a more general level. Therefore we look into the literature on innovation studies and innovation management. How is innovation conceptualized? What is considered an innovation and what not? What types of innovation are there? How does an innovation development process look like? How can this process be managed? And how does the process of 'mutual shaping' affect innovation development?

2.3 Innovation-concept

The 'innovation'-concept has already been given a variety of definitions, indicating that there is no uniformly accepted definition. We will not go into too much detail regarding this discussion, but will present a selected overview, starting from a very narrow conceptualization towards more encompassing definitions.

One of the first definitions was advocated by Joseph Schumpeter (1934) in 'The Theory of Economic Development' and is fivefold in nature, indicating the breadth of innovation as a concept. He sees innovation as a) the introduction of a new good or of a new quality of a good, b) the introduction of a new method of production, c) the opening of a new market, d) the conquest of a new source of supply of raw materials or half-manufactured goods, and e) the carrying out of the new organization of any industry (e.g. creation of a monopoly position). This gives way to a wide array of innovations: product innovation, technological process innovation, marketing innovation, organizational innovation, and service innovation. Schumpeter further considered innovation to consist both of developing new technologies or finding new uses for existing ones and implementing these into existing or new products or processes. Without such implementation, an invention, modification or improvement is not to be considered as an innovation. This is confirmed by Roberts (1988), who considers innovation as the sum of invention and exploitation, and by McDaniel (2000), who characterizes an innovation as an invention put to productive use.

Other authors include the act of market introduction as an element of innovation. Lundqvist and Williams-Middleton (2008) see innovation as the combination of invention (R&D),

productization (design through manufacturing) and launch (market introduction). Veryzer (1998) offers another innovation model: a) concept generation and exploration, b) technical development and design, c) prototype construction and d) commercialization. Goldsmith and Hofacker (1991) also see innovation as consisting of two dimensions: 1) newness and 2) commercialization or introduction. This 'newness'-dimension is largely subjective and depends how the product or service is conceived by the user (Blythe, 1999). This subjective dimension, which was also present in the works of Rogers (cf. supra), can also be found in the definition of Gatignon and Robertson (1989): "An innovation is a new product or service which is perceived by consumers within a market segment at that point in time to have effects upon established consumption patterns. A continuum of innovation exists from continuous (minor effects on consumption patterns) to discontinuous (creation of new consumption patterns)." Sometimes, innovation is tied to the (successful) outcome of the 'launch' (see e.g. Schlebecker, 1977). This is also apparent in the work of Braun and Herstatt (2009) stating that "[b]y its very nature innovation requires the acceptance of consumers". In the light of the previous discussion, innovation includes the diffusion process. Kanter (1986) goes even a step further and sees innovation as the generation, acceptance, and implementation of new ideas, processes, products, or services. Besides adoption diffusion, a certain degree of use diffusion is seen as necessary.

Next to this extra 'success criterion', innovation is also explicitly broadened to include processes and services, something which is also the case in the definition of Jorde and Teece (1990): "Innovation is the search for and the discovery, development, improvement, adoption and commercialization of new processes, new products and new organizational structures and procedures"; and of Galanakis (2006): "the creation of new products, processes, knowledge or services by using new or existing scientific or technological knowledge, which provide a degree of novelty either to the developer, the industrial sector, the nation or the world and succeed in the marketplace." Abernathy and Utterback (1978) also include Business Model innovation. This highlights the fact that innovation is not a single event, but rather a process consisting of multiple events and activities.

Summarizing, besides the fact that innovation is conceptualized in different forms or degrees, we retain two important aspects: **innovation consists of an important subjective dimension** and **innovation is a process**. The subjective dimension indicates an important divergence, as the societal and social influence on innovation is acknowledged, and innovation is opened up to consist of other modifications or improvements beyond product innovation. This evolution shows parallels with the social shaping and mutual shaping stances (cf. supra) and will remain an important element within Living Labs and subsequently this PhD. Moreover, this subjective dimension also puts the attention towards the end-user who experiences or consumes the innovation and by doing, or not doing this, has a stake in the eventual success of the innovation. By connecting an innovation with some form of acceptance or market success, the role of the eventual end-user of the innovation subsequently increases in importance.

As the previous paragraphs dealt with how innovation itself is conceptualized, we will now briefly look into the types of innovation that are being discerned in literature. The main differentiation is between radical and incremental innovation. Radical or discontinuous innovation is used for the development or application of significantly new technologies or ideas in new markets or that require significant behavior changes in existing markets (McDermott & O'Connor, 2002). Incremental innovation is used for minor extensions or improvements to existing products or processes. Research has indicated that most product development efforts result in incremental innovations (Griffin, 1997). Lievrouw and Livingstone (2002) observe that in the case of ICT, most radical innovations can be situated in the 1980s and 1990s (cf. also chapter 5 where we discuss the social experiments in Europe), whereas from the 2000s onwards most ICT innovation is incremental in nature. This flood of incremental innovations also caused the so-called innovation spiral in ICT (Poiesz & Van Raaij, 2002; cf. supra). This innovation spiral is also causing more incremental innovation, as the pressure on the time-to-market forces companies to speed-up their innovation process, leaving less room for ideas to blossom, and for serendipity, or unintended circumstances in which unintended outcomes can occur (Trott, 2008).

This classical view on innovation was challenged by Christensen, who pled for a dichotomy between sustaining and disruptive innovation (Christensen & Overdorf, 2000). He stated that a sustaining innovation is aimed at improving the current offerings of an industry incumbent and continuing business as usual as to improve profit margins. The most valued customers are targeted in order to satisfy them by offering even better products. Disruptive innovations are not targeted at the mainstream consumer values, but instead focus on a high end or low end niche. When the low end niche is targeted, the least demanding consumers are offered a product that fulfills their basic needs but often becomes cheaper. High end disruptions, also called radical disruptions, target a high end niche market with a new technology. When this disruptive innovation matures, it is often possible to improve its offerings and is able to move into the mainstream consumer market. Again we can see both conceptualizations as complementary, perceiving innovation from a different angle. The incremental/radical dichotomy takes a more user-oriented perspective, as it distinguishes innovation in terms of user perception, whereas sustaining/disruptive takes a market/business perspective on innovation. This important differentiation between viewpoints will also emerge when discussing the Open and User Innovation frameworks (cf. chapters 3 & 4).

Finally, we briefly elaborate upon the role of research in innovation. Regarding the relation between research and innovation, Eriksson et al. (2005) quote Per Eriksson, director at the Swedish Agency for Innovation systems: "Research is making knowledge out of money –

innovation is making money out of knowledge". In this view, innovation is seen as the capitalization of research, an idealistic outcome of research. Thus, innovation is unconditionally grounded in research, but not a necessary outcome out of all research. Innovative research, or research leading to innovation, thus has something that sets it apart from 'regular' research. Eriksson et al. (2005) indicate that the creative process of humans is crucial for innovation to take place, implying that innovation is created by humans, not by systems. This reasoning also resonates with the Social Shaping of Technology-school and with the interactionist stance from the previous paragraphs, and with the subjective element in innovation. However, we wish to complement this statement, as we believe innovation systems and networks can act as a facilitator and as an enabler of human innovativeness. Indeed the system itself will not generate innovation, but the system can govern human agency and creativity towards innovation. If not, than the act of innovation management (cf. infra) would be useless. Moreover, if we follow the reasoning of Dahlbom (2003) and Ulrich (2003) who state that most innovations come from gaps between an existing product and customers' expectations, this would plead for an innovation system which enables mechanisms and operations that look into the current experiences of end-users and into their actual expectations, or their user needs (cf. infra, chapter 4). Once the gap between current experiences and actual needs is detected, this can lead to an innovation solving these needs.

Concluding this selected overview of innovation conceptualizations, all authors agree that some kind of novelty has to be present to be labeled an innovation. However, this novelty can be perceived from both the company or the user perspective. An improved production process is an innovation from the perspective of a company, but not for the user, whereas a novel usage of an end-user is an innovation for the user, but not necessarily for the company. Moreover, what might be novel for one end-user, might not be novel for another, as there is no such thing as 'the' user (cf. chapter 4). This also makes it sometimes difficult to differentiate between incremental and radical innovation. De Marez (2006) also noted this dichotomy between the user and the company perspective on innovation and argued that the user perspective seems to be a more subjective take on what is an innovation, whereas the company perspective is more objective in nature. This difference in perspective is a distinction that will also play an important role further on in this PhD, as this also lies at the heart of the Open Innovation versus User Innovation paradigms. Furthermore, some authors also included success criteria in order to be called an innovation such as a successful diffusion, and some even included use diffusion. Within this PhD, we propose to include both the more objective organizational definition of innovation (a process, service or product that is novel to the company) and the more subjective user definition (a product, service or usage that is novel to the user). To be labeled an innovation, this process, activity, product or service needs to be market-ready or implementable, but we do not consider other success criteria to be relevant. Otherwise it would not be possible to have a failed innovation, something which we disagree with. We consider it a given that other factors besides the innovation development process can cause an innovation to fail or succeed (e.g. the adoption diffusion strategy, environmental factors that impede a successful domestication,…). As was argued by Frissen & van Lieshout (2006), we will look at the capability of Living Labs to study both sides of the mutual shaping process during innovation development and assess how a Living Lab-approach is able to enhance the successful introduction of an innovation, both from the more objective firm-perspective as from the more subjective user-perspective. Moreover, as Living Labs are sometimes referred to as innovation networks or instruments within innovation systems, we will consider their ability to generate user contributions to an innovator's innovation process that have a positive impact on the outcomes of this process.

2.4 Innovation management models

As we could witness in the previous sections, innovation is not a single act or action, but should be seen as a process, or even a series of processes. Moreover, not every action or invention leads to innovation, as Cooper (2009) states that for every 100 innovative ideas, only one ends up being a successful product. This means that the attrition rate is huge, which led to the notion of the 'innovation funnel'. Therefore, to end-up with (successful) innovation, orchestration and management of these processes is required. Thus, the discipline of managing processes in innovation is being referred to as innovation management. Innovation management looks at tools and strategies to allow managers and engineers to cooperate with a common understanding of goals and processes. The focus of innovation management is to allow the organization to respond to an external or internal opportunity, and use its creative efforts to introduce new ideas, processes or products (Kelly & Kranzburg, 1978). Tidd and Bessant (2013) have come up with a (simplified) model, taking the shape of a funnel, to describe the innovation process from an innovation management perspective, consisting of the following elements: search, select, implement and capture.

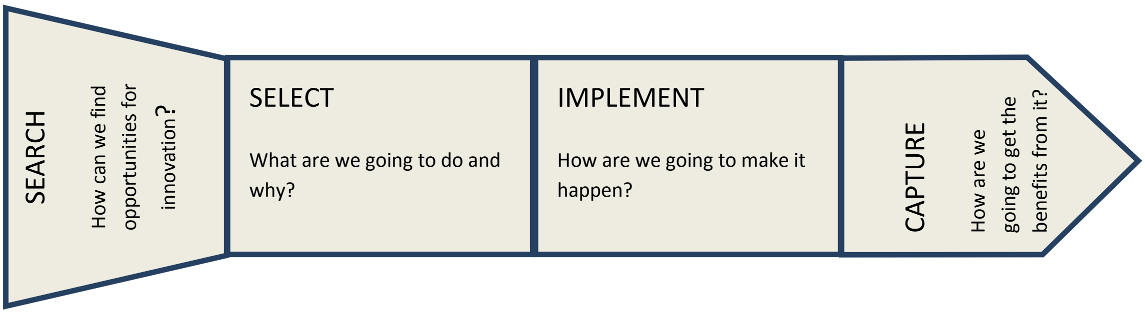

Figure 5: Innovation management funnel, adapted from Trott (2008)

In its original sense, innovation management was concerned with using adequate innovation management tools and strategies to trigger and deploy the creativity of all employees from the company towards continuously developing the company. However, some of the main difficulties in managing firm-level innovation are due to inconsistent understanding of innovation models and the lack of adequate measurement-based management methodologies and tools (Brem & Viardot, 2013). Innovation is complex and multidimensional, and many firms have let important innovations languish or were incapable of maintaining their competitive position through continued innovation (Christensen, 1997). Traditionally, innovation research focused on three dimensions: the source of the innovation (internal or external), the type of innovation (product, service, or process innovation) and the rationale for the innovation (voluntary initiative or a necessity demanded by competitive pressures in the market) (Siguaw et al., 2006). Later, it was argued that inadequate attention had been given to the interaction between innovation and the firm's organization and to the multitude of factors affecting innovation, some of which may be external to the firm itself (Tidd, 2001; Tidd & Bessant, 2013). The acknowledgement of the distributed nature of innovation (cf. infra) led to an even more complex innovation management process as besides employees, this required managing external actors as well (e.g. customers, suppliers, universities,…).

Shifting attention for various parts of the innovation management process, changing environmental conditions, and trends in management styles have resulted in a multitude of 'best practice' innovation management approaches being put forward in management literature. We will give a selected overview in more or less chronological order based on Rothwell (1992), Marinova and Phillimore (2003), and Ortt and van der Duin (2008).

Table 1: Innovation management models

Time frame	*Rothwell, 1992*	*Marinova & Phillimore, 2003*	*Ortt & van der Duin, 2008*
Pre-war period 20^{th} century		First generation: black box model	
Post-war period to the mid-1960s	Technology push	Second generation: linear models (including technology push and need pull)	TECHNOLOGY (science) PUSH
Mid-1960s to the late 1970s	Need pull		MARKET PULL (need-pull)
Late 1970s to the early 1990s	Coupling model (with feedback loops)	Third generation: interactive models (including coupling and integrated models)	MARKET PULL AND TECHNOLOGY PUSH COMBINED
	Integrated model (with simultaneous links between R&D, prototyping and manufacturing)		OPEN INNOVATION
Early 1990s to the early 2000s	Systems integration/networking model (with emphasis on strategic linkages between firms)	Fourth generation: systems models (including networking and national systems of innovation)	
From early 2000s		Fifth generation: evolutionary models	CONTEXTUAL INNOVATION
		Sixth generation: innovative milieux	

2.4.1 Black box model

The first model with a subsequent innovation management approach is the black box model. During the 1950s technological progress was for the first time incorporated in the economic equation. The black box model sees the innovation process as something which cannot be analyzed in itself, but which is seen as a 'black box'. What can be analyzed within this model are the inputs (e.g. money invested in R&D) and outputs (e.g. a new technological product) of the innovation process, without looking into the actual mechanisms of transformation (Marinova & Phillimore, 2003). Within this view, R&D and innovation are almost equated, without taking into account other factors such as marketing, manufacturing, user needs, etc. In terms of innovation management, the emphasis was put on input factors such as investment in R&D. This led to a number of new models, trying to look inside the black box of the innovation process.

2.4.2 Linear models

During the 1960s and 70s, the ‘black box’ was opened up by researchers trying to conceptualize the innovation process as a step-by-step process, as a sequence of activities leading to technologies being adopted by markets (Marinova & Phillimore, 2003). As can be deducted from the definition, these models are focused on product innovation and do not take into account other types of innovation. Two opposing stances on innovation were perceived: the technology push- versus the market pull approach. The basic premise, underlying both linear models, is that innovation is seen as a diffusion over time (Katzy, 2005). These models are heavily linked to the works of Rogers (cf. supra) with a narrow vision on innovation.

Technology push

From the post-war period to the mid-1960s is indicated as the era of technology or science push (Ortt & Van der duin, 2008). The innovation process is seen as linear from scientific discovery to commercialization on the market, with single companies following this straight path. There is little attention for the innovation process or for the market. This technology push-model is closely related to the ‘science push’ model of science policy, where technological newness is seen as the driving form for innovation. Technology push is also closely associated to the work of Schumpeter (1934, 1942), who saw two possibilities for this ‘technology push’-innovation to happen: 1) innovation through independent entrepreneurs and 2) innovation through R&D departments of (large) enterprises. The innovation management approach, coinciding with the technology push model, consists of investing in R&D and internal knowledge generation in order to achieve technological excellence, which would result in breakthrough innovation. This resonates with the virtuous cycle of closed innovation (Chesbrough, 2003; cf. chapter 3).

Market pull

From the mid-1960s to the late 1970s, a shift occurred towards the market and the user, indicated as market or need pull. This shift was caused by a multitude of innovations coming to the market being technologically superior, but failing to meet actual user needs. The cause of innovation is now situated in the market, i.e. the existing demands of potential consumers of technology, which is consistent with the social shaping perspective (cf. supra). Market research is put forward as a best practice in order to identify the needs within the market before an innovation project is started. One of the downsides of this innovation approach is the so-called ‘incrementalism’, or the fact that innovations based on user needs tend to be incremental in nature, and not radical. This is explained by Howells (1997) who states that in the case of radical innovation, there might not be articulated needs prior to innovation or prior to persuasive activity by the firm. Besides the search for alternative innovation models and innovation management approaches, this observation also triggered scholars to look deeper into the nature and characteristics of users in innovation, as von Hippel (1976) came up with the Lead User-concept near the end of the 1970s (cf. the chapter 4).

2.4.3 Interactive models

Both of the linear models helped to generate initial insights into the barriers and success factors for adoption of innovations. However, it was felt that these rather simplistic models showed too much of a deviation from reality, and that the question which comes first, technological invention or user need, turned out to be a chicken or egg question. This is argued by Mowery and Rosenberg (1979) in their review paper of ‘market pull’ literature where they state that none of both models is superior over the other based on empirical evidence. As a correction to these opposing linear models, a combined or interactionist innovation approach was suggested (Bijker & Law, 1992; van den Ende & Dolfsma, 2005). This interactionism can be situated from the late 1970s to the early 1990s (Ortt & van der Duin, 2008). This is a quite similar evolution as we witnessed in the stances on ICT adoption and diffusion, with the competing technological determinism versus the social shaping of technology, resulting in a mutual shaping perspective. However, this mutual shaping only started to appear near the end of the 1990s, a few decades later than the start of the interactive models in innovation management. This adds more evidence that ICT research and innovation management research were strictly separate research domains with little to no exchange or interdisciplinary activity.

Both technological advancement and market needs are seen as elements within an innovation process where different separate stages interact with and influence each other. Instead of a linear sequence, innovation is seen as an iterative process, with innovation no longer being the end product of a final stage of activity, but rather as possibly occurring at various moments throughout the process in which *both* demand and supply forces are responded to (Mowery & Rosenberg, 1979). Innovation management thus had to incorporate strategies to manage and integrate both technology and market inputs during the innovation process. A widely known and still used model is Cooper’s stage gate decision model (Cooper, 1988; 2009). Briefly, this model involves inserting decision gates along the different parts of the trajectory of an innovation project. In order to pass the decision gate, certain quality measures and criteria have to be attained, otherwise the project gets killed or is sent back for redeveloping. This approach is successful in weeding out so-called ‘false positives’ before market launch, securing the company from launching new products or services that would fail on the market. However, as we will see in the chapter on Open Innovation, this approach has as negative side-effect that it kills ‘false negatives’, or projects that do not seem promising at a given stage, but that would turn out to be a market success eventually. Another insight surfaced during this period, as consciousness grew that innovation is a complex process, involving some kind of coupling between technology and market, but also that innovation is intrinsically uncertain and 'non-linear' (Coombs et al., 1987). This led to challenging the linearity of the innovation model.

2.4.4 System models

Within the system models-approach, the main focus is on innovation as a system with emphasis on interactions, inter-connectedness and synergies between multiple actors. This extends the view on innovation beyond the borders of a single firm or company. It is argued that smaller firms, without large resources for in-house innovation development, can benefit from establishing relationships with other firms or organizations. This leads to a network or system in order to come to innovation (Marinova & Phillimore, 2003). This model explains the place and role of small firms within innovation and how they can compete with large firms by means of engaging in an innovation network. The system model can thus be seen as a more open alternative for small firms to the in-house innovation model of large firms. Katzy (2005) indicates the system models approach as 'innovation through strategic cooperation'. This view also had an impact on innovation policies, as the interactions and linkages between stakeholder groups were facilitated, emphasized and strengthened more and more, resulting in national and regional innovation systems (Hanson, 2006). Well-known is the research of Leydesdorff and Etzkowitz (1996) who pointed out to the emergence of Triple Helix innovation systems. These types of system models are considered a correction of the too simplistic linear models that were not capable to explain or induce the transfers of knowledge and technology occurring in society (Etzkowitz & Leydesdorff, 2000). The helices consist of academia, industry and government, and are seen as interrelated institutions that reshape themselves and each other through various modes of interaction. From a policy perspective '[t]he Triple Helix model leads us to view the institutional actors on an equal level in the network. However, each is positioned differently with reference to the infrastructure that they collectively reproduce. Therefore, the focus on observable interests and agency should be complemented with attention to expectations and orientations in communication systems.' (Leydesdorff & Etzkowitz, 1996). This calls for simulations and projections to take into account the impact and implications for the different helices of innovation efforts.

Therefore, the system models approach can be seen as a direct predecessor and logical extension of the Open Innovation model, shifting the focus outside the company borders and taking into account the complexity of innovation and innovation processes. Therefore, innovation systems will be discussed in more detail in the chapter on Open Innovation (chapter 3). However, with regards to the Triple Helix, one important element is missing in the equation: the citizen or end-user. This issue shall be dealt with later in this PhD when we touch upon the emergence of Living Labs (chapter 5 & 6), which can be regarded as a systemic instrument within the Quadruple Helix-model, an extension of the Triple Helix with the citizen as extra helix (Arnkil et al., 2010).

2.4.5 Open Innovation

Conscience grew from the early 1990s on that innovations could be improved when creating alliances or partnerships between different companies, resulting in opening up the innovation process. This culminated in a new paradigm within innovation management literature: 'Open Innovation'. Within this brief overview we will focus on Open Innovation as innovation management approach. In the dedicated Open Innovation-chapter we will deal with Open Innovation as an innovation paradigm. Chesbrough (2003) identified Open Innovation as innovation management model for 21st century innovation, characterized by a non-linear, or even cyclical, innovation process, more cooperation between internal R&D and the outside world, and with companies benefiting from the synergies associated with this collaboration. He sees this 'Open Innovation'-paradigm as "the antithesis of the traditional vertical integration model where internal research and development (R&D) activities lead to internally developed products that are then distributed by the firm." (Chesbrough et al., 2006). Levén and Holmström (2008) identified four factors that have facilitated the decline of the closed innovation model in favor of Open Innovation: 1) the existence of critical sources of knowledge outside the research laboratories of large companies, 2) knowledge flows between (competing) companies caused by changing job positions of employees, taking their knowledge with them, 3) the increasing number of possibilities for developing ideas and technologies outside firms (e.g. through spin-offs) and 4) other actors in the value chain, such as customers and users, playing increasingly important roles in contemporary innovation processes. Chesbrough (2003) mentions that an Open Innovation management approach requires letting go part of the control and self-reliance within the innovation process. Reger and Schultz (2009) describe this previous best practice of 'closed innovation', innovating insularly from external sources, as a means to gain first mover advantages in a Schumpeterian sense. Nowadays, the 'creative destruction' model of Schumpeter has become more and more obsolete because of external factors, favoring the Open Innovation model where firms commercialize external as well as internal ideas by deploying outside as well as inside pathways to the market. Because of this, compared to the stage gate model for innovation management, Open Innovation also incorporates the ability to rescue 'false negatives', as these projects might be further commercialized outside the firm. In terms of innovation management, a balance should be found between open and closed innovation, as all businesses can be allocated on a continuum from essentially closed to completely open. Lakhani and Panetta (2007) agree with this notion as they insist that there is no standard approach to evolving towards Open Innovation. These insights are also reflected in the notion of contextual innovation (cf. infra).

2.4.6 Innovative milieux

The innovative milieu-approach towards innovation is quite closely related to the system models-approach. It finds its origin in the 1970s as from then on, a quite extensive body of literature started developing regarding the occurrence and growth of regional clusters of innovation and technology (Feldman, 1994; Keeble & Wilkinson, 2000). The importance of geographical location for knowledge generation became apparent and eventually led to the innovative milieux explanatory model. It includes linkages and networking between different actors in the same geographical location, but also emphasizes the importance of quality-of-life factors. It stresses the fact that innovation has not become completely separated from space, but can be an intrinsically territorial, localized phenomenon, highly dependent on location specific resources (Longhi & Keeble, 2000). Again, this puts more emphasis on contextual elements within the innovation process, something which is at the heart of a Living Lab approach.

As was the case with the systems model, the innovative milieux-approach is mostly used to describe and explain the success of small- and medium-sized enterprises. It also explains why certain localities witness the birth of a large number of small, innovative firms and shows that innovation can have a location-specific character (Marinova & Phillimore, 2003). It can be argued that the importance of geographical location has diminished over the years. Especially the rapid development and implementation of ICTs has facilitated tearing down geographical barriers. Cooperation, communication and collaboration between the different actors within the innovation process have become more and more detached from place and time. However, this approach still has its merits because of other regional factors that cannot be overcome by ICT such as local/national policy.

2.4.7 Contextual innovation

Ortt and van der Duin (2008) add yet another 'model' to this list: the era of 'contextual innovation'. This implies that innovation practices and decisions have to be adapted to the specific context, which means that there are no more general 'best practices', as was the case in the past. However, it can also be argued that 'contextual innovation' means that all of the previous 'best practices' still have value and that a 'choice' for one (or more) of these practices within a certain innovation process depends on different 'context'-factors, such as type of innovation (e.g. incremental/radical), industry, (end-)users, etc. This reasoning can also be found in the work of Trott (2008). He states that innovation processes can either be pushed or pulled through development: a pushed process is based on existing or newly invented technology that the organization has access to, and tries to find profitable applications to use this technology, whereas a pulled process tries to find areas where customer needs are not met, and then focus development efforts to find solutions to those needs (Trott, 2008). Ortt and van der Duin (2008) see 'contextual innovation' as a counterweight to Open Innovation, as opening up the innovation process increases the complexity and makes the process increasingly difficult to manage. Moreover, too much reliance on openness risks to endanger fundamental research, which is still a driver for breakthrough innovation. This topic will also be discussed in the chapter on Open Innovation (chapter 3).

2.4.8 Dynamic & evolutionary models

Based on the development and success of the Open Innovation framework, other authors started looking for alternative models to describe the innovation process that captured the increasing complexity. Katzy (2005) pleads for a dynamic vision on innovation as opposed to the classical economic theory of equilibrium, based on force and counterforce. Dynamic theories acknowledge the impact of time on innovation and see innovation as change. He sees more dynamic explanations as necessary to advance the field of innovation studies. The evolutionary model of innovation is the most developed in this area. This point of view started when a number of failures in neoclassical economics, such as the inability to deal with dynamic qualitative changes, induced some scholars to look for other metaphors to conceptualize innovation beyond the dominant mechanical metaphor. As economics and innovation are products of human beings, a biological metaphor was suggested, resulting in evolutionary approaches to innovation. This way, parallels could be made between innovation and the Darwinian evolution of species. More recently, evolutionary studies of technological change have also used insights from equilibrium thermodynamics, organizational theory and heterodox approaches to draw parallels with innovation processes. Saviotti (1996) mentions the following key concepts for an evolutionary approach to innovation: generation of variety, selection, reproduction and inheritance, fitness and adaptation, population perspective, elementary interactions and external environment. This evolutionary model challenged the central concept of economic theory, which focuses on market equilibrium and complete information, and instead put the focus on change, which is by definition a by-product of innovation. It stresses the need for imperfections as a necessary precondition for technical change to occur in a market economy. Evolutionary models could for example shed more light on failures of superior innovations because of the importance of the fit with the surrounding environment. Kiemen and Ballon (2012) ground the need for more complex innovation models in the fact that technology itself is becoming more and more complex, something which they refer to as 'meta-systems' that are always in progress. However, they also identify a gap between 'philosophers' who observe and study the increasingly complex nature of technologies and 'practitioners' who actually develop and innovate new technologies. They actually refer to Living Labs as having the potential to close this gap. They define Living Labs as the next generation of laboratories that follow a more general trend in science from so-called Newtonian Science (deterministic and predictable) to Darwinian Science (adaptive and self-organizing). However, in chapters 5 and 6 we will argue that the current Living Labs movement is mostly based on 'practitioners' without an adequate follow-up of 'philosophers' that make sense of the evolving phenomenon.

This evolutionary view on innovation also resonates with the Triple Helix-model as proposed by Leydesdorff & Etzkowitz (1996, cf. supra), as they also perceive the relations and interactions between these helices as being in constant flux. One of the most important insights from this evolutionary take on innovation is that the process is considered at least as important as the R&D-outcomes. One of the major downsides of this evolutionary model is the lack of predictive power, as it sees the innovation process as a constant change, with its parameters always in flux (Leydesdorff, 2010). This makes it very hard to distillate implementable guidelines for managing the innovation process. However, we also retain that Living Labs are put forward as a possible means to innovate in an adaptive and self-organizing way.

2.4.9 Summary of innovation management models

In this overview of innovation management and the evolving views, we can detect a lot of parallels to the debates on post-launch ICT innovation research. A similar evolution took place from linear models (technology push versus market pull) towards more complex and open models (interactionistic and Open Innovation), to arrive at the contextual innovation view. This contextual innovation stance acknowledges the **complexity of the innovation process** and the fact that **a multitude of factors influence innovation development**. From a mutual shaping point of view, this means that both the technological evolutions as well as the societal constellation have an impact on the innovation in development, but that the nature and magnitude of these 'effects' is not always the same. This pleads for mechanisms and techniques that allow to capture and describe the context in which the innovation is shaped in order to steer and optimize the innovation development process. This also raises **the need for analytical frameworks that are able to capture this complexity** and that acknowledges the fact that different sources of knowledge and input need to be taken into account. This is exactly what the concept of distributed innovation stands for. Within the final section of this chapter, we will discuss this distributed vision on innovation as a broad societal phenomenon that had a major impact on all aspects with regards to innovation.

2.5 The distributed nature of innovation

We conclude this chapter with an overview of the concept of distributed innovation, as we believe that all of the previously discussed evolutions can be situated within a larger societal awareness of the distributed nature of knowledge. Although the phenomenon has roots going back more than 50 years, it only surfaced in academic literature at the turn of the century. Therefore distributed innovation can be considered as an observed phenomenon, looking back at previous evolutions, not as a way of managing innovation, although we will present three distinct examples of distributed innovation modes, referred to as distributed innovation systems. We also see this phenomenon as the basic premise of both the User and Open Innovation paradigms which we will use as theoretical foundations to clarify the European

Living Labs phenomenon. In this sense, we largely follow the thinking of Bogers and West (2012).

The roots of the distributed innovation phenomenon lead us back to the 1940s when Friedrich Hayek argued that knowledge is unevenly distributed in society (Hayek, 1945). This problem was later recognized and rephrased by Bill Joy, the famous American computer scientist and co-founder of Sun Microsystems, with his well-known quote: “No matter who you are, most of the smartest people work for someone else” (quoted in Lakhani & Panetta, 2007). Since the turn of the century, external sources of knowledge and innovation have become increasingly relevant (Porter & Stern, 2001), something which was also reflected in the rise of alternative innovation management approaches such as the system models and Open Innovation (cf. supra). Lakhani and Panetta (2007) state that Joy’s Law applies to most organizations that are responsible for continually delivering innovations to stakeholders. They see distributed innovation systems as an alternative approach to organizing for innovation, as they demonstrate the effectiveness of new methods and organizational structures for improving innovation outcomes by engaging a broader base of outside knowledge holders. Gassmann (2006) also argues that the strategy to access knowledge resources externally has recently been emphasized, as knowledge is growing faster and clusters of highly specialized knowledge are globally dispersed. This phenomenon is being referred to as ‘distributed innovation’, or the fact that tapping into multiple external sources of knowledge when innovating leads to better results (Lakhani & Panetta, 2007).

Lakhani and Panetta (2007) see the User Innovation literature of von Hippel (1976) as the first acknowledgement of the existence of distributed innovation (cf. chapter 4). They look into the governance of this distributed innovation process and take crowdsourcing and open source software development as examples of this distributed innovation phenomenon. However, by doing so, they also tend to make the mistake of equaling Open Innovation with User Innovation, a fallacy also present in a lot of Living Labs literature (cf. chapter 6). Sawhney and Prandelli (2000) take a broader innovation management perspective when approaching the notion of distributed innovation, as they deal with the issue to find a governance mechanism that strikes the balance between order and chaos. They observe a shift towards a network economy and a knowledge society, where knowledge is required to compete in technology markets that become more and more diverse with industries converging and colliding. Gassmann (2006) argues that nowadays knowledge has become the most important resource for firms. Moreover, despite discussions regarding tacit knowledge that is bound to specific persons (Nonaka, 1994), the mobility of knowledge has increased over the last decades. Open source software development can have thousands of decentralized programmers working on one platform and has become possible because of the special character of software: high separability and codability as well as high knowledge intensity. Developing a car engine in Open Innovation mode is much more difficult – at least in the physical prototype stage. New ICTs, especially the Internet, accelerated the knowledge diffusion process and increased the personal mobility of knowledge workers. Many specialized knowledge workers (e.g. freelancers, consultants or part-time engineers) make a living as portfolio workers, offering their services to different organizations at the same time. Instead of hiring the best engineers internally, companies are forced to act as knowledge brokers. New capabilities and organizational modes are needed to cope with this outside-in thinking. Once again, we can see that ICTs are both enabler and subject.

Moreover, as firms tend to narrow their knowledge base in an effort to specialize and focus, there is more need to co-operate with trading partners and customers to create knowledge. Therefore, because of the distributed nature of innovation, the firm's problem is no longer how to defend itself from members in its value network, but how to involve them in its processes of knowledge creation. They propose that firms structuring themselves as complex adaptive systems are able to operate in complex environments with a high degree of flexibility, without degenerating into chaos, calling these firms 'adaptive innovators' (Sawhney & Prandelli, 2000). This resonates a lot more with the notion of Open Innovation from Chesbrough (2003, cf. the next chapter).

Brem and Viardot (2013) also note that nowadays it is a given that collaboration with consumers and with a variety of strategic partners is mandatory in order to have a successful management process in the hypercompetitive world system of customers, suppliers, distributors, markets, governments, and institutions. Gassmann (2006) states that the propensity to cooperate on R&D projects has increased since the 1980s, yet reached a new peak during the 1990s. As firms replaced their internal R&D activities more and more by contract research and external development, the academic community (e.g. Rigby & Zook, 2002; Chesbrough, 2003) began to emphasize the opening of the firm's boundaries to outside innovation. Brem and Viardot (2013) situate the emergence of distributed innovation phenomena in the 1990s with Lead Users, one-to-one marketing, and customer-centric marketing as exploitation-side concepts, and notice a shift in the first decade of the 2000s with co-creation, Open Innovation, open source, and service-dominant logic as exploration-side concepts. **They put forwards nowadays challenge to reconcile exploration and exploitation with the help of all the strategic partners in a collaborative and networked innovation mode, in order to deliver innovative solutions to the market and have a significant competitive advantage**. This balance between exploration and exploitation is also one of the key issues to be dealt with in Living Labs, as will become apparent in the chapters 5, 6 and 7.

However, Lakhani and Panetta (2007) warn that traditional organizations should not seize on distributed innovation systems as a solution to their internal innovation problems. Rather, these systems are an important addition to an organization's portfolio of innovation strategies. Those who would adopt or create a distributed innovation system must be prepared to acknowledge the locus of innovation to be outside the boundaries of the focal organization, and will require a fundamental reorientation of views about incentives, task structure, management, and intellectual property. In other words, according to Lakhani and Panetta (2007), there is no standard approach to evolving towards a distributed mode of innovation.

Sawhney and Prandelli (2000) do suggest three 'ideal types' for organizing distributed innovation within turbulent markets, based on three case studies: a hierarchical model with complete control of the firm, a community model with an emergent self-organization, and a market model without any governance and with total openness. The *hierarchical model* proposes distributing the locus of innovation among different entities, e.g. research labs spread around the world, but the knowledge stays within the boundaries of the firm. This model provides protection for IP, structured innovation development due to the large degree of governance and a clear understanding of who owns what. The quality of the knowledge depends solely on the owner organization, and the role of external actors such as customers or suppliers remains rather passive, which limits the creativity and diversity of the ideas. On the opposite side of the spectrum, they see totally *open market models* such as open source software (Linux) or Alhpaworks (IBM) with an absence of clear control over compatibility and quality, which can provoke fragmentation and make progress chaotic and undirected as there is no clear governance. Another major problem for this model is to create incentives for developers to share knowledge with the company. In between these two extremes, Sawhney and Prandelli (2000) place the '*communities of creation*' model as an alternative that is able to reap the best of both worlds. ICT creates a distributed system of innovation within a group of individuals and/or organizations centered on an infrastructure provided by a so-called developing organization. This community is not entirely open, but is a gated community with certain barriers to access. The locus of innovation is no longer in the firm or out in the open, but resides in the managed and supported community.

A critique we wish to make is that these governance models for distributed innovation are very much tailored towards large companies and that they rely on observations of very specific cases in very specific markets. So how to deal with this notion of distributed innovation for companies not able or not willing to implement and pursue one of these three ideal types of distributed innovation systems? Following Bogers and West (2012), the distributed nature of knowledge in society lies at the heart of both the Open and User Innovation paradigms. Both can be seen as making sense of distributed innovation phenomena, but from a fundamentally different perspective. Where Open Innovation looks at this from a firm-perspective, trying to find out how a single firm can benefit the most from these principles, User Innovation starts from the end-user and his/her needs, and looks how an innovation can optimally solve these needs. Both paradigms share this distributed notion of innovation, as in both the innovation process is inherently opened up beyond the traditional closed, in-house firm innovation process. However, distributed innovation includes phenomena that go beyond Open and User Innovation, such as open source software development and crowdsourcing. The focus is on maximizing and optimizing the knowledge aggregation and accumulation itself, without looking to optimize this for a single actor. Open and User Innovation are both frameworks trying to optimize these distributed innovation principles for specific actors.

Other authors perceive the relation between Open and User Innovation in a different way. According to Reger and Schultz (2009), Chesbrough and his epigones do not lay emphasis on customers, but still they are regarded as one of the possible external sources when it comes to generating innovations, which provides a link to the User Innovation paradigm. Gassmann et al. (2010) also follow this line of reasoning as they identify nine research perspectives on Open Innovation: the spatial perspective, the structural perspective, the user perspective, the supplier perspective, the leveraging perspective, the process perspective, the tool perspective, the institutional perspective and the cultural perspective. Interestingly, they literally state that '[u]ser innovation is one of Open Innovation's best-researched part fields'. Put differently, Gassmann et al. (2010) see User Innovation as a part of the Open Innovation research domain, although von Hippel's seminal work in this field predates the Open Innovation paradigm with almost two decades. This discussion will be dealt with more in detail within the epilogue of part I of this PhD (cf. infra).

2.6 Conclusion

Within this chapter, we have started by looking into the nature and conceptualization of innovation as a concept. Taking a social sciences perspective, we have argued that the introduction of (ICT-) innovation was originally studied from a technological deterministic point of view in the 'diffusion of innovations' paradigm. The European domestication school reacted by studying the actual implementation process of an innovation by end-users from a social shaping perspective, shifting the balance completely as opposed to the technological determinism. Eventually, both diffusionism and domestication were regarded as two sides of the same innovation coin, which was also reinforced by the mutual shaping perspective on (ICT-)innovation, which acknowledged that both technology shapes society as well as society shapes technology.

We witnessed a rather similar evolution when looking into the innovation management literature. From the linear technology push and market pull models, a more interactionist stance evolved. However, subsequent models started to highlight the complexity of innovation processes more and more. The importance of the (complex) context in which innovations take shape is best highlighted in the contextual innovation framework. However, in order to take this (innovation-specific) context into account, methods and tools are needed to assess, describe and influence this context. Moreover, we gathered that the innovation landscape underwent important changes because of three environmental factors: a shorter time-to-market for innovations, increased competition, and an improved accessibility and availability of information.

This led us to the notion of distributed innovation which proposes that knowledge is unevenly distributed in society. Applying this to innovation development, one needs to tap into various types of knowledge from various sources, which meant a fundamental shift in terms of innovation management, as instead of managing internal firm assets, external capabilities needed to be developed and managed. This links up perfectly with the increasing complexity we saw in innovation management models, and explains the search for more encompassing innovation management models. In the distributed innovation literature, three ideal types were suggested, but these were based on a limited amount of case studies with a low degree of replicability. In practice, we see companies and organizations trying to tap into these external sources of knowledge in numerous ways (e.g. Nokia with its Betalabs[11], Philips with its now defunct leaduser.nl site, city crowdsourcing initiatives such as AppsForGhent[12], Lay's flavor innovation contest[13],…), but in most cases these initiatives remain experiments that are carried out without abstracting lessons learned on a more general level. As we will argue in chapters 5 and 6, the same applies for Living Labs. **Within this PhD, we wish to contribute to these issues by connecting practice and theory, and by abstracting more general lessons learned with regards to distributed innovation and how to cope with it.**

We will do this by looking into two main academic paradigms that emerged, looking at these distributed phenomena from a fundamentally different viewpoint: Open Innovation taking a firm-perspective, and User Innovation taking a user-perspective. Although both paradigms start from a different perspective, we see the act of co-creation as a bridge between these two perspectives (user-centric versus firm-centric). As co-creation is regarded a central process in Living Lab operations, we propose Living Labs as an innovation network that tries to generate value out of the distributed nature of knowledge for all the involved actors.

In the remainder of this PhD, we will investigate whether **Living Labs can be seen as an innovation approach given shape in order to deal with this increasing complexity, trying to govern the innovation process based on contextual factors and input from different actors**. First, we will introduce the two major frameworks rooted in the notion of distributed innovation: Open Innovation and User Innovation. We will subsequently use these frameworks as anchor points to analyze the Living Labs-phenomenon, but also as theoretical sources to enrich and improve the current and future Living Lab constellations and cases.

[11] https://betalabs.nokia.com/
[12] http://appsforghent.be/apps-for-ghent-4/
[13] http://www.lays.be/maakjesmaak/

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3. OPEN INNOVATION

From the previous chapter, we gathered that knowledge was regarded as being unevenly distributed in society, leading to the notion of distributed innovation. The distributed nature of knowledge was accelerated by the advent and implementation of ICT fostering alternative models and approaches for managing innovation beyond simplistic linear innovation models. The distributed innovation phenomenon points out to the fact that innovation in isolation yields suboptimal results, as according to Joy's law "you can never have all the smartest people working for you" (cited in Lakhani & Panetta, 2007). However, we regard distributed innovation not as a paradigm in itself, but rather as a description of a wider societal phenomenon. Open Innovation, which will be discussed within this chapter, can be considered a paradigm consisting of analytical concepts and frameworks that enable to study distributed innovation processes, albeit with a strong firm-centric character and aimed at value maximization for the companies engaging in Open Innovation. This is opposed to the User Innovation paradigm that takes a user-centric perspective (cf. chapter 4).

We consider Living Labs as clear examples of distributed innovation through a collaborative effort of different actors, therefore we consider Open Innovation as a designated theoretical framework to study and make sense of innovation processes occurring in Living Labs. To this end, we will discuss the Open Innovation literature with a focus on inter-organizational processes and on Open Innovation networks. Out of this literature we will abstract relevant analytical concepts and frameworks that we consider valuable in the context of Living Labs.

3.1 From vertically integrated closed innovation towards a more open view

As was already mentioned earlier, traditionally innovation was viewed as an inherently closed process with most operations running inside the boundaries of the company and R&D processes taking place in 'secretive in-house laboratories' in a vertically integrated fashion (Chandler, 1962). Company knowledge and technologies were protected and kept safe from external influences. We proposed to refer to this view on innovation management as 'closed innovation' or the 'vertical integration model'. The main idea was that companies experienced significant economies of scale when integrating all R&D effort into the company. In a broader sense, vertical integration refers to management styles that bring large portions of the supply chain not only under a common ownership, but also into one corporation. Mowery (1983) situates the largest emergence of internal, centralized R&D departements in the beginning of the 20th century. Chesbrough (2003) lists the implicit rules of the Chandlerian view on closed, vertically integrated innovation:

- We should hire the best and the brightest people, so that the smartest people in our industry work for us.
- In order to bring new products and services to the market, we must discover and develop them ourselves.
- If we discover it ourselves, we will get it to market first.
- The company that gets an innovation to market first will usually win.
- If we lead the industry in making investments in R&D, we will discover the best and the most ideas and will come to lead the market as well.
- We should control our intellectual property, so that our competitors don't profit from our ideas.

Still according to Chesbrough (2003), this closed innovation paradigm led to a virtuous circle, where increased investment in R&D leads to fundamental technology breakthroughs and to new products and features, which in turn lead to increased sales and profits via existing business models, which enable to increase the investment in R&D.

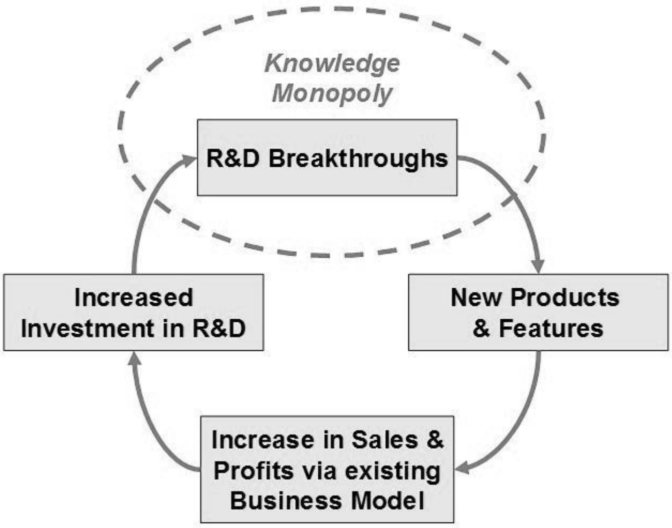

Figure 6: the virtuous cycle, retrieved at http://www.mindsheet.com/innovation-like-clockwork/

However, gradually more and more research and insights pointed out to some side effects of this virtuous circle, insights that would later play an important role in the Open Innovation paradigm. First is Arrow's (1962) idea of **economic spill-overs**. According to him, spill-overs are a byproduct when investing in R&D, as it cannot be predicted what the outcome of research will be. This means that R&D produces 'excess' knowledge that does not lead to fundamental breakthroughs or new products. Teece (1986) also pointed out to the fact that **research needs to be appropriated** in order to come to successful innovation. He demonstrated that the winners from breakthrough ideas need not necessarily be the original inventors, but can also be companies that control for example distribution and consumer service. Therefore it can be more important for a business to be able to win at marketing, distribution, manufacturing and other areas than to come up with a big idea in the first place. Teece proposed a model on how value is appropriated from the imitability of technology and complementary assets, and helps explain whether an innovator is likely to profit from an innovation or not. This already provides some evidence against the virtuous circle of closed innovation. In his later works Teece expanded on this, introducing the notion of **dynamic capabilities**, by which he means the ability of firms or organizations to address rapidly changing environments by integrating, building or reconfiguring internal and external competencies (Teece & Pisano, 1994). Research also started exploring strategies to manage the innovation process in terms of strategy, such as the 'make or buy'-decision (Veugelers & Cassiman, 1999; Cassiman & Veugelers, 2002). This coherent view on firm capabilities also built further on previous notions of firm capabilities, such as Cohen and Levinthal's (1990) influential work on **absorptive capacity** of organizations, or the ability to recognize the value of new knowledge, appropriate it, and apply it to commercial ends. They argue that the absorptive capacity is enhanced by increasing the internal R&D teams, which leads to the fact that a firm's investment in R&D has a direct impact on its absorptive capacity. In the meantime, some other 'erosion factors', as Chesbrough (2003) termed them, led to cracks in the foundations of the virtuous cycle. An increased job mobility (Cooper, 2001), the recognition of decentralized knowledge (Evans & Wolf, 2005) and shorter product life cycles (Van de Vrande et al., 2009). Chesbrough (2003) adds more capable universities, a declining US hegemony and a growing access of start-ups to venture capital as additional erosion factors which led to a more open view on innovation processes and to the death of the virtuous circle. Gassman and Enkel (2004) also mention the escalating costs of industrial R&D, and the dearth of resources as main reasons why companies started looking for new innovation strategies. They see this phenomenon reinforced by the increasing globalization of research, technologies as well as innovation through the amplified use of ICT. Chesbrough and Bogers (2014) recently added the rise of social media as a final erosion factor because it has brought the knowledge access and sharing capabilities of firm-specific internal ICT networks to the internet.

3.2 The basics of the Open Innovation paradigm

Chesbrough and Bogers (2014) state that Open Innovation is at the most fundamental level embedded in the notion that the sources of knowledge are widely distributed in the economy. This leads us back to the work of Hayek (1945) who saw knowledge as unevenly distributed in society, making it impossible to have 'all the smart guys working for you' (cf. the previous chapter). However, the first acknowledgement of distributed innovation processes can be found in the works of von Hippel (1976) who pointed out to the existence of User Innovation, or the fact that for some innovations the locus of innovation resides with the end-user, while the role of the company is limited to producing and marketing the innovation. These insights eventually led to the so-called User Innovation framework, which will be discussed in the next chapter. We now dig deeper into the other major framework building further on the notion of distributed innovation which took shape in the beginning of the 2000s: **Open Innovation**. Commonly, Chesbrough's 2003 seminal and widely cited book is taken as the start of the Open Innovation paradigm, although he already published his initial ideas in a conference paper in 2001. However, these works meant the introduction of Open Innovation as a concept with common currency and the start of building a paradigm and larger theory based on Open Innovation phenomena. The occurrence of Open Innovation phenomena, as was already dealt with in the previous paragraphs, already started earlier on. The literature on external technology sourcing, governance models and company capacities to cope with these strategies already boomed in the 1990s (Torkkeli et al., 2009). The fact that these 'open' processes were already happening before the turn of the century is also apparent when looking at the innovation management literature, as Ortt and van der Duin (2008) situate 'Open Innovation' as best practice innovation management strategy from the early 1990s to the early 2000s (cf. the previous chapter). However, Chesbrough should be credited for bringing together these different phenomena and trying to fit them into a larger theory or paradigm. As Huizingh (2011) states it, Open Innovation became an umbrella that connected a range of already existing activities.

The first premise of Open Innovation is that from the perspective of a single firm, the usual level of analysis in Open Innovation research, opening the internal innovation process of a firm yields extra value (Chesbrough et al., 2006). According to Chesbrough and Bogers (2014), the critical conceptual distinction between the previous literature on spillovers (= knowledge exchange) in innovation is that Open Innovation transforms these spillovers into inflows and outflows of knowledge that can and should be purposively managed. A lot of Open Innovation research deals with the economic (pecuniary) implications and opportunities provided by external sources of innovation and commercialization, and mainly focuses on the revenue-generating practices from a firm perspective (Vanhaverbeke et al., 2008; van de Vrande et al., 2009). This holds already a first criticism towards the research on Open Innovation, as typically, the level of analysis is either an individual firm or dyadic pairs of firms, although a limited amount of research has examined value networks of multiple firms/organizations, or communities of individuals (Chesbrough & Prencipe, 2008; Vanhaverbeke & Cloodt, 2006; West et al., 2006; West & Lakhani, 2008). Chesbrough et al. (2006) defined Open Innovation as a non-linear innovation process with more co-operation between internal R&D departments and the outside world, and with companies benefiting from the synergies associated with this collaboration. It carries the premise that firms benefit from commercializing external sources of innovation and from finding external paths for commercializing internally sourced innovation (Chesbrough, 2003; Dahlander & Gann, 2010; Enkel et al., 2009). Open Innovation assumes that firms can and should use external ideas as well as internal ideas (Chesbrough, 2003). Bogers and West (2012) mention that the core research questions in Open Innovation research are how and when firms can commercialize the innovations of others and commercialize their valuable innovations through others. This view is sketched in the figure below, which is a representation of the famous permeable funnel of Chesbrough.

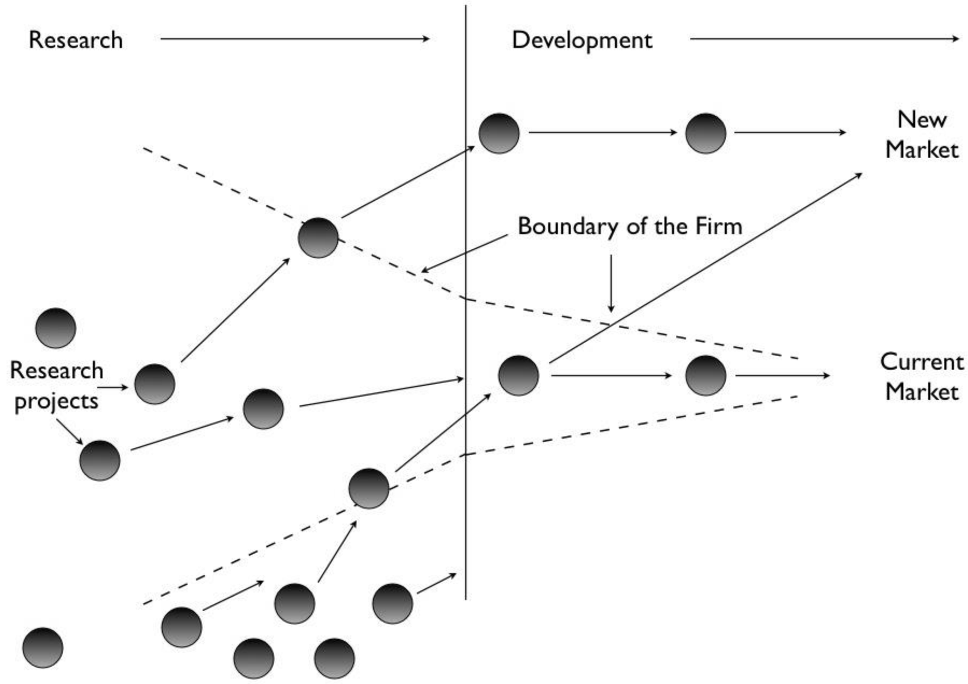

Figure 7: the Open Innovation funnel from Chesbrough (2003)

Dahlander and Gann (2010) identify at least four reasons why this concept of Open Innovation has common currency: 1) it reflects social and economic changes in work patterns where professionals rather look for portfolio careers than a job-for-life with a single employer, which makes firms looking for new ways to access talent that might not wish to be employed exclusively, 2) globalization has expanded the extent of the market that allows for an increased division of labor, 3) improved market institutions such as IPR, venture capital and technology standards allow for new ways to collaborate and coordinate across geographical distances, and 4) new technologies allow for new ways to collaborate and coordinate, despite geographical or time-based distances. As a fifth reason Huizingh (2011) adds the connection of the processes of acquiring external knowledge and exploiting internal knowledge under the same Open Innovation umbrella. This process perspective offered an integrated view on previously separate activities. In the next section, we will dig deeper into this process view.

3.3 A process perspective on Open Innovation

Already one year after Chesbrough's initial book on Open Innovation, Gassmann and Enkel (2004) further explored this rapidly emerging concept and took a process perspective on Open Innovation. Based on a case study of the IBM Industry Solution Lab in Zürich, they demonstrated that the locus of the various innovation activities is decoupled into three parts. First there is the locus of knowledge creation, the locus of innovation (indicating applying the idea/knowledge/technology and transforming it into an innovation), and the locus of commercialization (product development or exploitation of the innovation). Gasmann and Enkel (2004) argue that one of the major contributions of Open Innovation is the insight that the locus of innovation and the locus of knowledge need not necessarily be the same. The fact that the locus of innovation shifts during the innovation development process also implies the existence of knowledge transfers. Moreover, by distinguishing a locus of knowledge creation, a locus of innovation and a locus of commercialization, Open Innovation also acknowledges the fact that innovation is a process, something we gathered from the previous chapter. The shifting locus of innovation is also something that will be dealt with in the next chapter on User Innovation.

Research into these transfers lead to the identification of three core Open Innovation processes: **outside-in** (enriching the company's knowledge base through integrating customers and suppliers and through external knowledge sourcing), **inside-out** (getting pecuniary returns for transferring ideas/knowledge/technologies to the outside environment), and the **coupled process**, which combines both inside-out and outside-in processes by working in alliances with complementary partners (Gassmann & Enkel, 2004). West and Bogers (2013) argue that the outside-in or inbound process has received most research attention and ascribe this to the fact that this process builds further on a large body of prior research. They see three different research angles on this inbound process: how firms obtain external innovation, the role of innovation created outside the firm by individuals, and research on open source software (including open source communities).

Instead of outside-in and inside-out, **exploration** and **exploitation** are also sometimes used (van de Vrande, Lemmens & Vanhaverbeke, 2006). These are concepts introduced in the context of organizational learning and refer to the relation between the exploration of new possibilities and the exploitation of old certainties (March, 1991). Purposive outflows of knowledge or knowledge exploitation implies innovation activities to leverage existing technological capabilities outside the boundaries of the organization, whereas purposive inflows, or knowledge exploration, relates to innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments (van de Vrande et al., 2009). The coupled process can then be seen as a form of simultaneous exploration and exploitation between two companies or organizations. Interestingly, Enkel et al. (2009) equal the coupled process to **co-creation with complementary partners** that engage in simultaneous outside-in and inside-out processes through alliances, cooperations and/or joint ventures. The description of this third reciprocal process ‘softens’ the Open Innovation concept, as Bogers and West (2012) note that the strong focus on firm success in most Open Innovation literature gives Open Innovation more parallels with the vertical integration model than compared to other perspectives on distributed innovation, such as open source or cumulative innovation, which are more a form of ‘open collaborative innovation’. The occurrence of the ‘coupled process’ and the description of it as being an act of co-creation can also be seen as an example of the apparent convergence between Open Innovation as conceived by Chesbrough and open, collaborative innovation as conceived by von Hippel (cf. chapter 4). Chesbrough and Bogers (2014) note the signs of convergence of both perspectives into a larger, holistic research domain drawing on the notion of distributed sources of knowledge for innovation. Gassmann et al. (2010) even state that “User Innovation is one of Open Innovation’s best-researched part fields”, which takes this idea even one step further, but implicitly suggesting that Open Innovation is the ‘master domain’. However, as we already argued in the previous chapter, **we see distributed innovation as the underlying phenomenon, and both Open and User Innovation as derivative paradigms**, taking different perspectives on the phenomenon. Building further on this line of reasoning, we regard **Living Labs as an innovation approach**, born out of past European experiences and practices (cf. chapter 5) **that unites elements from both paradigms into a network based vision on innovation that drives on knowledge and technology transfers between the involved actors**.

Van de Vrande et al. (2006) relate three organizational capabilities to these processes: *absorptive capacity* for the outside-in process, *multiplicative capacity* for the inside-out process and *relational capacity* related to the coupled process. These capabilities were later extended and partly renamed by Lichtenthaler (2008; cf. infra). This process view on Open Innovation sheds a different light on the literature on R&D spillovers (Arrow, 1962; cf. supra), in which these knowledge spillovers or leaks were regarded as threats to the innovation process. The proposed framework also builds further and extends the work on absorptive capacity (Cohen & Levintal, 1990, cf. supra). Chesbrough and Bogers (2014) argue that the Open Innovation concept deals with purposively managing the mechanisms and characteristics of such spillovers. Moreover, these spillovers are seen as an essential part in the Open Innovation strategy of a company or organization, something which they see as differing from any other innovation theory. Regarding these three main Open Innovation processes, some Open Innovation research has considered outbound commercialization of a firm’s technology (e.g. Lichtenthaler & Ernst, 2007), but the large majority of Open Innovation research has focused on the inbound process, in which firms source external knowledge to reduce cost or increase opportunity related to innovation (cf. Dahlander &

Gann, 2010; Enkel et al., 2009). Such research identifies a variety of external stakeholders as possibly valuable sources of knowledge for innovation, such as suppliers, customers, competitors and universities (cf. Chesbrough, 2003, 2006; Christensen et al., 2005; Laursen & Salter, 2006). However, the third process, coupled innovation, has received only a limited amount of attention in research (Gassmann & Enkel, 2004), and is sometimes not even mentioned at all. Bogers (2011) dedicated some attention to this phenomenon in his work on what he called the 'Open Innovation paradox', also referred to as the 'information paradox', or the blurry boundaries between sharing and protecting. The fact that this is still an issue indicates that there is an imbalance in terms of knowledge and research data regarding these processes. This is surprising, as Chesbrough and Crowther (2006) propose that in a fully open setting, firms combine both technology exploitation (inside-out) and technology exploration (outside-in) in order to create maximum value from their technological capabilities and other competencies. However, it remains unclear how this 'maximum value' can be attained.

3.4 Extending the process view on Open Innovation

An interesting and influential addition to this process-view on Open Innovation was made by Dahlander and Gann (2010) who add the dimension pecuniary (with monetary return) versus non-pecuniary (without monetary return). This results in an analytical framework to describe and research Open Innovation processes, also balancing the strong focus on benefits that has dominated the first literature on Open Innovation with more attention for potential disadvantages associated with different forms of openness. This results in four different Open Innovation processes: revealing, selling, sourcing, and acquiring.

Table 2: Open Innovation processes from Dahlander & Gann (2010)

	Inbound innovation	**Outbound innovation**
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

Revealing is a form of outbound or inside-out innovation where internal resources are 'revealed' without a direct pecuniary return to the external environment. An example of revealing is a software company that publishes the source code of one of its products to allow improvements, modifications or new developments. Fostering incremental or cumulative innovation are mentioned as advantages for this form of Open Innovation (Murray & O'Mahony, 2007; Scotchmer, 1991), together with the aim of getting support and resources from external parties such as end-users and gaining legitimacy from the external environment (Nuvolari, 2005). Bogers and West (2011) define cumulative innovation as unmonetized knowledge spillovers of intentional collaboration or unintended spillovers that cannot be stopped between rivals in order to advance technological progress and improve societal welfare. They see this type of innovation occurring mostly for immature or not fully commercialized technologies. Two different patterns of cumulative innovation occur: various parties successively refine a single technology until the improved technology is widely used by a range of producers (Allen, 1983; Nuvolari, 2005), or companies build up a common, ever-increasing pool of enabling science (Murray & O'Mahony, 2007). The ability to build upon each other's work results in a steady stream of incremental innovation across the community of firms. As disadvantages the difficulty to capture the eventual benefits of revealing and the leakage of internal resources to competitors (Laursen & Salter, 2006), or negative knowledge spill-overs, are mentioned. Dahlander and Gann (2010) state that mostly smaller companies lack the resources to structure the process of revealing, which would make this a less attractive strategy for SMEs.

Selling is a form of outbound or inside-out innovation where internal resources are 'sold' or 'out-licensed' to external parties with a pecuniary return. This is also referred to as the act of commercializing inventions by selling or licensing them to other organizations, for example Microsoft that licenses its software products to other companies[14]. The main advantage is that products or patents that are 'on the shelf' can be commercialized immediately, as it is possible that outside partners can be better positioned to commercialize inventions with a mutual interest for both organizations (Chesbrough & Rosenbloom, 2002). A disadvantage is that over-commitment to own products and technologies makes it difficult to out-license them (Lichtenthaler & Ernst, 2007). Another major obstacle is the so-called 'information paradox'. As an inventor wants to license or sell information to a potential licensee or buyer, it is necessary to reveal some of this information 'for free', which allows the potential licensee or buyer to 'steal' the idea or information (Arrow, 1962; Bogers, 2011). The market for technology literature has also argued that transferring technologies between different actors involves significant transaction costs, therefore, the potential of selling technologies in the market place has not been fully leveraged (Gambardella et al., 2007).

Sourcing is a form of inbound or outside-in innovation where external ideas or knowledge are 'sourced' from external parties such as customers, suppliers, competitors, universities,… with a non-pecuniary return for these actors. An example of sourcing are the so-called innovation centers of large companies that deal with knowledge exchange and innovation support of smaller, innovative companies and research organizations (e.g. the Microsoft Innovation Centers[15]). The advantages of this type of Open Innovation are the potential access to a wide variety of ideas and knowledge (Laursen & Salter, 2006) and the potential discovery of radical new solutions for existing problems (Lakhani et al., 2007). The disadvantages are that sourcing can create an attention problem (Laursen & Salter, 2006), and

[14] https://licensing.microsoft.com/
[15] http://www.mic-brussels.be/

along the same line of reasoning that it might become difficult to choose between too many alternatives (Sapienza et al., 2004). Katila and Ahuja (2002) propose that search behavior is critical for understanding the limits and contingent effects on innovation. A widely cited study by Laursen and Salter (2006) builds further on this notion and has showed that searching widely and deeply across a variety of search channels can provide ideas and resources that help firms gain and exploit innovative opportunities. However, when certain thresholds are crossed, a phenomenon referred to as 'over-search', openness negatively affects innovative performance.

Acquiring is a form of inbound or outside-in innovation where external inventions or other external inputs to the innovation process are 'acquired' from external parties with a pecuniary return in exchange for these actors, through formal or informal relationships. An example is large companies 'buying' innovative small companies to acquire their technology or some other asset that they possess. Firms differ in their degree of organizational integration for acquiring external R&D (Granstrand, 2000; Vanhaverbeke et al., 2002) which might include technology sourcing and acquisition (Arora et al., 2001; Nicholls-Nixon & Woo, 2003; Veugelers & Cassiman, 1999), strategic alliances with external suppliers of technology (Lambe & Spekman, 1997; Narula & Hagedoorn, 1999), or a collaborative R&D joint venture (Peck, 1986). The drivers of external sourcing emphasize two types of motivations: improved efficiency through scale economies, and access to innovations (or innovation producing capabilities) not held by the focal firm. Advantages to this Open Innovation approach are the access to resources and knowledge from partners (Powell, 1998), and the potential leveraging of complementarities with partners (Dyer & Singh, 1998). As disadvantages the maintenance of having a large number of ties with different partners (Ahuja, 2000), and the risk of outsourcing critical dimensions of the firm's business are mentioned. Incorporating knowledge bases too close to what the firm already knows may hamper the positive effect of assimilating external inputs. Too distant inputs are harder to align with existing practices, and if knowledge bases are too similar it is difficult to come up with novel combinations (Sapienza et al., 2004).

For now, we can summarize the literature on Open Innovation processes, the required firm capabilities and the strategies that can be followed in order to pursue these processes in the table below.

Table 3: Own summary of Open Innovation processes, related company capacities and modi operandi

Open Innovation process	**Exploration**		**Exploitation**		**Coupled process**
	Outside-in		Inside-out		
Company capacity	absorptive capacity		multiplicative capacity		relational capacity
Activity	Sourcing	Acquiring	Revealing	Selling	Co-creating
Strategy	Customer involvement External networking External participation Outsourcing R&D Inward IP licensing		Venturing Outward IP licensing Employee involvement		Alliances Cooperation Joint-ventures
Issue	Balancing between sharing and protecting (Open Innovation Paradox)				

The inclusion of the non-pecuniary dimension by Dahlander and Gann (2010), combined with the focus on the locus of innovation of Gassmann and Enkel (2004), links up nicely with the User Innovation paradigm of von Hippel, as (lead) users are considered to freely reveal their innovations (cf. infra). Bogers and West (2012) further expand on this reasoning as they see the Open Innovation and User Innovation paradigms differ mostly in terms of the level of analysis, as in User Innovation the main actor is the user, as in Open Innovation a company or organization is at the steering wheel of the innovation process. This differs with the argument of Gassmann et al. (2010) which we described earlier, where User Innovation was seen as a part of the bigger Open Innovation picture. We argue that this process-perspective offers a more holistic picture of what is actually going on when engaging in distributed innovation processes and does not contradict any of both paradigms.

Initially, in Open Innovation research these processes were studied within firms (intra-firm) or between firms (inter-firm), whereas later Open Innovation studies also examine how organizations can collaborate with users in order to facilitate a process of external exploration as well (West & Lakhani, 2008). However, both processes have different hypothesized spillovers: within Open Innovation research, these knowledge and technology spillovers are situated among firms in an exchange or pecuniary modus, whereas in User Innovation research, these spillovers from users to producers are not pecuniary in nature (Bogers & West, 2012). It is also remarkable that no attention is dedicated to the coupled process by Dahlander and Gann (2010). Therefore, based on the previously described literature, we have added this process to the table and added co-creation as the activity for this reciprocal process, following the reasoning of Enkel et al. (2009).

Another Open Innovation process that was only emphasized in later works on Open Innovation, besides the main processes of exploitation and exploration, is the process of external knowledge **retention** which refers to maintaining, storing and reusing knowledge over time outside of a firm’s organizational boundaries (Lichtenthaler & Lichtenthaler, 2009; Dittrich & Duysters, 2007). 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 et al., 2006). As such, this comprises both formal collaborative projects and more general and informal networking activities. Open Innovation networks, which can range from informal links 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).

3.5 Managing Open Innovation

In the previous chapter, we briefly touched upon Open Innovation as an innovation management approach. Within this section we will dig deeper into this matter, based on the insights from the Open Innovation paradigm. As we already proposed, Open Innovation is about purposefully managing inbound and/or outbound knowledge transfers in order to stimulate and optimize the innovation process. Gassmann and Enkel (2004) list determinants that make a firm better suited for an open or closed innovation approach. For Open Innovation: high product modularity, high industry speed, much explicit and tacit knowledge required, highly complex interfaces, and creating positive externalities. For closed innovation: low product modularity, low industry speed, less tacit knowledge required, low complex interfaces, no positive external effects through licensing. This proposes a very black and white view on open versus closed innovation, so these determinants seem less usable for actually managing Open Innovation processes. Almirall and Casadesus-Masanell (2010) take a different approach and distinguish various levels of openness versus closedness based on a simulation exercise that opposes discovery, or the positive effects of opening up such as discovering new product features, versus divergence, or the negative effects of opening up such as loss of control and increased coordination costs. A major critique would be that their simulations are not based on actual data, but rely on theoretical assumptions. However, their approach offers much more opportunities for actual innovation management. Some of the findings include that Open Innovation is generally superior to closed innovation when complexity is not high, whereas Open Innovation is generally inferior to closed innovation when complexity is high, with complexity likely to decrease with technological progress over time. This suggests that breakthrough innovation with a high degree of complexity should be pursued through a closed innovation approach, opening up more and more as the technology matures and evolves over time towards decreased complexity. Therefore, Almirall and Casadesus-Masanell (2010) suggest that discovery might arise from restricting the available choices in terms of product features by learning from the choices made by others on the market. A criticism is the fact that this model focusses on inter-firm Open Innovation through collaboration or alliances. However, Almirall and Casadesus-Masanell themselves propose that their model sheds light on value creation, whereas it lacks insight into the value capture process. Therefore, they suggest that research into user-driven innovations should consider the complexity of mapping between product features and customer value created as a factor that can potentially moderate the effects of user contributions to product innovation. This statement explicitly proposes to link Open Innovation and User Innovation, something which we also want to achieve within this PhD.

Other scholars looking at collaboration between companies or organizations, the inter-firm level, state there needs to be a balance between knowledge sharing and knowledge protection, to avoid the so-called information or Open Innovation paradox (Bogers, 2011) which we discussed previously. However, this is easier said than done, as Lichtenthaler (2011) states that firms need to address multiple determinants at distinct levels to enhance their Open Innovation management, as the outcome of an Open Innovation process depends on firm-level capabilities, project-level decisions as well as individual-level attitudes (cf. infra). Some of these factors are identified by Torkkeli et al. (2009) who take a contingency perspective on Open Innovation. They list the following variables as having an impact on the Open Innovation strategy decision: size, availability of complimentary assets, possible economies of scale, stocks of knowledge and absorptive capacity as internal determinants, and network externalities, appropriability regimes and game theoretic rationales as external determinants. This leads to the conclusion that there is not one single best approach to managing a firm's Open Innovation activities (Lichtenthaler & Lichtenthaler, 2009). This resonates with Ortt and van der Duin's (2008) notion of **contextual innovation** (cf. the previous chapter), a form of innovation management that tries to find an optimal balance between open and closed innovation strategies based on contextual factors.

For companies, on the intra-firm level it is necessary to attain an optimal level of ambidexterity, or the capability to explore external knowledge and valorize or exploit this knowledge for internal benefit (Andriopoulos & Lewis, 2009). In order to clarify this, Lichtenthaler (2011) developed a framework which points out to the fact that firms need to balance the development of organizational capabilities, but also that this integrated approach, impacting and aligning the different levels (inter-firm and intra-firm on an organizational, project and individual level), is difficult to observe and imitate, which makes that successful Open Innovation may be an important foundation for achieving a sustainable competitive advantage. Lichtenthaler (2011) states that in the light of the three Open Innovation processes, Open Innovation networks demand for three corresponding firm capabilities: **absorptive capacity**, or the ability to deal with knowledge exploration, **connective capacity**, or the ability to deal with knowledge retention, and **desorptive capacity**, or the ability to deal with knowledge exploitation. However, he also argues that these Open Innovation capabilities need to be balanced with internal firm capabilities that are also linked to these three processes, as internal and external processes are often complementary at the organizational level (Cassiman & Veugelers, 2002). These three capabilities are **inventive capacity** (linked to knowledge exploration), **transformative capacity** (linked to knowledge retention) and **innovative capacity** (linked to knowledge exploitation). Lichtenthaler also includes project level and individual level decisions and attitudes, but we will not go into further detail regarding these, as this goes beyond the scope of this PhD. We do retain that a distinction is made between different levels of analysis, and that the process view on Open Innovation infers quite some complexity. Also, note that Lichtenthaler does not consider the coupled process as a separate process, so no reference is made to relational capacity either, and he uses desorptive capacity instead of the term multiplicative capacity. This different wording and use of concepts also lies at the base of the identified conceptual ambiguity, which is one of the criticisms on Open Innovation as a paradigm.

Table 4: Open Innovation processes and related company capabilities by Lichtenthaler (2011)

		Knowledge exploration	**Knowledge retention**	**Knowledge exploitation**
Internal	*Organizational level*	Inventive capacity	Transformative capacity	Innovative capacity
	Project level	Make decision	Integrate decision	Keep decision
	Individual level	Not-invented-here attitude	Not-connected-here attitude	Not-sold-here attitude
External	*Organizational level*	Absorptive capacity	Connective capacity	Desorptive capacity
	Project level	Buy decision	Relate decision	Sell decision
	Individual level	Buy-in attitude	Relate-out attitude	Sell-out attitude

While Open Innovation considers that strong formal or informal appropriability mechanisms allow firms to profit from innovation (Chesbrough, 2003; West, 2006), they generally monetize their innovations rather than allowing free spillovers of knowledge (Chesbrough, 2006). Thus, the management of IP and licensing is a central means to control knowledge flows and determine ownership (Arora et al., 2001; Granstrand, 2000). In general, the distributed production of innovation relies on an IP regime that supports knowledge spillovers and collaborative ownership of innovation. Free spillovers can come from innovation benefactors such as universities (Chesbrough, 2003). In addition, a producer's internal characteristics and capabilities affect its ability to insource useful knowledge for innovation (Mowery et al., 1996).

Regarding the ‘coupled process’, absent in the framework of Lichtenthaler, Bogers (2011) identifies the following characteristics as having an important impact on the nature and outcome of the collaboration: experience of and with partners, university involvement, number of partners, partner size and duration. In terms of the capacities within Lichtenthaler’s model, it seems reasonable that the corresponding capacities of the simultaneously occurring processes need to be balanced and aligned with each other, which would lead to the hypothesis that a coupled Open Innovation process is more difficult to manage. However, this contradicts the finding of Kock and Torkkeli (2008) who mention reciprocity as an Open Innovation best practice with trust between the actors engaging in this type of Open Innovation as an important factor. They even go further and see these reciprocal Open Innovation activities developing into ‘communities of openness’ that act as islands of strong mutual exchanges of knowledge within a sea of much lower degrees of knowledge interchanges.

Regarding the innovation process itself, Gassmann et al. (2010) observe a shift from the highly structured stage-gate process towards more iterative and interactive probe-and-learn processes. This shift can be explained by the fact that the stage-gate process proved to be very effective in reducing the number of type I errors (false positives), but yielded a large increase of type II errors (false negatives) (Chesbrough, 2006; cf. also the previous chapter). An additional difficulty for managing Open Innovation processes is the fact that opening up innovation creates spatially distant R&D teams, which are more difficult to energize, coordinate and enable in their knowledge creation (Gassmann et al., 2010).

Huizingh (2011) concludes that there are still large gaps in Open Innovation research, especially for the context dependency of Open Innovation, or how the internal and external environment characteristics are affecting innovation performance. The discussed framework of Lichtenthaler (2011) offers the most comprehensive view, but how to effectively apply this in innovation management remains open (cf. infra). Moreover, Westerlund and Leminen (2011) state that the change towards an Open Innovation approach is easier for small companies than for large firms, as they are often more agile and less restricted by current markets and practices due to their smallness and newness. The model of Lichtenthaler seems to support this hypothesis, as it points out to the complex interrelationships of organizational capabilities on different levels (organizational, project and individual), which would be easier to manage when the company size is small.

3.6 Open Innovation Systems, networks and systemic instruments

Most of the Open Innovation concepts and literature we discussed in the previous sections take a single firm or the exchange process of knowledge between firms as the unit of analysis. However, these exchanges do not necessarily occur between two actors, but can also be part of a larger network or constellation of actors engaging in Open Innovation. As Living Labs consist of multiple actors engaging in innovation projects that deal with knowledge transfers and collaborative activities (such as co-creation), we need to take a more encompassing perspective that is able to analyze and describe these networked structures and activities. Therefore we turn to the literature on systemic innovation, (open) innovation networks and systemic instruments for concepts and frameworks to facilitate this network view on Living Labs.

The first concept we introduce has received the least attention, especially in terms of empirical research, and operates on a more 'macro' level compared to innovation networks: **innovation systems**. Although there is no consistent definition available (yet), the concept of the innovation system sees technology and information transfers between people, companies, organizations and institutions as essential to the innovation process. Wieczorek and Hekkert (2012) state that, in its broadest definition, an innovation system entails all parts and aspects of an economic structure, together with the institutional set-up affecting learning, searching and exploring, which includes the production, marketing and finance system. Actors within innovation systems include users, producers, intermediary organizations and supportive organizations (Smits & Kuhlmann, 2004). Wieczorek and Hekkert (2012) discern between different types of innovation systems: national or regional innovation systems (when a geo space is a unit of analysis), sectorial innovation systems (dealing with a whole sector of economic activity, often going beyond national borders), and technological innovation systems (evolving around a specific technology). This means that innovation systems consist of multiple levels that interact with each other and that can be subjected to analysis. Fichter (2009) discerns the company level (the most used level of analysis in Open Innovation research), the value chain level of innovating actors, and the level of framing and interlinking organizations (a superstructure level that hosts organizations that enable other actors to innovate).

Following the broad definition of innovation systems, we can see **innovation networks** as part of these systems, where innovation networks can be defined as purposefully established connections between the demand side (intermediate and end-users of innovation) and the supply side (producers of knowledge and technologies) of the knowledge infrastructure, as well as with other relevant actors from within the innovation system (Klerkx & Leeuwis, 2009). Within this system and network perspective co-operation between several different types of actors is seen as key to successful innovation. Fischer (2006) relates this to the belief that innovation networks offer time advantages over internal development in realizing innovations in a shorter time interval. Rese and Baier (2011) discovered the following four network-related success factors that enhance the chances of successful innovation in innovation networks: *trust*, *commitment*, *dependency* and *compatibility* of the network actors. Referring back to the Open Innovation processes of exploration and exploitation, Dittrich and Duysters (2007) hypothesize that actors pursuing an exploration strategy will look for partners with distinctly different capabilities, resulting in an innovation network consisting of partners in new technological areas, whereas companies following an exploitation strategy will search for companies with similar technological capabilities, resulting in an innovation network of partners in similar technological areas. Rese and Baier (2011) state that innovation networks appeal in particular to SMEs as they are able to reduce existing barriers for innovation by complementing the resources they lack. This resonates with the hypothesis put forward by Westerlund and Leminen (2011) that small companies find it easier to switch to an Open Innovation strategy (cf. supra).

However, research into innovation systems and networks also revealed that several gaps might hinder effective co-operation. Based on an in-depth case study of an innovation network in the Dutch agriculture industry, Klerkx and Aarts (2013) provide an overview of the **three main challenges and paradoxes that occur when dealing with Open Innovation networks**. First, they need to find a balance between new relationships and existing relationships, i.e. balancing openness (exploiting weak ties) and closure of the network (fostering strong ties). This is also referred to as the need for 'dynamic stability' (Dhanaraj & Parkhe, 2006). Second, the ways of interaction between the actors in the network need to take into account the different perspectives of the actors on the nature and form of the cooperation, as (too) diverging perspectives may lead to conflicts or even network failure. Third, the formal and informal relationships between the actors in the network need to be balanced. Actors in the network need to manage the paradox that they have to develop their position in the network to reap the benefits, but that total control of the network by one firm may be counterproductive as it undermines the informal basis of network cooperation.

These challenges can be overcome through the process of network orchestration. The literature regarding this orchestration has identified three basic elements (Pittaway et al., 2004; Batterink et al., 2010; Klerkx & Aarts, 2013): *demand articulation*, which refers to the continuous vision development and articulation of related technology, knowledge, and other resource needs; *innovation network composition*, which entails scanning, filtering, and matchmaking of new network partners for accessing certain resources; and *innovation process management*, or coordinating the network to foster trust, transparency and reciprocity.

This led to the creation of **systemic instruments** that aim to address problems, referred to as systemic weaknesses or systemic failures, that arise at the innovation system level and which negatively influence the speed and direction of innovation processes that run in the innovation networks within the innovation system (Smits & Kuhlmann, 2004). One of these 'instruments', advocated by scientific and policy literature, are so-called intermediary organizations to fulfill bridging and brokerage roles within innovation systems to overcome various gaps among innovation system stakeholders that can lead to innovation system failures and reduced performance (Klerkx & Leeuwis, 2009). Katzy et al. (2013) also state that there is broad agreement in literature that innovation processes in open networks are coordinated through a visible hand, often referred to as **innovation intermediary**, and propose the Living Lab as a process coordinating innovation intermediary for "(1) closing the pre-commercial gap by manifesting initial demand for products and services, as well as (2) orchestrating the actions of disparate actors in order to gain critical mass for the creation of a product or service" (Almirall & Wareham, 2011). These innovation intermediaries are described to provide a set of operative activities that link them to the network innovation processes, but literature provides only fragmented insight about the intermediary–process relationship. Sieg, Wallin and von Krogh (2010) also note that there is a relatively limited understanding of the implementation of Open Innovation through innovation intermediaries, with the notable exceptions of knowledge brokers (recombination of existing solutions) (Hargadon & Sutton, 1997; Hargadon & Sutton, 2000), and virtual knowledge brokers (Verona et al., 2006). Moreover, Smits and Kuhlmann (2004) note that the most systemic instruments, such as brokers and intermediaries, take an individual organization or a bilateral relation as unit of analysis, focusing mostly on the private sector and far less on the public sector and public-private alliances, with only few attention for learning processes, platforms for experimentation or tailor-made strategic intelligence.

This apparent gap in the literature is somewhat filled by the research stream focusing on Triple and Quadruple Helix models. We already introduced the Triple Helix model when discussing the System Models of Innovation Management (cf. supra). The Triple Helix thesis states that the university can play an enhanced role in innovation in increasingly knowledge-based societies (Etzkowitz & Leydesdorff, 2000), and represents an evolutionary model of innovation that looks at the interactions between three distinct actors ('helices'): university, industry and government (Leydesdorff & Etzkowitz, 1996). By acknowledging interactions between and influence of these actors on one another, the Triple Helix as an analytical model looks to describe institutional arrangements and policy models, conceptualizing innovation as inherently dynamic and driven by various forces interacting with each other (Etzkowitz & Leydesdorff, 2000), which resonates with the evolutionary models of innovation in the previous chapter. A connection between these systemic and evolutionary models on innovation and Living Labs is made by introducing Quadruple Helix models that add the user as a fourth helix. Arnkil et al. (2010) see the evolution towards Quadruple Helix models as an acknowledgement of broad cooperation in innovation, and a shift towards systemic, open and user-centric innovation policy, as opposed to an era of linear, top-down, expert driven development, production and services. This way, **Living Labs can be seen as Open Innovation networks that function as systemic instruments or innovation intermediaries that try to overcome innovation barriers for the involved actors in the Living Lab network**. However, research on how these innovation processes are coordinated is largely lacking, especially literature linking a more systemic view with the Open Innovation processes we discussed in this chapter.

3.7 Criticism on Open Innovation

A major criticism on Open Innovation is that, at first sight, open and closed innovation are perceived as mutually exclusive and dichotomous approaches. Trott and Hartmann (2009) argue that there is a continuum of innovation approaches from very closed at one end to very open at the other, whereas 'open' versus 'closed' is too simplistic and fails to adequately describe and analyze recent innovation strategies. Indeed, the collaboration between companies is often only ad hoc or project based, and not all the relevant stakeholders are always involved in the innovation process (Bogers, 2011). We argue that in order to develop his thinking on Open Innovation, Chesbrough captured the two extremes in order to clearly delineate both a totally closed innovation process versus a totally open innovation process, as it is necessary to define white and black to distinguish gray. Huizingh (2011) argues that Open Innovation has become more than one mode of innovation, as it is an umbrella connecting and integrating various approaches and activities.

Enkel et al. (2009) mention some other potential risks associated to Open Innovation, based on empirical research: loss of knowledge, higher coordination costs, loss of control, higher complexity, difficulty in finding the right partner, imbalance between Open Innovation activities and daily business, and lack of time and money for Open Innovation activities. Therefore, they conclude that the future of innovation processes lies in an appropriate balance between open and closed innovation approaches, as too much openness can lead to a negative impact on companies' long-term innovation success, loss of control and loss of core competences, while a too closed innovation approach does not serve the demands of increasingly shorter innovation cycles and reduced time-to-market. Almirall and Casadesus-Masanell (2010) also researched this matter and reached a similar conclusion, as they state that the best approach to innovation is the resolution of the trade-off between benefits of discovery and costs of divergence. However, based on a study among 131 Spanish companies, Kock and Torkkeli (2008) conclude that the majority engages in Open Innovation that 'goes steady', meaning that they rely on repeated interactions with the same partners. Although this is in line with Laursen and Salter's (2006) finding that searching too broadly and/or deeply has a negative impact on innovation performance, Kock and Torkkeli (2008) argue that only engaging in Open Innovation with a small and fixed set of partners might even lead to a lower degree of really path-breaking innovation in the long run. This is confirmed by Dhalander and Gann (2010) who state that from a long term perspective, it is important to maintain a diverse partner base over time. There seems to be a gap between theory and practice here. This is also apparent in other empirical research into Open Innovation strategies and the management of these efforts, as they have indicated that a lot of companies struggled with implementing Open Innovation processes (Lichtenthaler, 2008; van de Vrande et al., 2009), and that there are major differences between different firms and organizations (Laursen & Salter, 2006). Also, as appeared in the previous section, there is no clear way either to adequately manage Open Innovation. Huizingh (2011) states that a decent cookbook and integrated framework that helps managers to decide when and how to deploy which Open Innovation practices remains absent. The main criticism that can be abstracted here is that Open Innovation remains too descriptive and is less able to provide concrete innovation management guidelines given certain circumstances. Given these inconsistencies between theory and practice, Lichtenthaler (2011) argues that in order to advance the field of Open Innovation, practitioners and academics need a better understanding of Open Innovation processes in order to reap the benefits and avoid potential negative consequences. Therefore, **by unraveling knowledge tranfers during innovation processes in Living Labs, that we regard as innovation networks, we contribute to the Open Innovation literature within this PhD**.

On top of that, organizations and collaborations can differ in their degree of openness as well. When practicing Open Innovation, there is a difficult balance between sharing knowledge and protecting knowledge, something which is referred to as the 'information paradox' or the 'Open Innovation paradox' (West et al., 2006; Bogers, 2011). Ortt and van der Duin (2008) also acknowledged this issue and stated that in nowadays turbulent innovation environment, no single innovation management best practice exists anymore. Instead, they plead for so-called 'contextual innovation', or the fact that innovation management should be tailored towards the organizational and societal context of the innovating company (cf. also the previous chapter). This is confirmed by Torkkeli et al. (2009) who found that the incentives to engage in Open Innovation are different for large versus small companies, while Mention (2011) discovered that a higher degree of innovation novelty shows a positive relation with the degree of co-operation and usage of external knowledge sources. Summarizing, this holds the criticism that **there are at this moment too many 'blind spots' to implement the insights from the Open Innovation framework into an easy-to-use and one-size-fits-all Open Innovation management approach**.

A final criticism, that is linked to the previous one, is the imbalance in the focus and amount of research dedicated to the different **levels of analysis**. A lot of research takes the firm as central unit of analysis, and most of the Open Innovation-literature takes a firm company-centric perspective. However, as already mentioned in the introduction, the starting point for Open Innovation is that a single company cannot innovate in complete isolation, but has to engage with other stakeholders in order to acquire ideas as well as resources external to the company (Chesbrough, 2003; Laursen & Salter, 2006). Regarding this openness, Chesbrough states that "Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology". This is the most commonly used definition in literature and is regarded as broad, underscoring that valuable ideas emerge and can be commercialized from inside or outside of the firm. In this view, external actors can leverage a firm's investment in internal R&D through combinations of previously disconnected silos of knowledge and capabilities (Fleming, 2001; Hargadon & Sutton, 1997; Schumpeter, 1942). However, the Open Innovation literature is biased and focusses more on the positive aspects of openness, although the downsides can also be considerable: openness can result in resources being made available for others to exploit, with intellectual property being difficult to protect and benefits from innovation difficult to appropriate (Dahlander & Gann, 2010). Therefore, one of the main research questions researchers in the area of Open Innovation are dealing with, remains how openness influences the ability of companies to innovate (Chesbrough, 2003; Helfat & Quinn, 2006; Laursen & Salter, 2006). One of the problems is that in spite of the rising interest in using Open Innovation, systematic studies remain cumbersome because of conceptual ambiguity (Dahlander & Gann, 2010). In this matter, we can also refer back to the discussion regarding the position of User Innovation in comparison with Open Innovation.

3.8 Research gaps in Open Innovation

As we argued in the previous section, most Open Innovation research focusses on the firm and takes the firm as central *unit of analysis*. West and Bogers (2013) also identified a large discrepancy in the research attention between the different innovation processes. In their analysis of Open Innovation articles in the top 25 journals from the period 2003-2010, they identified 165 articles, from which 71.5% included some form of inbound Open Innovation, 30.3% some form of outbound innovation, and 42.4% considered the co-creation process combining inbound and outbound flows. There is also a lack of research into Open Innovation within *SMEs* (van de Vrande et al., 2006), although recently more attention has been paid to this topic (Brunswicker & Vanhaverbeke, 2013; Lee et al., 2010; van de Vrande et al., 2009; Zeng et al., 2010). This is quite surprising, as van de Vrande et al. (2009) argue that the Open Innovation model recognizes that smaller firms take an increasingly important role in the contemporary innovation landscape and that because of their lack of resources and smallness, they are more relying on their networks to find missing resources. They further state that in today's increasingly complex and knowledge-intensive world with shortened product life cycles, such networking behavior becomes increasingly more important (cf.

supra). The most recent study on Open Innovation in SMEs (Brunswicker & Vanhaverbeke, 2013) is the most comprehensive one, offering a typology of five strategic types of external knowledge sourcing. However, firms under two years or firms having less than five employees were not included in the analysis. This is even more surprising, as Gans and Stern (2003) state that small start-up firms and entrepreneurs have to deal with specific management challenges: how to translate promising technologies into a stream of economic returns for their founders, investors and employees. Therefore, their main problem is not so much invention but commercialization, which would require other types of ‘openness’ such as outbound flows, which are also under researched, as most research is focused on sourcing innovation while ignoring profiting from these innovations. West and Bogers (2013) compare this to User Innovation researchers emphasizing the distributed creation of innovation without looking into firm exploitation. Besides being under researched, van de Vrande et al. (2009) state that inbound Open Innovation is far more diffused among SMEs than *outbound Open Innovation*. The fact that SMEs cannot cover all innovation activities required to successfully realize an innovation is ascribed to their smallness and resource constraints (Brunswicker & Vanhaverbeke, 2013). However, this also holds opportunities, as SMEs are usually more flexible, less formalized and quicker to make decisions (Lee et al., 2010).

Besides a bias in company size, there is also a lack of studies on Open Innovation in *low-tech industries*, as most research deals with high-tech industries (West & Bogers, 2013), and of Open Innovation for the *service sector*, the largest sector in developed countries (Gassmann et al., 2010). Associated with the criticisms on Open Innovation, Chesbrough and Bogers (2014) also mention that there is a lack of studies assessing the *limits, risks and costs* of Open Innovation, *large-scale studies* are still scarce and there remains a bias in focusing on successful cases and examples of Open Innovation. The existing large-scale studies are mostly based on *secondary data sources* such as existing innovation surveys (Laursen & Salter, 2006; van de Vrande et al., 2009) and merely report the occurrence of certain Open Innovation practices or strategies. Moreover, Kock and Torkkeli (2008) also criticize *self-reporting* of companies as this might induce a strong social desirability in terms of reporting Open Innovation practices as this is regarded as a good management practice.

West and Bogers (2013) also state that more research is needed on the *motivation* of the external collaborator, especially in cases where the collaboration is driven by non-pecuniary motivations. Chesbrough and Bogers (2014) also note that the *institutional context* plays an important role in Open Innovation and mention that research into the impact of institutional factors on innovation remains an important area for future research. Regarding *firm capabilities*, most research has focused on absorptive capacity, and the results are inconclusive regarding the exact role in Open Innovation processes (West & Bogers, 2013). Moreover, Enkel et al. (2009) state that there are only few studies that try to put forward *measurement systems* and key performance indicators to evaluate open versus closed approaches. In an attempt to solve this, West and Bogers (2013) identified the following metrics to measure value creation based on Open Innovation: rate of new product releases, product performance, revenue growth, fraction of revenues attributable to radical innovations, fraction of revenues attributable to new products, revenues per employee due to new products, and patenting. However, large-scale or more holistic studies on these matters are still missing. Finally, there is also a lack of attention for the *retention process* in Open Innovation, which is only dealt with in Lichtenthaler and Lichtenthaler (2009), Lichtenthaler (2011) and Huizingh (2011). This is very clear in terms of empirical research, as to our knowledge there is none available to this day.

Regarding Open Innovation networks and systemic instruments, Dahlander and Gann (2010) identified a research gap in terms of coordination in Open Innovation. This is confirmed by Katzy et al. (2013) who argue that the engineering and execution of collaborative innovation processes is conceptually and practically underdeveloped. Moreover, literature provides a relatively limited understanding of the implementation of Open Innovation through innovation intermediaries (Sieg, Wallin & von Krogh, 2010), and only fragmented insight about the intermediary-process relationship (Katzy et al., 2013).

3.9 Conclusions & key concepts

Within this chapter, we looked at the Open Innovation literature as an application of distributed innovation from a company-centric perspective. Although a lot of principles and phenomena, such as economic spill-overs and dynamic capabilities, were already described a long time ago, it took until the start of the 21st century for Henry Chesbrough to start connecting the dots towards a more comprehensive paradigm. Although there are still quite some blind spots and research gaps, we have been able to distillate some relevant concepts and frameworks to study Living Labs.

First, we gathered from the Open Innovation paradigm that innovation processes essentially deal with **exchanging relevant knowledge** between actors. This also confirms the idea from the previous chapter that innovation is a process, as a distinction is made between knowledge creation, innovation, and commercialization. Building further on the argument from the previous chapter, where we defined Living Labs as innovation networks, we now extend this by positioning Living Labs as purposefully set-up Open Innovation networks where knowledge is exchanged between the participating actors. However, regarding these exchanges, the literature is still inconclusive on the nature and outlook of these Open Innovation processes, as some authors use different terminologies and discern various elements within these knowledge transfers. Out of the above we distillate the following framework describing the different knowledge transfers that occur within Open Innovation systems with their related firm or actor capabilities.

Table 5: Summary of Open Innovation processes and related capabilities

Open Innovation process (Lichtenthaler & Lichtenthaler, 2009; van de Vrande et al., 2009)	**Exploration** *= innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments*	**Exploitation** *= innovation activities to leverage existing knowledge or technological capabilities outside the boundaries of the organization*	**Retention** *= maintaining, storing and reusing knowledge over time outside of an organization's boundaries*
Internal organizational capabilities (Lichtenthaler, 2011)	Inventive capacity *= the ability to generate knowledge internally*	Innovative capacity *= the ability to generate innovation internally*	Transformative capacity *= the ability to re-use internal knowledge*
External organizational capabilities (Lichtenthaler, 2011)	Absorptive capacity *= the ability to explore knowledge from external actors*	Desorptive capacity *= the ability to exploit internal knowledge to external actors*	Connective capacity *= the ability to connect with external actors to store or re-use knowledge*

The exchanges can take three forms: **exploitation** (also labeled inside-out), **exploration** (also labeled outside-in), and **retention** (the storage and/or re-use of knowledge over time). An internal and external organizational capability is linked to each of the three processes: inventive and absorptive capacity, innovative and desorptive capacity, and transformative and connective capacity. We will use this as an analytical framework to analyze and make sense of knowledge transfers between actors involved in Living Labs.

Within this chapter on Open Innovation, it became clear that distributed innovation processes can be analyzed from different angles and perspectives. Chesbrough and Bogers (2014) distinguished between Individual/Group, Firm/Organization, Network, Industry/Sector and National/Institutional. We will contribute to this by taking into account different levels of analysis in the studied Living Labs and Living Lab cases. Moreover, in chapter 6 we will look into the different levels of analysis for Living Labs and propose our own distinction in three levels of analysis (micro, meso and macro level).

From this chapter, we also gather the network perspective when multiple stakeholders organize for knowledge exchange. When looking at an Open Innovation Network, we can distinguish the following challenges and issues that must be managed between the participating actors (Klerkx & Aarts, 2013): balancing new relationships and existing relationships, referred to as 'dynamic stability' (exploiting weak ties versus fostering strong ties), determining the most appropriate way of interaction for perspective and goal alignment, and balancing informal and formal relationships (i.e. avoiding and uncontrollable network versus avoiding that one or more actors gain total control of the network). However, we also gathered from this chapter that there are still a lot of gaps and blind spots within Open Innovation theory. This prevents an easy-to-use and one-size-fits-all innovation management approach.

References chapter 3

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4. USER INNOVATION

As active user involvement is one of the central elements in Living Labs, we will now aim our attention towards the end user. Within this chapter, we will give an overview of the literature and research from the User Innovation paradigm in order to abstract relevant concepts and frameworks to analyze and make sense of user involvement and user contributions in Living Labs. In the previous chapter we discussed Open Innovation as a paradigm acknowledging distributed innovation and the unevenly distribution of knowledge across society. Open Innovation offered a point of view towards these distributed innovation processes predominantly from a company perspective. The main question was: 'How can a company benefit from external sources of knowledge or benefit by externalizing internal assets?' We see User Innovation as a form of distributed innovation that acknowledges the user as a source of innovation, which makes User Innovation perfectly compatible with the Open Innovation literature as the user can be regarded an external source of innovation by a company. However, the initial main question of User Innovation researchers was fundamentally different: 'Under what circumstances do users start innovating themselves?' This was later extended to the question 'Which users can be involved in what way to contribute to innovation processes?' This is also referred to as the customer active paradigm (CAP), which implies that the user takes the initiative in one or more stages of the innovation process, as opposed to the previously dominant manufacturer active paradigm (MAP). This evolution runs quite in parallel with the evolutions in innovation management, where after the technology push and market pull paradigms, an interactionist approach was taken (cf. chapter 2). Within our selected overview of User Innovation literature, in general three different approaches towards user involvement can be distinguished. The first approach is User Innovation by and with Lead Users. With roots dating back to the 1970s, Eric von Hippel's Lead User-concept has dominated most of the research in the User Innovation paradigm. Lead Users can be considered as the 'holy grail' for user involvement, as by definition a Lead User gives access to new needs that will become general in the marketplace. However, the main problem was that identifying Lead Users appeared to resemble the search for needles in a haystack. Most research was also 'post hoc', which meant that for a given (already successful) innovation, the role of (lead) users was demonstrated. To move beyond descriptive Lead User papers, research into the nature and characteristics of these Lead Users and into identification methods was carried out. This eventually led to the second approach, where User Innovation research looked into a wider range of users, who were regarded as being able to actively participate in NPD. However, not all user types were seen as desirable in all stages of NPD (Nambisan, 2002). It was acknowledged that users vary in their expertise and knowledge, and therefore companies should match NPD stage, user role and user type for any given new innovation project to secure a fruitful co-creation (Jespersen, 2008). This take on User Innovation deals with all kinds of user conceptualizations, customer characteristics, user roles,… which set certain users or groups of users apart from 'ordinary' users. This also meant that no longer an exclusive and selected set of Lead Users was deemed suitable for participation in the innovation process, but a larger group of users could participate in a fruitful way. Most recently, the scope of User Innovation and user involvement has opened up even more, as research started to look into the possibilities and methodologies for involvement of 'ordinary' users in NPD (Kristensson et al., 2008). These studies focus more on different methodologies or stimuli that can be applied with ordinary users and that yield positive effects for NPD-processes, and suggest that Lead Users and other specific user types might even hinder or constrain creativity in certain stages of the NPD process. This third type of research also deals with tools for user involvement such as online crowdsourcing platforms and other tools enabled by ICT (Füller & Matzler, 2007).

4.1 The roots of User Innovation

As we already argued in the chapter on innovation and innovation management, the first well-grounded acknowledgment of the distributed nature of innovation can be traced back to the 1970s with the pioneering works of Eric von Hippel. In terms of innovation management, this period was characterized by the shift from a market pull paradigm, where an innovation process started from generating user needs, towards a coupled model, trying to integrate both 'market pull' and 'technology push'. During his early research on innovation von Hippel noticed that regular market research, used for need detection when innovating within the market pull paradigm, usually fosters general needs that are common in the market place (von Hippel, 1986; Lüthje & Herstatt, 2004; von Hippel, 2005). This resulted in a wave of 'incrementalism', or innovations that only contained slight modifications or adjustments to already existing products or services. Instead of traditional market research, he pled for new tools able to generate novel and innovative input and trends, which would lead to radical, breakthrough innovation (von Hippel, 1986). In his earlier works, von Hippel focused on the role of the user in industrial product and process innovation (von Hippel, 1977). Essential in his work is the distinction he makes between the 'user' and 'manufacturer' of an innovation, where the former uses an innovation but does not manufacture it for sale, while the latter manufactures an innovation for sale but does not use it. In his study on scientific instruments (von Hippel, 1976), he found that for both major and minor innovations in this field, it was nearly always the user, and not the manufacturer, who recognized the need, solved the problem through invention, built a prototype and proved the prototype's value in use. In other words, the 'locus' of almost the entire innovation process within the domain of 'scientific instruments' is situated with the user, whereas only 'commercial diffusion' is carried out by the manufacturer. However, in other sectors and cases, von Hippel found different patterns in terms of the locus of innovation, with e.g. also roles for the material supplier in the process.

Table 6: Locus of innovation by von Hippel (1976)

INNOVATION PATTERN	DOMINANT LOCUS OF ACTIVITY					
User-dominant	Product user					Manufacturer
Commercializer dominant	User	Product manufacturer				
Materials supplier dominant	User	Material supplier for product				Manufacturer
Innovation Process Stage	*Recognition*	*Idea formulation*	*Problem solving*	*Solution*	*Utilization and Diffusion – pre-commercial*	*Utilization and Diffusion – commercial*

This led him to propose three innovation patterns, based on the shifting locus of innovation in the different stages of the innovation process: a user-dominant pattern, a commercializer dominant pattern, and a material supplier dominant pattern.

This means that already **near the end of the 1970s**, von Hippel not only witnessed the distributed nature of innovation, but in his observations **we can already detect the foundations of the Open Innovation paradigm**, as he acknowledged that the commercializing firm opened up its innovation process to external inputs in order to benefit from them, and even that an innovation generated by a firm (the material supplier) could be externally commercialized by another firm (the manufacturer). He also acknowledged the presence of multiple 'loci of innovation', which is also at the foundation of Open Innovation. Thirdly, von Hippel also stated that the innovation processes and the dominant actors therein differed from industry to industry, and even within industries, which can be seen as a prelude for the contextual innovation management approach, as the 'optimal' innovation process depends on contextual intrinsic and extrinsic factors. Therefore we conceive the works of von Hippel not only as pioneering for User Innovation literature in particular, but also for distributed innovation phenomena in general.

However, despite the various angles from which his observations could be studied, von Hippel chose to focus on the user. Therefore, he first introduced the customer active paradigm (CAP), which implied that under certain circumstances the user could take the initiative in various stages in the innovation process, as a counterweight to the dominant manufacturer active paradigm (MAP), where the manufacturer generates all innovation by himself, or put differently, where the locus of innovation resides with the manufacturer (von Hippel, 1976). In later works, von Hippel dug deeper into the nature and the characteristics of these 'innovating users', introducing the 'Lead User'-concept (von Hippel, 1986). Lead Users display two main characteristics with respect to a novel or enhanced product, process or service: a) *Lead Users face needs months or years before they will be general in a* *marketplace* and b) *Lead Users expect to benefit significantly by obtaining a solution to these needs*. Urban and von Hippel (1988) state that Lead Users are especially relevant '[w]hen new product needs are evolving rapidly, as in many high technology product categories'. Reflecting back to the subject of this PhD, this would make the LU-concept very useful in the case of ICT-innovation and development.

Eric von Hippel considers the employment of Lead Users as a counter weight for traditional market research that addresses users at the center of the market and had caused a flood of incremental innovation (cf. chapter 2). Instead, Lead Users are users from the leading edge of the target market or users from markets facing similar problems in a more extreme form. Opposite to the majority of users, whose personal real-world experience sets the limits of their imagination and problem solving abilities, Lead Users do have real-life experience with novel product or process concepts (Lettl, 2004; von Hippel, 1986) which allows them to take the role of 'need-forecasting laboratory' (Lilien et al., 2002; Lüthje & Herstatt, 2004; von Hippel, 1986). However, besides the generation of innovative needs and ideas, Lead Users are also seen as sources of innovative solutions (Lilien et al., 2002; von Hippel, 2005). It is also contended that being a Lead User is relative with regards to the trend or innovation domain that is focused upon, meaning that an individual who is a Lead User for one field does not have to be a lead user in a totally different or even an adjacent field (von Hippel, 1986), an observation similar to the discussion in adoption diffusion regarding the innovation specific character of early adoption(De Marez, 2006, cf. chapter 2). This means that von Hippel sees Lead Users as capable of generating both *need* and *solution information*.

In later works, von Hippel related Lead Users to the concept of 'sticky information', which implies that user needs can be latent and thus hard to transfer to the manufacturer (von Hippel, 2005). When looking to the 'locus of innovation', or the initiator of the innovation process, users will tend to develop innovations that draw heavily on their own information between need and context of use, while manufacturers will tend to develop innovations that draw heavily on the types of solution information in which they specialize. When a company succeeds in integrating Lead Users into their innovation processes, they can possibly overcome this information stickiness and solve their own functional fixedness. However, this means that a Lead User should be an innovator and initiator of the innovation process, which narrows down the possible Lead Users as within the above reasoning, information stickiness can only be overcome through the act of innovating by the Lead User. As was demonstrated within Lead User-research, User Innovation is quite common in some product domains (e.g. extreme sports, see e.g. Lüthje, 2003), but this is not always the case. When User Innovation is scarce or not easily detectable, Lead Users should somehow be involved within the innovation process in order to capture their advanced needs. Within Lead User-literature, this has resulted in attempts to outline a 'Lead User-method', which will be discussed in the next section.

4.2 The Lead User-method

Within the literature on Lead Users, some attempts have been made to outline a method for involving Lead Users in innovation processes. Overall, four basic steps can be identified: 1) the *identification* of an important market or technical *trend*; 2) the *identification* of *Lead Users* for the trend, found in step one; 3) the *development and testing* of an innovation, based on the solution data from the *Lead Users* (this third step is seen as cyclical and iterative in nature), 4) *testing* of the innovation, resulting from step three, in the *general market*. Table 1 gives an overview of the evolution of the Lead User-method in three different papers. Note that von Hippel first thought of the Lead User-method as an instrument to obtain need data, which could be projected to the market (von Hippel, 1986). The initial method thus can be situated entirely within the opportunity identification-stage of the new product development-process (NPD). Two years later, Urban & von Hippel (1988) extended the LU-method to include the R&D-step in the NPD-process as well. This way, the LU-method results in a prototype or concept of an innovation which can be tested in the market. The LU-method outline described by Lilien (et al., 2002) starts more from the point of view of a company and stresses the interaction between Lead Users and innovation-teams, formed by people from different departments of the company.

Table 7: Evolution of the LU-method in literature

Author(s)	*von Hippel, 1986*	*Urban & von Hippel, 1988*	*Lilien et al., 2002*
Phase 1	Identify an important market or technical trend	Specify LU-indicators: a) find market or technological trend and related measures, b) define measures of potential benefit	Goal generation and team formation (Phase 0) Trend research
Phase 2	Identify LUs who lead in terms of a) experience and b) intensity of need	Identify LU-group: cluster analysis of survey-based LU indicators	LU pyramid networking
Phase 3	Analyze LU need data	Generate concept (product) with LUs	LU-workshop and idea improvement
Phase 4	Project LU-data onto the general market of interest	Test LU-concept (product)	Market research

Lilien et al's view results in a LU-workshop where concepts are generated and improved, followed by market research to test these concepts for the general market. Instead of the random search for market trends, there is a phase of 'goal generation' to direct this search and intra-company teams are formed. Note that within this application of Lead Users, there may already be a product concept or idea at hand to be discussed and improved within the LU-workshop. Where the previous two LU-methods could be seen as 'market pull', this method exemplifies a more interactionist stance between *push* and *pull*, as the Lead User-method is more used as an evaluative method, without excluding the option that the Lead

User-workshop can generate entirely novel ideas. In either case, this overview indicates that the Lead User-method can be used for different purposes and during different stages in the NPD-process. In terms of types of information, the later Lead User methods also focused on solution information, whereas the initial Lead User method only yielded need information. It is important to stress that Lead User involvement and the Lead User method were seen as suited for radical innovation (Lettl, 2007).

This Lead User-method for determining new product innovations has been successfully demonstrated in companies such as 3M (von Hippel et al., 1999), Hilti (Herstatt & von Hippel, 1992) and National Instruments (Seybold, 2006). Besides these case studies, several authors suggested that Lead Users in general can be important contributors to successful innovations (Rothwell, 1992; von Hippel, 1986; Voss, 1985), and empirical research has showed that the involvement of Lead Users produces commercially more successful products (Morrison et al., 2004; von Hippel, 2005). However, an important issue is not clearly resolved: the identification-phase, or how to get the 'right' Lead Users. Different methods have been proposed, such as pyramiding (Lilien et al., 2002), netnography (Belz & Baumbach, 2010) and screening (Urban & von Hippel, 1988; Bilgram et al., 2008). In the next section, we will dig deeper into the characteristics of Lead Users that allow to detect them through screening methods.

4.3 Identifying Lead Users

In order to allow effective screening methods, user characteristics should be more tangible and point to users with unsolved needs that will become general in the marketplace and that have a high benefit when these needs were to be solved. Urban and von Hippel (1988) suggest three proxies to be used when looking for high expected benefit from solving a need, the second Lead User indicator besides being ahead of a market trend. These are: 1. evidence of user product development or modification (users that have *innovated themselves*), 2. user *dissatisfaction* with current products or solutions, and 3. *speed of adoption* of innovations. The first characteristic equates scanning for User Innovation or user modification, and is only applicable in domains where User Innovation is common and detectable. The second characteristic suggests a high usage experience with current products and solutions, and unmet or not sufficiently met needs. This dissatisfaction-criterion will reappear later in the context of service innovation when we discuss so-called *defectors* (cf. infra). The third characteristic makes a connection with the diffusion of innovations-paradigm of Rogers (cf. chapter 2) and suggests a link with the earlier adopters of innovations. This is supported by Gatignon and Robertson (1985) who argue that: "The key to diffusion of technological innovation may be in building the consumer knowledge and experience base for that type of technology". If so, Lead Users, as early experiencers of new technologies, may play an important part in the diffusion process. Foxall (1994) supports this idea, arguing that for discontinuous innovations, Lead Users are crucial in providing detailed implementation experience to later adopters and play a valuable function in supporting the communication network, but at the same time acknowledges that the psychographic characteristics of these Lead Users and user innovators are more complicated than generally described in management literature.

Lüthje (2003) ascribes the ability of Lead Users to be effective contributors to the innovation process to two major characteristics: *adequate technological expertise* and superior knowledge of the user domain *'use experience'*. The first characteristic can be seen as a prerequisite to the innovating user-criterion, as it requires some technological skills to be able to innovate or modify, whereas the second characteristic connects to the use diffusion paradigm, as it suggests that intensity of use is a characteristic of Lead Users. Franke et al. (2006) see both characteristics as part of the variable expertise, consisting of two elements: *product* or domain *related knowledge*, which also refers to more technological knowledge, and *usage related knowledge*, which refers to use experience.

Schreier and Prügl (2008) build further on this reasoning and introduce the idea of 'Lead Userness', or the degree to which a user can contribute to the innovation process. Besides consumer knowledge and use experience they add some characteristics that positively influence the likeliness to contribute to the innovation process: *locus of control* and *innovativeness*. They suggest these variables might be used as a proxy to identify Lead Users, so the higher an individual scores on 'Lead Userness', the more likely this individual is a Lead User. However, in this view, *Lead Userness* is still used as a dichotomous variable, where one is identified as a Lead User or not. Morrison et al. (2004) propose the LES-concept (Leading Edge Status) which also uses variables from the adoption diffusion framework: Rogers' (1962) time of adoption and Midgley and Dowling's (1978) innate or dispositional innovativeness. Schreier and Prügl (2008) conceived and tested their LES-construct, consisting of seven items, in a B2B setting, similar to the earliest accounts of Lead Users. LES appeared to be distributed normally in the studied population.

Bilgram et al. (2008) offer their own overview and summary of the characteristics that are beneficial with regards to user involvement in innovation:

(1) *lead user criteria* (being ahead of market trend, high expected benefit, user investment, user dissatisfaction & speed of adoption);

(2) *user expertise* (use experience, frequency of use, total period of use, number of different disciplines, product related knowledge, frequency of use of information sources, professional background or hobby);

(3) *motivation* (extrinsic & intrinsic motivation);

(4) *extreme needs* and circumstances of product use;

(5) *opinion leadership* and word-of-mouth.

Somewhat similar, Piller and Ihl (2009) see three kinds of competences that users/customers should have for involvement in Open Innovation processes:

- *Product competence* (for need information): product related knowledge (technical) & use experience (extreme/deviant usage)
- *Technical competence* (for solution information): methodological knowledge, analogous market knowledge
- *Leadership competence*: especially relevant in Open Innovation settings with network collaborations in communities

Note that Piller & Ihl (2009) explicitly connect user involvement to Open Innovation, but do not include motivational characteristics.

Hoffman et al. (2010) also revisit the idea of a construct, measuring Lead Userness, but specifically for the domain of B2C innovation, introducing the concept of '*emergent consumers*'. Results of their study suggest that besides domain-specific Lead User-characteristics, other characteristics enhance the usefulness of customers in the innovation process, especially for generating new product or service ideas and developing them into concepts and prototypes. These unique personality traits and processing abilities for further developing successful product concepts include *openness* to new experiences and ideas; an intellective *self-focus*, or "reflection"; the ability to process information both verbally (rational style) and visually (experiential style); high levels of *creativity*; and *optimism*. This means that besides product- or domain-related characteristics, also personality-traits are introduced as variables to identify the 'right' users to involve in the innovation process. Besides being a Lead User, users also require certain personality traits that make them suited for involvement. Hoffman et al. (2010) also explicitly see emergent consumers as a different user type than Lead Users. However, recent research in the gaming domain has showed that emergent consumers and Lead Users in practice tend to show quite some overlap (Vernette & Hamdi-Kidar, 2014).

Lettl (et al., 2006a; 2006b; 2007) also drops the Lead User-concept, but rather argues that users with certain specific characteristics can contribute substantially to the development of radical innovation. He argues for the involvement of *inventive users*, which are users with a high motivation and with 'extreme' needs. These inventive users search in other domains to find ideas or solutions for their problems through analogical reasoning. Lettl also implicitly criticized the previous unclarity with regards to the type of information Lead Users or inventive users could provide, as he provided a 'swell model' which maps the desirable user characteristics according to the type of input that can be generated. The following characteristics are seen as beneficial in all stages or for all tasks: *Motivation* induced by problems, *openness* and *imagination* capabilities. For more active contributions, a high *level of expertise* in the user domain, *tolerance* of ambiguity, *resources* for research and access to *technological know-how* are added to the equation. Finally, for active contributions in the technological domain (or solution information), *technological expertise* is required.

Lettl et al. (2006b) also come up with the interesting concept of so-called 'lead manufacturers'. These are manufacturers that recognize the potential of emerging technologies earlier than others and therefore have an absorptive capacity for the contribution of entrepreneurial users. This also puts the attention towards the company engaging in User Innovation, which also bridges the gap with the Open Innovation paradigm, as User Innovation researchers generally only focus on user benefits from innovation. Note that these technology Lead Users are regarded as potential sources of radical ideas and of solution information. However, it is also unclear how these criteria are assessed with users. Therefore, in a later works Lettl (2007) also proposes a variation on the Lead User-method as he provides a search grid to scan for technology Lead Users as he calls them.

We notice an evolution in the literature on Lead Users, as authors started moving from the 'classical' Lead User definition, looking more into other characteristics and screening methods. This can also be explained by the fact that these Lead User methodologies appeared to be very cost- and time-intensive. A prototypical example is the widely cited 3M-case (von Hippel et al., 1999) where a Lead User project resulted in radical innovation, but also in the Lead User-approach being abandoned within the company because of the high investments. Another example can be found at Philips that launched its Lead User program with a lot of media attention[16] surrounding the launch. However, the 'http://www.leadusers.nl/'-site is down for already quite some time now, which serves as another illustration that companies struggle with the successful management and implementation of distributed innovation. Therefore, User Innovation researchers started exploring other paths beyond the Lead User-approach.

4.4 Digging into the nature of user involvement

In the previous section, we gave an overview of the literature on Lead Users. This research stream can be regarded as the root of the User Innovation paradigm and therefore dominated the early research on User Innovation (Piller & Ihl, 2009). However, we saw that later works started looking into and exploring other user characteristics, first in order to detect Lead Users, later also to identify other user types (e.g. emergent consumers, users with Leading Edge Status, inventive users,…) that could be beneficial for involvement in the NPD process, although this was still focused on radical innovation. Essentially, this came down to a concrete translation of the fact that the value of customer involvement is co-determined by

[16] http://www.emerce.nl/nieuws/philips-experimenteert-met-consumentgeleide-innovatie

the customer's capability for innovation, the customer's motivation to participate and the degree of involvement (Brockhoff, 2003; Enkel et al., 2005).

In parallel with this evolution, authors also started looking into the nature of this user involvement and in matching user types with stages in the NPD, as the literature on Lead Users remained largely silent on these matters. This literature also did not limit user involvement to radical innovation. In a way, this line of User Innovation research builds further on the observation of Rothwell et al. (1974), still rooted within the market pull-thinking: "User needs must be precisely determined and met, and it is important that these needs are monitored throughout the course of the innovation since they very rarely remain completely static. Many successful firms achieve this deep and imaginative understanding of user needs through interaction with a representative sample of potential customers throughout the development." The acknowledgement that user needs are not static implies the need for user involvement beyond Voice of the Customer-techniques at the beginning of an innovation trajectory. This triggered User Innovation researchers to look into methods for user involvement. In the second part of the statement, a 'representative sample of potential customers' is suggested as the ideal user group to involve. This triggered User Innovation researchers to look for user profiles related to the stages in the NPD process. These research approaches meant a divergence from the Lead User-concept, although its influence remains clearly present in most works.

We start this overview with Kaulio (1998) who reviewed a selection of user methods. He distinguished two dimensions on which they varied: the stage in the innovation process in which these methods were used and the **degree of user involvement**. For this second dimension Kaulio saw three different levels: design for users, design with users and design by users. *Design for:* denotes a product development approach where products are designed on behalf of the customers. Data on users, general theories and models of customer behavior are used as a knowledge base for design. This approach often also includes specific studies of customers, such as interviews or focus groups. This category can be seen as the Voice of the Customer-methods that originated from the market pull-approach. *Design with:* denotes a product development approach, focusing on the customer,
utilizing data on customer preferences, needs and requirements as in a 'design for' approach, but, in addition, includes the display of different solutions/concepts for the customers, so the customers can react to different proposed design solutions. This approach can be equaled to a co-creation approach, as users and manufacturers work together in an iterative manner, and is in line with the interactionistic stance between a technology push and a market pull approach. The locus of innovation can be seen as shared between both involved actors. *Design by:* denotes a product development approach where customers are actively involved and partake in the design of their own product. This degree of involvement is most in line with the Lead User-approach and the CAP, as the locus of innovation resides with the user.

Brockhoff (1997, 2003) makes a distinction between the types of customer input from the perspective of a company. Customer input can be unsolicited, or spontaneous from the perspective of the customer. He further distinguishes between complaints from dissatisfied customers and suggestions from satisfied or potential customers. Solicited customer input can be undirected, in the form of an open call, or directed, where specific customers are requested for input. He further elaborated on this reasoning and mapped the types of input in terms of the NPD process. Interestingly, in this classical model of product development and customer contributions, Brockhoff includes experience based suggestions only at the market launch phase, and not during the development or testing stage. **The Living Lab-approach offers a major divergence from this idea as experience based feedback and input from users during the development phase are seen as a corner stone of this approach.** Moreover, Brockhoff also introduces the notion of the *launching customer* who participates in the development phase to stimulate, design or participate in development activities. This type of user has a high amount of technical expertise. The idea of a 'launching customer' originates from the aviation industry where airplane manufacturers were heavily involved in the NPD processes of airplane parts (cf. Goldsmith, 1981). Note that Brockhoff conceived his work in a B2B context, similar to von Hippel's Lead User-concept which was also rooted in this setting. Brockhoff also mentions Lead Users as user type to be involved during NPD, and not linked to a specific stage, but argues that it is difficult to find and recruit this type of user.
Dahan and Hauser (2002) and Nambisan (2002) built further on this work and distinguished three customer roles in a B2C context associated to three phases in the NPD process. 'Customer as resource' is associated to the ideation stage and can be seen as 'design for users' in terms of Kaulio's typology. 'Customer as co-creator' is linked to the design and development-stage and 'customer as user' refers to the user role during the product testing stage. Both are clearly examples of 'design with users'. Note that 'design by users' is not present within this conceptualization of user input in NPD, which shows a further divergence of the CAP and the classical Lead User-theory. Enkel et al. (2005) and Füller & Matzler (2007) add the 'customer as buyer' role to this typology and associate this with the market launch stage. This role can be connected to the adoption diffusion paradigm, and more specifically to the earlier adopters (innovators and early adopters).

Besides their 'swell model' for user characteristics, related to the type of task users perform in the innovation process, Lettl et al. (2006a) also put forward guidelines for recruiting test users, based on empirical research. They argue that the conventional characteristics for the selection of test users, including opinion leadership, representativeness and high sales volume of the user, are not suited for radical innovation. Instead, motivation by an unsolved problem, a high level of experience in the user domain, and a high innovation tolerance, combined with a high geographical proximity to the manufacturer (to enable face-to-face interaction), are regarded as optimal for test users for radical innovation. Notice that Lettl is referring to user involvement for radical innovation only, which is similar to the original Lead User literature.

Enkel et al. (2005) and Jespersen (2008) go one step further and associate user types to the different roles and stages in the NPD process. They identify the following user types: Lead User, First Buyer, Reference customer, Requesting customer, and Launching customer. 'Requesting customers' provide ideas for new products that follow their needs. However, as complaints tend to be anchored to current product characteristics and use, this source of information is rather limited for new product information. It seems that this information is better suited for incremental innovation. This user type resembles the 'expressive user' from Grabher et al. (2008), who are motivated to share their experience in order to provide a contribution to a possible solution, which would allow them to solve their needs in a better way. Their motivation is thus largely extrinsic in nature. The 'launching customer' is integrated from the development phase to stimulate, design or participate in development activities. This type of user has a high amount of technical expertise. This type is similar to the launching customer from Brockhoff (cf. supra), albeit now in a B2C setting. The 'reference customer' supplies application experience. This kind of customer is also referred to as 'pioneering customer', someone with a high amount of product application experience that is motivated to participate in product testing (Jespersen, 2008). The 'first buyer' role can be equaled to the 'innovator' and 'early adopter' from adoption-diffusion studies (cf. supra). 'Lead users' are seen as customers that can be used throughout the whole NPD-process. Lead users must be in a position to capitalize on their engagement; they are, in other words, extrinsically motivated to participate in producer-driven innovation (von Hippel 1986; Olson & Bakke 2001). Jespersen (2008) notes that it takes great effort and careful selection to identify Lead Users. She summarizes the different user roles, NPD-stages and user types in the following table:

Table 8: User roles related to NPD process, Jespersen (2008)

NPD-stage	***Idea***	***Concept***	***Development***	***Test***	***Commercialization***	***Post-launch***
User role	*Resource*		*User*			
		Co-creator			*Buyer*	
					Product (transformation)	
User types						
Requesting	X	X			X	X
Launching		X	X	X	X	
Pioneering				X	X	X
First buyer					X	X
Lead user	X	X	X	X	X	

Lead Users are clearly regarded as an ideal type that can be used in most stages of the NPD. Launching customers are also regarded as a versatile user type, although they are not considered useful in the ideation stage. This can be ascribed to their deep technical knowledge which may grant them with a so-called functional fixedness. Requesting customers are users that provide unsolicited, spontaneous feedback because of dissatisfaction (complaints) or because of certain needs they have that are not fulfilled by the current product or service offering. Pioneering customers are seen as especially relevant in the testing, commercialization and post-launch stages because of their high usage experience and because of their motivation to participate. Lastly, the first buyer is suited for the commercialization and post-launch stages because of their early interest to adopt the innovation. Where Enkel et al. (2005) still place this model for user involvement in a radical innovation setting, this difference seems to have disappeared from the work of Jespersen as she sees it as a guide for moving towards a more user-involving culture, regardless the type of innovation.

Summarizing, User Innovation researchers started looking beyond the initial Lead User framework for other, more tangible user characteristics to involve users in innovation. The focus also shifted from users taking the initiative and being in control of the innovation process towards shifting degrees of user engagement, also coupled with the stage in the innovation process. Motivation also played a more prominent role as an important feature of users to be involved. However, when referring to user roles and characteristics during the NPD process, the NPD process itself is conceptualized as very linear, consisting of ideation, R&D, testing and commercialization. Moreover, it also remains unclear how to recruit these users, how to keep them motivated and how this involvement should be structured during the different NPD stages. Also, initially conceived as a means for radical innovation, some authors generalized user types and user inputs for all kinds of innovation, and out of the more and more complex conceptualizations of user characteristics, our initial Lead User remained the ideal user type to be involved. This search for more actionable user types to be involved has the merit of pointing at the fact that the degree of user involvement can vary according to the desired outcome and contribution, and that different users can have different contributions. However, we feel that the increasing complexity of these models and typologies has as a side-effect that **involving end-users looked more and more difficult and only suited for large, resourceful companies**. This triggered some scholars as well as practitioners to look beyond complex user typologies and screening methods and turn attention towards methods and tools to successfully involve ordinary users.

4.5 Involving 'ordinary users' in NPD

Parallel to these advances in user involvement and user roles in NPD based on user characteristics, research started to focus on the possibilities and methodologies for involvement of 'ordinary' users in NPD. Duverger and Hassan (2008) suggest that unsatisfied users, or users that have stopped using a certain service or product (also known as 'defectors'), are a potential source of innovative ideas. They make this observation in the context of service innovation. This is in line with Reichwald and Piller (2006) who found that dissatisfaction with existing solutions motivates consumers to participate in forms of product innovation. Magnusson (2009) states that too much expertise and knowledge might inhibit development of novel, original and creative knowledge, therefore pleading to involve end-users that do not display Lead User-characteristics. This is contradictory with Lüthje (2003) and Piller and Ihl (2009) who argue that technical expertise to develop new solutions may qualify an 'expert user' to stimulate technical innovation and assist in the development of products that are technically feasible. Kristensson and Magnusson (2010) also state that, in the context of service innovation, 'ordinary' users with contextual use experience and without too much restriction (caused by fundamental technological expertise or knowledge on the potential feasibility), can contribute to the innovation process, but situate this contribution in the provision of innovative ideas.

From this overview, we gather that the involved users are not Lead Users as defined in the previous sections, nor are they carefully selected users with certain characteristics. However, they cannot be labeled as 'ordinary users' either as they seem to display certain characteristics with regards to the innovation domain, such as dissatisfaction with the current product offering (defectors), or personality-related characteristics such as creativity or enthusiasm. Instead of carefully selecting these users, it is assumed that the 'right' type of 'ordinary user' is reached through self-selection in the process of user involvement. Therefore, researchers started investigating ways of user involvement and how this affected the self-selection process. Poetz and Schreier (2011) researched the characteristics and motivations of participants in an online idea generation contest. They found that participating users tend to have experience with the underlying problem, a sound technical knowledge of the related products, score higher on the Lead User characteristics 'high expected benefits from innovations' and 'being ahead of a trend', and creative personalities. However, none of these measures appeared to be significantly correlated to the quality of the submitted ideas. The quality of the submitted ideas was assessed by an expert panel. The authors also concluded that not all participants were true Lead Users, but that the crowdsourcing process had attracted qualified users to participate. Similar results were found in studies by Kleemann et al. (2008) and Reichwald and Piller (2006). When compared to ideas from professionals, the user ideas scored even higher in terms of novelty and customer benefit, and slightly lower on feasibility. Research by O'Hern and Rindfleisch (2008) discovered four types of user co-creation: co-designing (spontaneous design of innovation), collaborating (active participation in NPD-activities), submitting (spontaneous ideation), and tinkering (modification by using). They also see self-selection and motivation as more important factors than using a screening method to select the right customers. Kristensson et al. (2008) conclude out of empirical research that actually experiencing certain situations was of great significance for users when developing ideas for innovative NPD. The further argue: "As users are experiencing various situations in which they encounter difficulties (their own and those of others), certain emotions and cognitions are triggered. Through such experiences, users become aware of their needs, and these needs then stimulate ideas that stem directly from real experience."

This view also extends the previous works in this section, as these viewed user involvement mostly from the angle of 'customer' involvement. By adding the concrete use experience, something which customers per definition have, as a separate factor in the equation, this broadens the potential of 'useful' users beyond the current customer base, as users can acquire usage experience through specific research methodologies. In the next chapters, **we will further argue that this 'experiencing', that facilitates need awareness and valuable user contribution for the NPD process, is a central aspect of Living Lab projects** that evolve around an intervention that enables the users to experience (certain aspects of) the innovation.

Summarizing, most of the studies in this area are influenced by criticisms on the Lead User and user characteristics research, and consist of empirical research into user ideas and contributions, especially in the ideation stages. The authors that argue for the involvement of ordinary users in NPD base their ideas on a rather limited amount of empirical studies, situated mostly in the domain of service innovation and focusing on ideation, although some of the online crowdsourcing and idea contest platforms and methods are also used in other stages of the NPD process. They warn against too much technological knowledge as a killer of unburdened creativity, but the involvement of ordinary users is situated almost exclusively in the front-end of innovation. Therefore, this line of reasoning does not contradict the other User Innovation authors, but rather complements them, demonstrating that a large variety of ideas can enrich the innovation process, and that multiple user types might play a role in innovation. The literature dealing with crowdsourcing and idea contests turns the equation upside down and looks for methodologies and (online) platforms to attract the 'right' users and user input through self-selection. So instead of generating difficult and lengthy screening processes, attention turned towards solutions that would perform this screening by itself. An example of these platforms are the socalled innovation contest platforms, such as InnoCentive, where challenges are broadcasted to an undefined audience of 'solvers' that can return 'solutions' in order to obtain a (mostly monetary) reward (Allio, 2004), or other crowdsourcing platforms such as Wikipedia that rely on user contributions for its content generation and aggregation (Bruns, 2008). The participating users are labeled as 'ordinary users' as often their innovation related characteristics are not known, but through the self-selection mechanism they do exhibit the characteristic 'motivation to participate' that can be linked to intrinsic as well as extrinsic motivations, depending on the platform and mechanism that is used (Lakhani & Wolf, 2005). For an overview of the research in this field, see Bullinger and Moeslein (2011), but conclusive findings with regards to user motivations and characteristics are not available yet. Moreover, we also gathered that actual usage or situational experience with the innovation in development is able to facilitate relevant user contributions and to abstract need-related knowledge.

4.6 Criticism on the User Innovation-paradigm

Although the foundations of the User Innovation paradigm date back to the 1970s, our overview and discussion of the literature has showed that the field is still rather scattered. This contrasts with the Open Innovation paradigm, which started developing itself only a decade ago, but its theoretical concepts and models already show a lot more parsimony. Therefore, over the years, a lot of authors have also criticized the User Innovation theory and assumptions. Most of these criticisms deal with the Lead User concept, as this still takes a central place within the User Innovation literature. A first issue deals with the nature of the Lead Users themselves. Originally, the Lead User-concept was conceived in a B2B setting (von Hippel, 1976), but later the employment of Lead Users in B2C settings was also successfully demonstrated (see e.g. von Hippel et al., 1999; Herstatt & von Hippel, 1992; Seybold, 2006). Although a lot of these successes are quite anecdotal and are not to be found in a lot of different product categories, within a lot of literature the distinction between a business and a consumer setting is not clearly delineated. Moreover, the focus is almost invariably on successful cases, leaving unsuccessful user involvement untouched. Second, despite some attempts to outline a general Lead User method, a clear cut methodology for involving Lead Users for innovation remains absent. What Lead Users should a company look for, leading edge users or customers within their target market, or users from other markets, which are likely to be non-users/customers within the companies' own target market? The widely-cited 3M-case suggests a mix of both 'Lead User-types' (von Hippel et al., 1999), but it remains remarkable that despite the successful implementation of a Lead User methodology, the usage of Lead Users within 3M was abandoned afterwards for cost-cutting reasons.

Trott et al. (2013) have recently provided the most detailed criticism on the User Innovation research stream. In general, they see User Innovation as a valuable framework that definitely has its merits, but they put forward three main critical remarks. First, they state that the Lead User-school tends to use a narrow definition of innovation, as they equal this in a lot of instances to invention. Most research focusses on how Lead Users provide novel needs, but is less clear how they can have other inputs along the innovation process, with the exception of innovating Lead Users, who simply innovate themselves. Other theories such as Open Innovation provide a more holistic account of distributed innovation, while Lead User theory tends to overstate the role of users in the innovation process. However, this criticism is **an argument to implement User Innovation insights into other theoretical frameworks and approaches towards innovation, such as Living Labs**. The focus on invention was also apparent in the section on the involvement of ordinary users in NPD.

Second, User Innovation tends to rely on case studies for theory building and testing. Trott et al. (2013) question the generalizability of a lot of these findings as they come from rather 'exotic' product categories such as scientific instruments and sporting goods. Most research looks at cases where User Innovation was successful and then abstracts the user inputs in these cases, without taking other inputs from other actors (such as other companies, intermediary organizations, public organizations,…) into account. Recently, there have been some attempts at identifying User Innovation in a more systematic manner through surveys and patent searches, but these efforts remain problematic as it is difficult to discern the exact contribution of users (Bogers & West, 2012).

Third, empirical research into the origin of the most influential and important breakthrough technological innovation has showed that most of this is technological in nature. Such a list was made in 2005 in collaboration with the Lemelson-MIT Program containing the 25 most important innovations of the past 25 years. The list contains "25 non-medical innovations that have become widely used since 1980, are readily recognizable by most Americans, have had a direct and perceptible impact on everyday life and could dramatically affect the future."[17] It appears that none of these innovations was produced by or originated from end-users. Therefore, Trott et al. (2013) question the assumption that most innovation originates from users. However, they do argue that more research should be dedicated to exploring the link between technology-push and market-pull with the goal to inform companies how to implement user involvement. We also believe that the argument from the previous point of criticism applies here as well. It might be that the 'formal' origin of these 25 innovation does

[17] http://edition.cnn.com/2005/TECH/01/03/cnn25.top25.innovations/

not come from users, but it might as well be that users played an important informal role in these innovation developments, as within a distributed view on innovation, the eventual innovation has multiple origins and relies on various types of input and knowledge. Lettl et al. (2006a, 2006b) also use this argument as they observe that to sustain long-term competitiveness, companies need to develop radical innovations besides incremental innovations. Therefore, they require technological and market-related capabilities. One of the market related capabilities is the competence to involve the right users at the right time. However, there is no clear picture yet of what user to involve at what time. We have discussed some attempts (e.g. Jespersen, 2008; Nambisan, 2000), but developing a coherent framework why and how users innovate remains a major challenge (Bogers & West, 2012). Moreover, Lettl et al. (2006a) mention some general challenges when involving users for radical innovation:

1. Cognitive limitations can hinder users in delivering valuable inputs. This can be ascribed to functional fixedness (von Hippel, 1988), or the fact that users are constrained in their creative thinking due to their use experience with current products or solutions. In this chapter, several solutions were introduced to overcome this functional fixedness: searching Lead Users with new needs, using empathic lead users (Lin & Seepersad, 2007), utilizing 'defectors' or dissatisfied users, or employing 'ordinary' users that do not have a high use or technological expertise.

2. User needs and wants tend to be latent, rather than manifest or real (Sowter, 2000; Franke & Schreier, 2002). Put differently, a lot of user needs are 'sticky' (Ogawa, 1998; von Hippel, 1994), which means they are difficult and costly to transfer from the user to the manufacturer. This relates to the type of knowledge users possess: tacit knowledge is stickier, thus harder to transfer, which implies that users are more likely to innovate themselves (von Hippel, 1994). This suggests that the nature of the innovation, and the nature of the knowledge that is required to produce the innovation, affects the locus of innovation (Nonaka, 1994). Although these hypotheses were already formulated in the 1990s, the precise role of tacit knowledge in innovation and the way to deal with sticky information for both users and manufacturers remain issues to be further investigated (Bogers & West, 2012).

3. A lot of users have a natural resistance to change or are not willing to contribute to radical innovation projects (Lettl, 2007). This was reflected in the User Innovation literature when besides Lead User and other innovation related characteristics, motivational characteristics and personality traits were also included.

Besides the solutions already mentioned, Frissen (2000) proposes a **triangulation** of methods and as much **contextualizing** as possible of uses and needs in order to overcome these barriers for user involvement in radical innovation. As we will gather from the next chapters on Living Labs, this is facilitated in Living Lab projects. Therefore we will assess whether these elements are capable of having a positive influence on the user contribution.

4.7 Research gaps in User Innovation

One of the main research gaps for User Innovation is a **more quantitative assessment** of user involvement and user contribution in innovation. Trott et al. (2013) state that most of the research on Lead Users and Lead User Innovation is rather anecdotal and hard to reproduce or extrapolate to different product categories or innovation domains. Too many studies focus on simply indicating that users were involved, but fail to show the **added value** of their contribution. Bogers and West (2012) confirm that studies find it difficult to grasp and discern the more informal innovation input from users. **This is why we will take the perspective from both the instigator of an innovation project and of the researcher involved in these innovation projects.** For the instigators, as they are at the steering wheel of the innovation process of their own innovation, they may be in a good position to discern the user contribution on the eventual innovation, whereas the researchers are in an equally good position as they are the direct link with the end-users.

There is also a lack of research into the motivations and characteristics of users contributing to innovation or participating in crowdsourcing. Despite some interesting work on motivations (e.g. Lakhani & Wolf, 2005; Bullinger & Moeslein, 2011; Poetz & Schreier, 2012) and on contributions linked to user characteristics (Enkel et al., 2005; Lettl et al., 2006a; Jespersen, 2008), **an overarching paradigm or framework** that is **easily applicable** in different innovation domains and that has a high degree of managerial relevance remains absent. Most research in User Innovation focused on the early stages in the innovation process (ideation and the 'fuzzy front-end'), with significantly less attention for the later stages in the innovation development process (Trott et al., 2013).

4.8 Conclusions & key concepts

Within this chapter we have given an overview of the literature from the User Innovation paradigm. The roots lie with von Hippel's work on innovating users, later called Lead Users. Initially, the work in this domain looked into examples of innovating users, the so-called Customer Active Paradigm where the initiative for innovating resides with the user. Later works started looking into the nature and characteristics of these Lead Users and also tried documenting methods to identify these Lead Users and implement them in innovation processes. Regarding characteristics, first innovation related-characteristics such as usage experience, dissatisfaction, and technological knowledge were mentioned, later motivational and personality characteristics were also introduced. This also led to other user types beyond Lead Users being considered as beneficial in the innovation process (such as inventive users, emergent consumers,…). Regarding identification methods, screening was also complemented with self-selection methods such as crowdsourcing which proved to be efficient.

Table 9: Stances on user involvement

Voice-of-the-Customer	User co-creation	Lead User methods
MAP	Shared locus of innovation	CAP
Design for users	Design with users	Design by users

Throughout this chapter we have witnessed a shifting view on the nature and role of user involvement in innovation. The two 'extreme' stances regarding this involvement are summarized by Hansson (2006): voice of the customer-methods and Lead User-methods. With the former, the manufacturer identifies consumer needs and develops solutions, whereas in the latter, the manufacturer works with Lead Users who develop solutions or identify solutions that have already been developed by Lead Users. These stances were also defined by von Hippel as the Manufacturer Active Paradigm versus the Customer Active Paradigm. It was believed that conventional marketing techniques (Voice of the Customer-methods) are appropriate for incremental innovation, but are of limited value in radical innovation projects as these require a completely different marketing research approach. Piller and Ihl (2009) argued that the Lead User-concept has dominated the perspective of the earlier research on User Innovation, and plead for a collaborative mode of user participation, which they call 'design by users' or Open Innovation with customers. This can be seen as an intermediate stance, relying on co-creation with the locus of innovation able to shift between both users/customers and manufacturers. First, this co-creation was regarded as suited only with users with specific Lead User or other characteristics, but recently it was suggested that ordinary users can also contribute to radical innovation. The evolution from Lead User methods towards user co-creation marks an important evolution, as traditionally, User Innovation research focused on the conditions under which users would start innovating themselves and how they could be supported to be more innovative (Bogers & West, 2011), whereas now **interaction methods** and **different user contributions** are being researched beyond pure User Innovation.

However, within the User Innovation literature, disproportionate attention has been dedicated to the CAP and to Lead Users that are being involved from the fuzzy front end of innovation through the whole innovation process. In terms of practical implementation, the Lead User-method is the most tangible outcome, but this method appeared to be resource-intensive and consequently only suited for large companies. The literature on user characteristics and Open Innovation with customers is still less developed and sometimes inconsistent and contradictory, which makes it difficult to abstract general guidelines and methodologies for the 'middle' option between the CAP and the MAP, which we label as *co-creation with users* and equal with Kaulio's (1998) 'design with users'-stance. Although there is agreement the user should be involved in innovation, it remains unclear *what* kind of user should be involved *when*. Various examples are described in the literature, but these examples remain too much on the level of single case studies. In fact, we can describe the evolution of the field as starting from true User Innovation, where a user drives most part of the innovation process, towards user innovativeness, or the capabilities and contribution an end-user can have in the innovation process. There was also an evolution from 'screening' methods for detecting the 'right' users towards methods and tools relying on 'self-selection' to gather relevant user input. In the following chapters, we will assess whether Living Labs and Living Lab projects are conceived in the MAP (voice-of-the-customer methods), the CAP (Lead User methods), or in the middle stance.

References chapter 4

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Epilogue: Open Innovation & User Innovation converging

We have now discussed the Open and User Innovation paradigms and abstracted key concepts and frameworks in the light of Living Labs, which is a part of our first research goal. In the next chapters, we will investigate the current body of Living Labs literature to assess whether this relates to the abstracted key concepts and whether Living Labs are an emanation of Open and User Innovation. Our fourth research goal is also related to the Open and User Innovation literature, as we want to assess whether Living Labs have value in governing and structuring user contribution for innovation, whether they can play a positive role in the European Paradox issues, and whether they might help closing the gap between Open and User Innovation. Regarding the first subgoal, this deals with the apparent lack of an overarching paradigm or framework for implementing User Innovation, as most studies lack a more quatitative and precise assessment of user contribution (Trott et al., 2013). In part II we will investigate whether specific Living Lab characteristics such as real-life experimentation, a 'multi-method' approach and active user involvement through co-creation yield positive results. Regarding the second subgoal, this can be situated within the Open Innovation literature. Within the European innovation system, there is an apparent imbalance between generating new knowledge (exploration in terms of the Open Innovation processes) and putting this knowledge to productive use (exploitation in terms of Open Innovation processes) (Dosi et al., 2006). In part II we will contribute to this by assessing the presence of the Open Innovation processes in Living Labs, in the literature as well as in practice. For the third subgoal we want to investigate the role Living Labs might play in bridging the gap between Open and User Innovation as proposed by Bogers and West (2012). They indicated that despite their largely disjoint bodies of theory and empirical evidence, both literature streams are rooted within the broader domain of distributed innovation and the distributed nature of knowledge needed for innovation. The main gaps are the fundamentally different starting points, as Open Innovation looks at how distributed sources of knowledge can be used by an organization for its own benefit, whereas User Innovation tends to look at innovating and contributing users. Open Innovation tends to aim for profit maximalization, whereas User Innovation looks at ways in which users can optimally solve their needs. In some instances, these perspectives might merge, whereas in other cases, they conflict with each other. However, Bogers and West (2012) suggest that careful examination of the convergent and conflicting predictions and proscriptions of these streams will improve the understanding of both paradigms, but also offer a broader and more uniform understanding of distributed innovation processes. They further state that prior research in distributed innovation either focused on one perspective while ignoring the others, especially in terms of the main stakeholders (being the organization engaging in distributed innovation versus the user). With active user involvement and a multi-stakeholder approach, we positioned Living Labs within both literature streams and as (potentially) capable of merging both perspectives.

Most recently, this convergence has manifested itself in mutual conferences such as the Open and User Innovation workshops[18] and in literature involving collaborations between Open and User Innovation scholars (cf. e.g. Chesbrough & Bogers, 2014; Piller & West, 2014). However, when discussing von Hippel's (1976; 1977; 1986) seminal works on Lead Users and the 'locus of innovation' from the 1970s, he already laid the foundations of distributed innovation as a broader, more encompassing phenomenon. He distinguished a Manufacturer Active Paradigm (MAP) in which the manufacturer keeps total control over the innovation process and simply listens to the users with 'voice-of-the-customer' techniques, in line with the at that time dominant market pull paradigm (cf. chapter 2). However, he also described the Customer Active Paradigm (CAP) where the locus of innovation resides with the user, whereas the manufacturer simply commercializes the innovation. This led von Hippel to look for these 'innovating users' and focus the User Innovation research towards motivations and characteristics of these users. However, von Hippel also described a 'material supplier dominant' model in which the locus of innovation resides with the supplier and the manufacturer also simply commercializes the innovation. This means that in these works von Hippel acknowledged that the commercializing firm opened up its innovation process to external inputs in order to benefit from them, and even that an innovation generated by a firm (the material supplier) could be externally commercialized by another firm (the manufacturer). He also acknowledged the presence of multiple 'loci of innovation', which is also at the foundation of Open Innovation. However, by focusing on Lead Users and innovating users, von Hippel did not go into detail regarding the 'exchange' processes between different actors, or the Open Innovation processes that were described in the Open Innovation literature. In the instances where the locus of innovation is shared among multiple actors, the notion of 'co-creation' applies. In our conceptual model where we positioned Living Labs relative to Open and User Innovation, we regarded exactly this process of co-creation between users and companies as the potential 'bridge' between Open and User Innovation. It is on this process of co-creation that Piller and West (2014) focus, as they also perceived a lack of research into co-creation as a process. One of the issues they detect is different notion of 'openness' in both Open and User Innovation. In Open Innovation the firm opens its boundaries for external ideas or knowledge to flow in, of for internal assets to flow out of the company to be externally commercialized or exploited, whereas User Innovation emphasizes 'free revealing' and the user interest of finding a solution to their need and 'using' the innovation. Exactly these fundamentally different perspectives are responsible for the 'gap' between both paradigms, although they seem to be part of larger

[18] Cf. e.g. http://userinnovation.mit.edu/conf2012/, http://about.brighton.ac.uk/bbs/research/oui2013/, http://www.hbs.edu/faculty/conferences/2014-oui/Pages/default.aspx

research domains and contemporary phenomena (the distributed nature of knowledge). Piller and West (2014) regard co-creation as the bridge between both, but notice that there is a lack of research into this area. 'Co-creation' was coined in strategic marketing and innovation management literature, but has received only a limited amount of research attention. In terms of Open Innovation this is refered to as the coupled process (Gassmann & Enkel, 2004), although Piller and West (2014) state that in its original notion this entails a bi-directional knowledge flow without an interactive aspect, such as licensing including monetary transfers. Blazevic and Lievens (2008) and Mahr et al. (2014) also note that little research has examined the structures and processes supporting collaborative knowledge creation with external actors. Therefore, as co-creation is regarded the central tenet in Living Labs, we see the study of Living Lab activities as a potential means to overcome this gap. Therefore, in part II, we will study Living Labs and assess whether they can be considered as 'interactive coupled open innovation' between organizations and users, as pointed out by Piller and West (2014), thus offering the opportunity to bridge the (research) gap between Open and User Innovation. Moreover, we will also assess the value of the Living Labs characteristics 'real-life experimentation' and 'multi-method' as structuring mechanism for user contribution, and look at their potential for helping to solve the European Paradox.

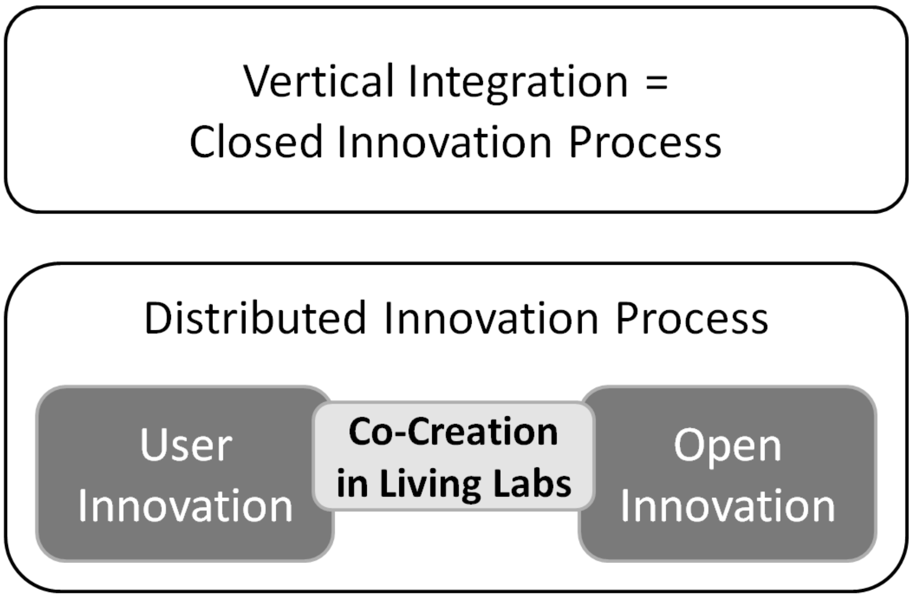

Figure 8: Co-creation as bridge between Open and User Innovation

References epilogue

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II. LIVING LABS

Research design

Within the second part of this PhD thesis, we turn towards our main subject: Living Labs. Within this introduction we want to discuss the used methodology and research approach for the next chapters in order to clarify the research design and the empirical data that was used for the analyses. In this second part we will approach Living Labs in a twofold way: we will look at Living Labs theory, meaning the body of literature that is available specifically dealing with Living Labs, and at concrete Living Labs practice, meaning Living Lab activities. In general, the main goal of this PhD is inductive theory-building, as in the literature Living Labs as a concept have not clearly and univoqually been defined. Studies have indicated that Living Labs have been used to identify a wide variety of approaches and projects (Shamsi, 2008), are used interchangeably to refer to different aspects of Living Labs (Følstad, 2008; Dutilleul et al., 2010), and are not backed up by a consistent research stream or supporting theories (Eriksson et al., 2005; Schaffers & Kulkki, 2007; Ståhlbröst & Bergvall-Kåreborn, 2008; Westerlund & Leminen, 2011). Therefore, we want to draw up a state-of-the-art regarding the current Living Labs practice and regarding the Living Labs literature. For the Living Labs practice investigation, we employed a funnel-like approach. By this we mean starting from an extensive sample that is analyzed only superficially towards smaller and more focused samples that are analyzed in increasingly greater detail. We started from a high level analysis of all ENoLL Living Labs, over a more detailed content analysis of 64 active ICT Living Labs, towards an in-depth case study analysis of four Flemish ICT Living Labs with 21 concrete Living Lab innovation projects consisting of 107 separate research steps. For the Living Labs theory investigation, we constructed a sample of the most cited Living Labs papers and looked at the occurrence and embedding of the Open and User Innovation paradigms and the abstracted key concepts and frameworks from chapters 3 and 4 that relate to the Living Lab characteristics.

We will now discuss the methodological steps of both the theory and practice investigation of Living Labs in more detail, and how this relates to our research goals.

Living Labs theory

Our first research goal was to look at Living Labs from a theoretical perspective, investigating how Living Labs are conceptualized in the literature and whether Living Labs relate to more established innovation theories. In part I we already reviewed the literature on Open and User Innovation and gathered relevant research concepts and frameworks for Living Labs. As a first empirical investigation, in chapter 5, we constructed a sample of the most cited Living Labs papers. We used the Google Scholar academic search engine[19] and looked for articles by using the search string "Living Lab" (end of October 2014). This yielded more than 6.500 results. Subsequently, we narrowed the number of articles down by only including articles where "Living Lab" was mentioned in the title in order to weed out the articles where "Living Lab" appeared 'accidentally' or only occurred on a side note. This resulted in 563 articles. From this sample, we chose to include only journal or conference papers (excluding books, book chapters, blogposts, thesisses or other citations) with a direct link to the abstract and only articles with a citation count of more than 10. This led to a total sample of 45 articles (see appendices for the full list). For this sample of 45 top cited Living Labs articles we assessed whether the key concepts and frameworks of Open and User Innovation are already present and how the papers are embedded within or related to Open and User Innovation theory. We did this simply by reading and coding all 45 papers.

Table 10 Methods LL theory

Sample/data	*Research steps*	*Methods*
Open and User Innovation papers abstracted in WoS	Literature review Open and User Innovation papers	Gather relevant concepts and frameworks from Open and User Innovation based on extensive screening of WoS papers containing 'open innovation' or 'user innovation'
All Living Labs papers with 10+ references in Google Scholar	Literature review and content analysis Living Labs papers	Assess whether Open and User Innovation are already used within the current state-of-the-art in the field of Living Labs and how the gathered key concepts and frameworks occur in the Living Labs papers
None	Inductive theory building	Construct an overarching theoretical model that incorporates and allows to differentiate the different conceptualizations of Living Labs and the key concepts and frameworks from Open and User Innovation

From chapter 3 on Open Innovation, we gathered that Open Innovation processes deal with knowledge exchange between actors. Therefore, we looked at the Living Lab definitions, and more specifically the goals that were mentioned for the Living Lab activities that were described in the paper. We coded all papers for the three Open Innovation processes of exploration, exploitation and retention, which we defined in chapter 3 (Licthenthaler & Lichtenthaler, 2009; van de Vrande et al., 2009).

[19] http://scholar.google.be/

- Exploration: innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments.
- Exploitation: innovation activities to leverage existing knowledge or technological capabilities outside the boundaries of the organization.
- Retention: maintaining, storing and reusing knowledge over time outside of an organization's organizational boundaries.

Besides the word exploration itself, we considered words such as experimentation, study (of user behavior), testing,… as indicators of exploration goals. For exploitation, we searched for words and phrases like 'creating initial demand', 'adoption', 'technology transfer', 'implement', and 'business models' to refer to an exploitation goal. For retention, indicators such as 'knowledge' and 'information sharing', 'multi-stakeholder communication' and 'rethinking' were used.

As within the Living Lab definitions user involvement and user co-creation are essential characteristics, which also adheres to the User Innovation chapter, we looked in our sample for the degree of this user involvement. From the chapter on User Innovation and from some of the papers within our sample, we gathered that user contribution can differ in terms of the degree of involvement. As key framework, we chose the categorization of Kaulio (1998), who discerns innovation/design for, with and by users. 'Design for' denotes an innovation approach where user involvement is limited to passive user feedback, gathered through 'Voice-of-the-Customer'-methods or user behavior studies. 'Design with' denotes an innovation approach based on co-creation, as users and manufacturers work together in an iterative manner, where the locus of innovation can be seen as shared between both involved stakeholders. 'Design by' refers to an innovation approach where users innovate themselves, which is in line with the Lead User-approach and the CAP, as the locus of innovation resides with the user. Within the sample of 45 papers we assessed how user contribution was defined, and which of the three types was dominant.

We concluded the investigation into the theoretical basis of Living Labs, building further upon the apparent conceptual unclarity and diversity, by developing our own three-layered model. This is in line with our third research goal where we indicated we would compose a general Living Lab framework. This theoretical model, based on inductive theory building, incorporates and allows to differentiate the different conceptualizations of Living Labs and the key concepts and frameworks from Open and User Innovation and is presented at the end of chapter 6.

Living Labs practice

Next to the investigation of Living Labs theory, we also looked into the actual Living Lab practice. In the introduction, we stipulated as second research goal the exploration of the emergence and current state-of-the-art within the Living Labs field, drawing up a more clear picture regarding the apparent diversity of approaches and practices. Our fourth research goal also relates to Living Labs practice, as we aimed to assess the (potential) value a Living Lab can generate for the three identified problems and gaps in the literature:

1. whether they are able to govern and structure user involvement and user contribution for innovation;
2. whether they can play a positive role in solving the 'European Paradox';
3. whether they might help closing the gap between Open and User Innovation.

In order to investigate the Living Labs practice and tackle our research goals, we set up the following funnel-like research framework, where we started from the large sample of all ENoLL Living Labs, analyzing a more focused and smaller set of Living Labs with more detail.

Table 11 Methods LL practice

Sample / cases	*Methods*	*Data*
All ENoLL Living Labs	Content analysis	URLs on ENoLL website
64 active ICT Living Labs	Coding & k-means clustering	ENoLL Living Lab descriptions + personal interviews
4 Flemish ICT Living Labs	Case study analysis In-depth interviews	Project proposals Steerco meeting minutes
21 Living Lab projects	Case study analysis In-depth interviews instigators	Interview transcripts Data of closed questions Project deliverables (ppt)
107 research steps	Case study analysis In-depth interviews instigators & researchers	Interview transcripts Data of closed questions Project deliverables (ppt)

In order to start tackling the second research goal, we based ourselves upon all Living Labs that are part of the European Network of Living Labs, the epicenter of the Living Labs movement. Because member Living Labs have to apply for membership during yearly 'waves' where experts evaluate the applications based on fixed criteria, we consider this sample of Living Labs as 'representative' for the Living Labs movement. In order to assess the current Living Labs activity, we use a funnel-like approach. We first perform a high-level analysis of all 345 ENoLL Living Labs. Therefore, we have investigated all web pages on the official ENoLL website[20] for all Living Labs from waves 1 to 7. These pages can be accessed through a weblink[21] with a map locating all Living Labs and a table containing all Living

[20] http://openlivinglabs.eu/
[21] http://openlivinglabs.eu/livinglabs

Labs which link through to a dedicated page for each Living Lab, containing contact information, a summary of the Living Lab goals, organization and activities and links to the official ENoLL application documents. For our analysis, we have used the ENoLL table as the primary source for all Living Labs currently considered as ENoLL Living Labs. Subsequently, we visited all dedicated pages and used the links to the ‘official’ webpages of the Living Lab itself. The analysis was carried out in January and February 2014. The data was collected, coded and translated into a number of graphs and tables. First we checked whether the link to the dedicated site(s) still worked. If this was not the case, or when there was no link mentioned, we looked for an alternative link by using the name of the Living Lab as search term in Google. When visiting the dedicated site of the Living Lab, we looked for traces of recent activity by checking whether there were projects or cases on the site, whether there were recent events planned and whether the site had been update recently. When the last update or sign of activity was situated before January 2013, we considered the Living Lab to be inactive. In case the active links referred to a general website of a university, company, city or organization, we looked for links referring to Living Lab activities and, where possible, used the website search function with “Living Lab” or the name of the specific Living Lab as search terms. We also used the same criterion, i.e. activity or updates from 2013. For some Living Labs from the last wave, established later than January 2013, no activity was mentioned on the website yet, but we decided to code these Living Labs as ‘active’. It remains to be seen whether these initiatives succeed in developing sustainable activities, projects and cases in the future. While going through all the online material, we also made notes when encountering unexpected or notable cases. For the Living Labs initially coded as inactive, we conducted a second data collection round in the first two weeks of March by sending an e-mail to all contact persons, also mentioned on the Living Lab profile on the ENoLL website. In this e-mail we asked the representatives whether the Living Lab was still active, and in case the Living Lab was in fact inactive, what the reasons were for this inactivity.

Next, in order to get a more in-depth insight into the actual practice and into the variety of approaches being implemented, we conducted a more content-based analysis on the 64 active ENoLL ICT Living Labs, starting from a theoretical segmentation of four types of Living Labs. For this analysis we started from Følstad’s nine bottom-up Living Lab characteristics which we coded on a four point scale (Neuendorf, 2002). Cooperation with the network enabled us to access the non-public registration documents and facilitated contact with a key responsible at each Living Lab, resulting in a unique data set. The data collection took place in two steps. The first step - “Living Lab Characteristics” - encompassed a quantitative assessment of Living Labs, based on the nine characteristics established in Følstad’s (2008) review. Two coders reviewed the publicly available material and the internal registration documents, and independently assessed the characteristics of all 64 Living Labs on scale from 1 (low) to 4 (high). The coding scheme can be found in annex. The second step augmented the data from the first step with interviews with key informants at the Living Labs in order to resolve unclarities in terms of the coding. The analysis of the data followed two steps which paralleled the data collection. Step 1 ("Living Labs characteristics") encompassed the assessment of 64 Living Labs. The coding of the experts showed high reliability (Krippendorff α >.8), except for co-creation and technical testing (α >.6) (Hayes & Krippendorff, 2007). Disagreements were re-examined and dissolved. To uncover higher-order characteristics among the nine Living Labs characteristics, and cluster the Living Labs, we conducted K-means clustering with an ordinal scaling level in IBM SPSS Statistics 21 for a four cluster solution, similar to our fourfold typology.

In order to gain a more detailed and fine-grained picture of Living Labs practice, we conducted a comparative case study analysis based on document analysis, personal experience and interviews consisting of four Living Lab constellations, 21 Living Lab projects that have been carried out within these constellations, and 107 research steps that have been conducted in these 21 projects (Yin, 1984). We selected these cases deliberately because of two main reasons. First, as senior researcher within iMinds Living Labs, responsible for methodology, I have been involved in all four Living Lab constellations right from the start and experienced their set-up and (for 3 out of 4) eventual decline first-hand. Moreover, I am still in this position at the current iMinds Living Labs constellation. This also allowed me to collect all necessary primary and secondary data by having direct access to relevant documents and people involved in these Living Labs. Second, iMinds Living Labs has played an important role in the Living Labs community and is regarded internationally as a 'best practice' example (Almirall et al., 2012; Dell'Era & Landoni, 2014), something which is reinforced by the fact that iMinds Living Labs also acts as secretary of the ENoLL. Therefore, the availability of rich data, first-hand experiences and the leading role of iMinds Living Labs in the Living Labs landscape warrant the choice for these four cases on the macro level (Yin, 1984). This sample enabled us to pursue our fourth research goal, which was to assess the (potential) value a Living Lab can generate for the three identified problems and gaps in the literature. Hereby, this also enabled to put our theoretical Living Labs model into practice, as on the macro level, we studied key Open Innovation concepts and frameworks for the stakeholders active in the four Living Lab constellations. As data source, we conducted interviews with key informants from the four Living Labs and used the formal project proposals of the Living Labs and the available steering committee meeting minutes (see appendices for a list).

Table 12 Interviews LL managers

Informant	*Function*	*Date*
Tim Rootsaert	Mediatuin Living Lab manager iMinds Living Labs business developer	30/04/2014
Mark De Colvenaer	Flellap Living Lab manager	16/04/2014
Dirk Osstyn	LeYLab Living Lab manager	22/04/2014

For the 21 Living Lab projects, we conducted interviews with someone (mostly a founding partner) from the organization that instigated the project, which we refer to as 'instigator' of the project. We also gathered the main project deliverables (mostly PPT files) that contained the research results (see appendices for a list). Some data could also be gathered from the steerco meeting minutes in which the projects were somtimes discussed.

Table 13 Interviews LL instigators

Name	*Project*	*Instigator*	*Interviewee*	*Date*
David De Wever	Wadify	SME PlayOut!	CEO	26/11/2013
Jean-Sebastien Gosuin	Smart Seats	Start-up	Co-founder	24/02/2014
Heiko Desruelle	Webinos	EU-project University research group	Senior researcher	06/01/2014
Peter Leyder	Coxo	Organization VTBKultuur	Project manager	18/11/2013
Dominique Adriansens	Twikey	Start-up	Founder	05/11/2013
Eddy Schuermans	Ceonav	SME	Founder	14/11/2013
Thomas Van Landeghem	Veltion	Start-up	Founder	07/11/2013
Jeroen De Smet	Planza	Start-up	Founder	24/03/2014

Geert Polleunis	Qwison	SME – Aconos	Founder	29/10/2013
Femke Mussels	SonicAngel	SME	Co-founder	22/11/2013
Geert Reynaert	Hoaxland	SME	CEO	06/01/2014
Kristof Van den Branden	La Mosca	SME	CEO	06/11/2013
Sven De Coninck	Future Legends	Organization – REC	Director	22/11/2013
Tom Vandoorne	JukeBox21	Start-up	Co-founder	20/11/2013
Pieter Ardinois	Streemr	Start-up	Founder	19/11/2013
Bert Cattoor	Kianos	Start-up	Founder	28/10/2013
Hans-Bart Van Impe	OnCloud	Large firm - Belgacom	Senior strategic consultant	22/11/2013
Hannelore Van Buyten	Poppidups	SME Prophets	Project manager	26/12/2013
Ronald Hermans	Fietsnet	Organization	Co-founder	12/11/2013
Dann Rogge	Fifth Play	SME/Large firm	Business Unit Director	20/11/2013
Koen Tanghe	MuFoLive	Start-up SampleSumo	Co-founder	29/10/2013

Regarding the 107 research steps, we based ourselves on the instigator interviews, the project deliverables and extra interviews with the researchers from the projects.

Table 14 Interviews LL researchers

Informant	Function	Project involved in	Date
Bastiaan Baccarne	PhD student	Wadify Twikey Future Legends La Mosca SonicAngel Hoaxland Planza	17/10/2013
Lynn Coorevits	Researcher	Webinos	06/01/2014
Carina Veeckman	Junior researcher	Fietsnet Fifth Play MuFoLive	12/11/2013
Constantijn Seys	Junior researcher	Ceonav Veltion Qwison JukeBox21 Streemr Kianos	04/10/2013
Sara Logghe	Junior researcher	Coxo	18/11/2013
Annabel Georges	Junior researcher	Smart Seats	24/02/2014

Within a case study design, careful consideration should be dedicated to the selection of the cases to be included in the analysis (Dion, 2003). We tackled this by analyzing all three ICT Living Lab constellations, together with iMinds Living Labs, and all projects that were finished at the time of writing to which we had first-hand experience as researcher and where the instigator agreed to be interviewed. This makes a slightly larger sample of cases than usual, but this enables also a more quantitative, yet still exploratory, analysis coupled with more in-depth qualitative investigation. Therefore, the case studies are prospective (in which criteria are established and cases fitting the criteria are included as they become available) nor retrospective (in which criteria are established for selecting cases from historical records for inclusion in the study), but can be labeled as comprehensive for the analyzed time frame, from 2010 to 2013, which is in line with the "sustained period of time" criterion for data collection of Shepard (2001). The time frame also allows to include a more evolutionary perspective of the analyzed cases and of the different levels of analysis. To this end, we also included an overview of the historical developments that led to the establishments of the three Flemish ICT Living Labs. This allows to better frame these events and to position the different cases and levels of analysis.

Finally, our study also shows some elements of an action research design (Susman & Evered, 1978) as we participated ourselves in the cases studied as researchers, embedded in real projects and interacting in real-life settings with the different stakeholders participating in the Living Labs and in the Living Lab projects in order to help solving problems and learn from this experience (Ottosson, 2003). This position provided the author with in-depth, rich insights and access to all sorts of data sources. This unique position allowed to constantly shift between reflection and theorizing on the one hand, and actively doing and putting into practice on the other hand.

The interview guides were pretested with colleague Living Lab researchers from iMinds Living Labs. The results were also discussed with them. For the analysis of all interviews, we used the technique of affinity diagramming, which originates from the User Centered Design tradition (Beyer & Holtzblatt, 1999) and allows to discover emerging themes and topics in the research data. This technique consists of gathering the key statements of the interviews on post-its and clustering them. By doing this iteratively, this allows to detect emerging and underlying themes within the qualitative data. The data from the closed questions were analyzed using IBM SPSS Statistics 21, which allowed to add some quantitative data to the qualitative results, although the sample size (21 cases) remains relatively low. With this methodological design, we were able to identify key cases and outliers in terms of the topics and themes that emerged out of the interviews (Thomas, 2011). This enables us to explore the Living Lab constellations, projects and methodologies both from the theoretical frameworks and concepts from the Open and User Innovation paradigms, but also allows to add to the current understanding and research gaps from both paradigms.

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5. HISTORY AND EVOLUTION OF LIVING LABS-CONCEPT

This chapter deals with the second research goal from this PhD as we will look into the Living Labs phenomenon from a practice perspective. We will tackle the second problem associated to Living Labs, as in terms of Living Lab practice and activity there seem to be too many initiatives, without enough noticeable results or impact. Moreover, we will demonstrate that there is a remarkable decline in the growth of the ENoLL-network, as well as no clear picture of the current activity level of the previously established Living Labs. Moreover, the large amount of Living Labs also does not seem to have a consistent modus operandi and shows a (too) broad diversity of approaches and thematic goals, all without a clear picture of the added value they generate.

To this end, we will explore the emergence and current state-of-the-art within the Living Labs field by digging into the history of the concept, trace the roots and predecessors of the current European Living Labs movement, which is firmly entangled with the European policy level, and look into the more practice-based definitions and conceptualizations. Subsequently, we explore the rich diversity of Living Lab initiatives gathered under the banner of the European Network of Living Labs (ENoLL), a very important organization for the Living Labs movement, and draw up a current state-of-the-art regarding the active Living Labs in the network, which will unveil some of the current issues and caveats associated with a lot of contemporary Living Labs. Next, we specifically zoom in on the ICT Living Labs in the network and perform a four-way segmentation of ENoLL ICT Living Labs, based on an overview of early Living Lab conceptualizations. This illustrates the rich diversity of approaches and practices within the Living Labs phenomenon and shows the link with their historical predecessors, but also the shortcomings associated with an analysis on this level. This way, we set the scene for our analysis of the Living Lab research and theory building in the following chapter.

5.1 General definitions of Living Labs

On the Wikipedia-entry on Living Labs, the following definition is used: “A living lab is a research concept. A living lab is a user-centred, open-innovation ecosystem, often operating in a territorial context (e.g. city, agglomeration, region), integrating concurrent research and innovation processes within a public-private-people partnership.”[22] On the website of the European Network of Living Labs, we can find the following definition: “A Living Lab is a real-life test and experimentation environment where users and producers co-create innovations. Living Labs have been characterized by the European Commission as Public-

[22] http://en.wikipedia.org/wiki/Living_lab

Private-People Partnerships (PPPP) for user-driven Open Innovation. A Living Lab employs four main activities:

- *Co-Creation*: co-design by users and producers
- *Exploration*: discovering emerging usages, behaviours and market opportunities
- *Experimentation*: implementing live scenarios within communities of users
- *Evaluation*: assessment of concepts, products and services according to socio-ergonomic, socio-cognitive and socio-economic criteria."[23]

Both definitions stress the multi-actor innovation approach through a public-private-people partnership and mention co-creation as a central process, something which is also confirmed in academic literature on the phenomenon (Levén & Holmström, 2008; cf. chapter 6). Besides 'multi-actor' and 'co-creation', 'user-driven' or 'user-centered' is also seen as a shared characteristic, together with a 'real-life' or 'local' character. This is also summarized in the academic definition of Almirall and Wareham (2011), two of the most prolific and influential authors in the Living Labs field (cf. the next chapter), 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". However, when looking into the Living Labs literature, the situation tends to get more and more complex. In his pioneering early works, Følstad (2008a&b) identified nine characteristics for Living Labs which are partly diverging, partly converging, and with two general 'archetypes': Living Labs supporting context research and co-creation and Living Labs as testbeds (cf. infra). Dutilleul et al. (2010) mention five different and divergent meanings for which 'Living Labs' as a concept is used: an innovation system, a real-life social setting, an approach for user involvement in innovation, an organization facilitating Living Lab approaches, and the European Living Lab movement itself. Fulgencio et al. (2012) focus on the history of Living Labs as a concept, and how its meaning and connotation has changed over the years, ending up with yet another 'composed' definition: "A human-technology interaction innovation entity utilizing a mix of methods, tools and principles drawn from known disciplines (design, science, ict, etc.) and set in a real environment and in a locale/societal scale. In addition, Living Lab operates in a "multi-"mode that is evident by its multi-stakeholder, and multi-discipline, nature which eventually leads to a multi-method approach, and often implemented multi-culturally for an internationally collaborated Living Lab project. The phenomenon is within the context of innovation and has multiple applications." Westerlund and Leminen (2014) even identified

[23] http://openlivinglabs.eu/

eight different research avenues researchers have taken to study and conceptualize Living Labs. However, no research is available yet that looks into predecessors of Living Labs within European history that have similar characteristics, without any reference to the name ‘Living Lab’ itself.

Therefore, in order to further contextualize the emergence of this European interpretation of Living Labs, we first dedicate attention to three important European initiatives regarding information technologies, taking place in the three final decades of the 20th century, that we regard as important predecessors for the Living Labs-movement as we know it today. First, the cooperative design movement, or the Scandinavian tradition of user involvement in IT design processes (Ehn, 1989), can be traced back as far as the 1970s, in the 1980s there were the European ’social experiments’ with IT (Oestmann & Dymond, 2001; Qvortrup, 1987), and from the 1990s the ‘Digital City’-projects started to blossom, which were also predecessors of the nowadays also hyped ‘Smart City’-initiatives (Paskaleva, 2011). Building further upon these initiatives, we will argue that the European Living Lab notion offered a fundamental reinterpretation of the American Living Labs. We will start by giving a focused overview of these three important movements, demonstrating that the current Living Lab movement is firmly rooted inside these predecessors. We continue with an overview of the first ‘accidental appearances’ of the word ‘living lab’ and ‘living laboratory’, followed by an overview of the establishment of the ‘American Living Labs’. These evolutions and predecessors all played a role in the current European take on Living Labs, where we dedicate attention to the early conceptualizations based on the early Living Labs practice and to the establishment of the European Network of Living Labs.

5.2 Predecessors of Living Labs

Within these sections, we will discuss three predecessors of the current Living Labs movement: cooperative design, social experiments and digital cities.

5.2.1 Cooperative design: the Scandinavian tradition of user involvement

The basis of the User Centered Design (UCD) paradigm, which is used as a central paradigm in a lot of the current European Living Labs, evolved out of the Scandinavian tradition of cooperative design, which was later translated to participatory design in the US. Cooperative design can be traced back to the 1970s when research projects on user participation in systems development took place all over Scandinavia (Bødker, 1996). These early initiatives were supported by the then powerful trade unions and dealt with involving workers in the design of IT application in the workplace. This put them in an explicitly political context, as part of the Scandinavian workplace democracy movement which was aimed at empowering the workers and their involvement (Bjerknes et al., 1987). These projects, referred to as the ‘collective resource approach’, involved collaboration between the organization’s workers and researchers. Both benefitted from this collaboration as the researchers were able to gather data and the workers were able to influence the implementation of IT systems in their daily work context which indicates the mutual nature of value creation. Fowles (2000) refers to this as the transformation of “symmetry of ignorance” (mutual incomprehension between designers and users) into a complementary “symmetry of knowledge” through symmetries of participation and symmetries of learning. The cooperative design approach within these projects was grounded in the participants’ own experiences as they were acting in their current situation (Ehn, 1992). Bødker (1996) argues that the Scandinavian projects pointed out that systems description with users is a process, building on people’s own experiences while providing resources for them to be able to act in their current situation. This is being referred to as an experience-based design method and implies that the users need to be educated to participate in this process (Ehn, 1989). Key within cooperative design is the collective build-up of resources and knowledge. One of the aspects that is mentioned in Bødker and Grønbæk (1991) is the facilitation of trial use situations as part of the design process, so as to stage users' hands-on experience with the future. It is equally necessary to investigate ways in which users can feed back reflections over work and trial use to designers and usability people in ways that are directly anchored in the specifics of particular use situations.

In their 1991’s book ‘Design at Work: Cooperative Design of Computer Systems’ Joan Greenbaum and Morten Kyng shed some light on the transition and translation from these Scandinavian initiatives in cooperative design to the North-American **participatory design**, based on their first hand experiences. Kyng mentions a trip to the US in 1984 together with colleague and other pioneer in the field Pelle Ehn to discuss the experiences with cooperative design in Denmark and Sweden. The encounters and discussions with Americans, who they explicitly describe as not being ‘mainstream computer scientists’, led them to believe that their experiences with end-user cooperation could also work in an American setting; albeit in an adapted form because of different conditions, with the much less powerful trade unions and a strong separation between workers and managers in America as two main differences. The actual translation and transition towards participatory design (PD) started in 1986 when Joan Greenbaum visited Denmark and started teaching and discussing his US experiences in creating computer systems with Kyng and others. This led to the original elements of cooperative design being extended and complemented with other insights and ideas from various disciplines, establishing PD as a set of theories, practices, and studies related to end-users as full participants in activities leading to software and hardware computer products and computer-based activities (Muller & Kuhn, 1993). The field of participatory design is very diverse and inherently multi- and inter-disciplinary and constructed from localized experiences in diverse national and cultural contexts (Gregory, 2003). However, the distinction between the Scandinavian and North American approach has more or less prevailed, with the former remaining closer to its roots in the labour movement (Ehn &

Kyng, 1992), while the latter became a ‘broader’ version with attention for different stakeholder groups, but also for the design of separate features (Beyer & Holtzblatt, 1997), whereas the Scandinavian approach tends to focus on the system as a whole. Other sources tend to merge and combine both approaches (Greenbaum & Kyng, 1991; Bødker et al., 2004).

Because in recent years we started using technology not only at work, but also at home, in school, and even while ‘on the move’, it has been a major challenge to participatory design to embrace the fact that much technology development no longer happens as design of isolated systems in well-defined communities of work (Gasson, 2003). Therefore, the so-called **user-centered design**-approach (UCD) has gained a lot of popularity. UCD can be characterized as a multi-stage problem solving process that not only requires designers to analyze and foresee how users are likely to use a product, but also to test the validity of their assumptions with regard to user behavior in real world tests with actual users. This design methodology looks at the design of a product or service as a process in which the needs, wants, and limitations of users are given extensive attention at each stage of the design process, including testing in field studies. This is necessary to understand what each user's learning curve may looks like. We can summarize the three key principles of UCD as an early focus on users and tasks, an empirical measurement of product usage in field trials, and iterative design (Gould & Lewis, 1985). Relevant concepts are user needs and wants, usability testing, iteration and fine-tuning, and user requirements. Commonly used methods include ethnographic studies, contextual inquiry, prototype testing, usability testing and generative methods. Contextual inquiry, as a part of the ‘Contextual Design’ methodology, also evolved out of the cooperative and participatory design traditions during the 1990s, with Hugh Beyer and Karen Holtzblatt as prominent figures, and indicates that products or services are designed in the actual usage context by interviewing users during their normal daily-life routines, discussing with the researcher what is happening, which makes a contextual inquiry an ethnographic research method (Wixon, Holtzblatt & Knox, 1990; Holtzblatt & Beyer, 1995).

A major difference with other design methodologies is the social shaping-focus, as user-centered design tries to optimize the innovation based on user needs and wants, while other design approaches are more focused on changing user behavior according to the innovation (Gasson, 2003). The statement that the product should suit the user, rather than making the user suit the product, holds a social deterministic view on ICT innovation, as opposed to technological determinism which considers technology to be affecting and shaping society.

5.2.2 Relevance for Living Labs

Summarizing, cooperative design, as was implemented in the Scandinavian projects in the 1970s and 1980s, steered away from the idea that user involvement is restricted to observing users, as the users participated on equal footing with designers and researchers during the development and concrete implementation of information technology (IT) artifacts. This initial vision had a strong political and socio-deterministic nature, something which was weakened in the translation towards participatory design. Another important element is the real-life context that has an influence in the design process. This is further highlighted in the user-centered design tradition, which evolved out of both cooperative and participatory design, with methods such as contextual inquiry. The iterative nature of the development process is also present in all three approaches. It is interesting to note that there is also a different interpretation and approach of participatory design in Scandinavia and in the US, similar to the difference in American and European Living Labs, albeit that the Scandinavian approach preceded the American translation. The American take on participatory design also focused on including different stakeholders in the design process.

Two basic elements from Living Labs seem to have emerged from the Scandinavian cooperative design projects of the 1970s: the user-centered aspect and the real-life context. An important difference however is that the real-life context is mainly used to study current practices and that these initiatives were carried out in the context of IT for work. The Scandinavian tradition of cooperative design can also be seen as the starting point for the Participatory Design approach and the User Centered Design tradition, which are still important research traditions within the current practice of Living Labs (Krawczyk, Pallot & Kivilehto, 2013; Salminen et al., 2011; cf. chapter 6). These related approaches also include other elements from Living Labs, such as the multi-stakeholder aspect and the iterative nature of the innovation process.

5.2.3 Social experiments: field trials with IT in Europe

An interesting predecessor of Living Labs can be found in the 1980s when all over Europe various social experiments with information technology were held. Social experiments originate from the field of psychology and indicate experiments taking place outside of laboratories and therefore with less physical isolation of materials, less procedural standardization, and longer-lasting treatments when compared to experiments in laboratory settings. They are usually designed to test an intervention or treatment that is better characterized as a global package of many components, rather than as a uni-dimensional theory-derived causal construct (Cook & Shadish, 1994). This led to social experiments being used as a means to test, evaluate and measure the impact of public policy as an alternative to econometric approaches (Heckman & Smith, 1995). Under impulse of the European Commission and the FAST-programme, social experiments were also used as a local test and implementation methodology in the context of the developing field of ICT in the 1980s. Qvortrup (1987) defines these social experiments as specific forms of ICT implementation in which the primary goal is to establish new forms of organization using IT, in which the activities and resulting socio-technical products can be used as models for a more widespread, though contextually modified, implementation of similar IT systems, and in which independent researchers describe and evaluate the implementation process and the results of the experiment. He frames this as follows: "[…] social experiments with information technology constitute an enactment at the micro-level of the ongoing dialectical relationship between social and information-technological innovation, with a view to influencing the society at large." (ibid., p.282). Some examples of European social experiments with ICT include field trials with Interactive Videotex (France, Germany, UK and Denmark), Broadband Cable and Computer Conference Systems (Ancelin, 1987), and the implementation of so-called telecentres for rural ICT-development in various European countries (Oestmann & Dymond, 2001). Ancelin (1987) indicates the necessity to learn from other social experiments in order to build further on past experiences. This sharing of lessons learned is seen as problematic in the 1980s because of the large variety of initiatives and the absence of institutions facilitating this. In an attempt to give an overview of the scattered landscape of diverse social experiments all over Europe, which had applications in a wide variety of domains such as agriculture, health-care, education, local communities, and social services, Qvortrup (1987) distinguishes between participatory workshops and social laboratories. Participatory workshops are social experiments where all parties involved in and influenced by the IT systems participate on equal footing in decision making regarding the social organization and application of the IT system. If this is not the case, indicating the main subject is a hardware or software manufacturer or a third party, the term 'social laboratory' applies. He also discerns social experiments based on the main driving actor: governmental planning instruments and governmental activities to develop national IT services (government-driven), instruments for popular social movements and grassroots activities involving IT (user-driven) and a service for private companies and private firm's strategies for socially-oriented product refinement and marketing (industry-driven).

In an attempt to further delineate the concept, Ancelin (1987) adds that social experimentation is an open-ended process in which there are degrees of freedom and in which a mutual learning process for the promoter and for the user is facilitated. Regarding the role of these users, Hartley (1987) identifies a complex interaction between technological innovation and the response of individual and collective users of the technology. The key to the diffusion process is the mutual learning process involving supplier and user and their consequent mutual adaption. The responses of the users provide indications for the development of new technological applications, and these new applications in turn influence the users' behavior, giving rise to 'social inventions'. This indicates a shift towards a 'mutual shaping' view on ICT development instead of the dominant 'social shaping' view of the cooperative design approach of the 1970s (cf. supra). Within the variety of European social experiments, users have played different roles, from 'guinea pigs' to active and authoritative participants, and these users belonged to various user groups: local citizens, specific user groups, professional users,… This was also linked to the goal and modus operandi of these experiments, as some have tested a specific technology, while others have mapped potential needs or have developed a new service (Ancelin, 1987).

Qvortrup summarizes the activities of the European social experiments with IT in three main evaluative hypotheses:

1. social experimentation can promote socially beneficial ways of utilizing new information technology, as social experimentation is an instrument allowing all parties involved in the development of a specific IT system to influence its application and utilization.
2. Social experimentation is a method for the production, evaluation and refinement of high quality information and communication systems, and as such it is an instrument of economic and competitive relevance for the European production of information systems.
3. Social experimentation is an instrument for influencing rather than merely predicting the future. It does so by developing new socially advanced IT products and services, by demonstrating new forms of social organization using IT, and by catalyzing social awareness and generating societal learning processes.

5.2.4 Relevance for Living Labs

The social experiments in Europe during the 1980s carry already quite some elements and characteristics from the European Living Labs. First, similar to the Scandinavian experiences with cooperative design in the 1970s, the social experiments were a European phenomenon. Second, the appeal of social experiments, together with the European policy and funding support, resulted in a wild growth of initiatives being awarded the 'social experiment' label without much consideration. In the 1980s, some attempts were made to bridge this gap by organizing conferences on social experiments to facilitate exchanging experiences and best practices. This plea for cooperation can be seen as an early echo of the eventual European Network of Living Labs, which was founded only in 2006, 20 years later. The social experiments also emphasized the multi-stakeholder aspect, as there was a large variety of different actors involved: national and local public institutions, national and local private organizations, and end-users. The role of the end-user was also considered in these initiatives, but there was no conclusive stance towards the nature of this role: users could function as mere testers or respondents, but could also be involved on equal footing (co-creators) or as innovators themselves. Note that these diverging stances towards the degree of user involvement are still an issue in the current Living Labs literature (Westerlund & Leminen, 2011; cf. also the next chapter). The degrees of freedom and the differences between the various approaches are put forward as inherent in the concept. There is also a broad diversity in terms of themes and application domains, and attempts were made to structure and define the field, something which sounds very familiar in the current Living Lab-context. However, the experience with social experiments also holds a warning for the Living Labs movement. As quickly as they gained popularity, research interest died and so did the once hyped concept. When searching for current scientific literature, the term is only used for experiments in social psychology. Living Labs can be considered as the descendent of the social experiments, but a main lesson is that an unbridled enthusiasm without a clear theoretical foundation can result in a concept fading away as quickly as it was hyped.

5.2.5 Digital City-initiatives

The 'digital city' is the oldest of the city-concepts, with counterparts like the 'U-city' and the currently widely hyped 'smart city'. The term was originally used to refer to all sorts of digital initiatives undertaken by cities, especially digital representations of the city and the connection of citizens by providing internet access. In this sense, digital cities can be seen as the counterpart of the telecentres from social experiments, which were also infrastructure-driven initiatives, aimed at rural and remote areas instead of cities (cf. supra). The network infrastructure and the platforms to disclose the vast amount of digital information are of central importance within this initial digital city-discourse, which causes this concept to carry a quite heavy technology-deterministic connotation with it (Mechant et al., 2012). This differentiates the digital city-initiatives from the 1990s with the social shaping perspective of the participatory design movement in the 1970s and the mutual shaping of the social experiments with IT in the 1980s (cf. supra).

Although digital cities were a worldwide phenomenon, from 1994 onwards, more than 100 European local organizations started digital city-initiatives, mostly in the context of topics like telematic applications and car-free cities (Ishida, 2000). Some examples of these early digital city-initiatives could be found in the Netherlands (Digital City Amsterdam, founded in 1994) and in Finland (Virtual Helsinki, founded in 1996). In the US, on the other hand, AOL started a regional information service called "digital city" for several tens of major US cities, while in Japan, the Digital City Kyoto Project was launched in 1998 to create a social information infrastructure towards the 21st century. Some of these initiatives, like Helsinki and Kyoto, even included 3D-representations of physical locations of these cities, something which is referred to as 'cyber cities' (Ishida & Isbister, 2000). This leads us to a broader definition of digital cities as information systems that collect the corresponding digital information from the actual physical cities and organize this in a public virtual space where citizens can consult this information but also interact with it, and with each other (Loukis et al., 2011). This last part of the definition, interaction with each other, is also referred to in other definitions of digital cities that stress the connectivity between the various stakeholders in a city context, which steers digital cities away from the technological deterministic discourse (Ergazakis et al., 2011; Middleton & Bryne, 2011). Ishida (2000) sees digital cities as a metaphor to describe connected communities consisting of different stakeholders, which implies that digital cities can be extensions to real cities, but can also be seen as a new form of 'virtual cities'. When going through the literature, in Europe, digital cities are mostly seen as extensions to real cities, while the more metaphorical use of digital cities occurs mostly outside of Europe.

Summarizing, we can refer to van den Besselaar et al. (2000) who identify five different interpretations of the digital city-concept back in 2000:

1. a local social information infrastructure, providing information over the 'real' city to locals and visitors of the real, physical city.
2. a communication medium, influencing the personal networks of inhabitants of a digital neighborhood.
3. a tool to improve local democracy and participation.
4. a free space to experience and experiment with cyberspace.
5. a practical resource for the organization of everyday life by offering online public services.

This evolution and variation in definitions in the 1990s moves the digital city-concept from technological deterministic and infrastructure-driven towards a more open concept enabling experiment with new forms of solving problems and coordinating social life. Van den Besselaar et al. (2000) state that at the time of writing, most digital city-activities are still coordinated by the market or by the state, but over time the digital city may become a tool that enables people to do things by mobilizing the available local resources, using existing and emerging social networks.

Currently however, digital cities are considered as technology-burdened peers of smart cities (Paskaleva, 2011). This means that the promises withheld in the digital city-concept of the 1990s are currently being projected and realized under the smart city-label. Lievrouw (2006) summarizes this promise as the desire to develop sustainable and participatory citizen communities that integrate the mutual shaping perspective between society and communication technologies. The concept of smart cities can be viewed as a recognition of the growing importance of digital technologies for a competitive position and a sustainable future. Although the smart city-agenda, which grants ICTs with the task to achieve strategic urban development goals such as improving the life quality of its citizens and creating sustainable growth, has gained a lot of momentum in recent years through the programs of the EU or other organizations such as the Economic Co-operation and Development (OECD), the concept itself continues to be used in different ways and remains quite ambiguous (Paskaleva, 2011), which draws a clear parallel with the digital city-concept in the 1990s, the social experiments with IT in the 1980s and with the current Living Labs-concept.

An important differentiating element with the smart city-concept and the other city-concepts is the collaborative aspect between the various city stakeholders, including citizens. In smart cities these collaborative digital environments facilitate the development of innovative applications, starting from the human capital of the city, rather than believing that the digitalization *in se* can transform and improve cities. Six main areas can be identified in which these digital innovations should make a difference: smart living, smart governance, smart economy, smart environment, smart people and smart mobility (Giffinger et al., 2007). An important aspect within these innovative applications of ICTs for these six dimensions is the collection of all sorts of data and information by sensors and sensor networks. Under the label 'open data', this information is made public and put to use in smart city applications and technologies that visualize, transform and utilize this data on public and private screens through the web (Ojala et al., 2011).

In the current view, smart cities are built upon the involvement of all relevant stakeholders for an interactive, participatory and information based urban environment, whereas digital cities stress the presence of technological infrastructure needed to become a true smart city. In other words, a city needs to be digital, wired and intelligent in order to become smart, although being digital, wired and intelligent does not automatically imply that the city will become smart by itself (Baccarne et al., 2014).

5.2.6 Relevance for Living Labs

The digital city-initiatives are, more than the previous two predecessors, explicitly multi-stakeholder as they connect citizens (users), policy makers (public organizations) and private organizations (businesses). Thematically these initiatives also cover a broad range, albeit with a link to city life. In terms of user involvement, the user is seen as potentially innovative, with the technical infrastructure as a trigger for this creativity. However, the conclusion at the start of the 2000s was that this creative potential had not been attained yet. In the context of Living Labs, the infrastructural component of the digital city-initiatives could serve perfectly as a testbed infrastructure. Like smart cities evolved from digital cities utilizing their infrastructure to connect stakeholders and allow collaboration, a lot of Living Labs evolved from the technologically driven testbeds and from the previous European experiences with cooperative design in the 1970s and from the social experiments with IT in the 1980s. We also see the growing importance of user involvement, as virtually non-existing in digital cities to an active collaborator in smart cities. It remains interesting to see that the original digital city-concept had a very strong technological driven-character, whereas in the previous decades the focus was more on social shaping or mutual shaping. The ambiguity of the digital city-concept is very similar to the ambiguity of the social experiments and of Living Labs. What seems to unite these approaches, is a stronger will for action than for thought and conceptualization. This focus on action makes it even more important and relevant to conduct more in-depth research, based on previous experiences, and to focus on conceptual clarity.

5.3 First 'accidental' appearances

Within the literature on Living Labs, the first appearance of the term "Living Laboratory" is credited to the work of Knight who describes this as "conditions in the human body as an environment for experiments" already in 1749, while there is also an appearance in The Billboard magazine in 1956 where the scientific in-situ research experimentation and observation of users by Dr. Ernst Dichter from the Institute of Motivational Research in his facility is described as Living Lab (Fulgencio et al., 2012). The concept was used more often in the 1990s, starting with an appearance in a paper by Moffat (1990) who sees China as a 'living lab to study epidemiology' as it possesses unique features to analyze disease patterns. Bajgier et al. (1991) use the term in a journal article to describe a course for students from Drexel University, Philadelphia, on community operations research. A city neighborhood is described as a 'living laboratory' where students work on public sector problems and try to take into account the complex nature of these problems and of the stakeholders involved, being encouraged to bear a variety of traditional and non-traditional techniques from many disciplines. Følstad (2008a) traces the first use of the term Living Laboratory back to Lasher and colleagues (Lasher et al., 1991) who relate it to co-operative partnerships and live field trials in the area of information management systems. Also in the 1990s, the term is used in the context of a wildlife research center that looks at a country, Kenya, as a living lab to study the future co-existence of wild animals and humans (Stewart, 1996).

Summarizing, these first diverse appearances of the term 'Living Lab' are wordplays used to indicate the 'in situ' nature of different types of research. 'Living Lab' indicates research that takes place in a 'live' context, or indicates a real-life environment that is very well suited for conducting research. Living Labs are also not seen as 'infrastructures' with certain capabilities, they are mainly used as referral to a delineated part of a real-life environment in which a given study or activity is carried out. There is no clear thematic focus, as the label is used in education, biology, medicine and IT.

5.4 American Living Labs

In the majority of the Living Labs literature (cf. chapter 6), the actual birth of the concept is ascribed to MIT's prof. dr. Mitchell, who used it to refer to a real home where the routine activities and interactions of everyday home life can be observed, recorded for later analysis, and experimentally manipulated, and where volunteer research participants individually live in, treating it as a temporary home (Eriksson et al., 2005). These had an initial focus on testing new technologies in home-like constructed environments, something which we refer to as the 'American' notion of Living Labs. Bergvall-Kåreborn and Ståhlbröst (2009) situate the emergence of Living Labs as an innovation approach in the beginning of 2000 and mention Markopoulos and Rauterberg (2000) as first publication on the 'modern' version of Living Labs (cf. also the next chapter). They confront Living Labs with so-called 'smart home' type projects: whereas the latter type of projects acts as a showcase of an integrated vision of the 'home of the future', they define their Living Lab as a testing facility with as primary research goal to focus on how ubiquitous computing technology can be designed to fit the daily lives of the Living Lab inhabitants (Markopoulos & Rauterberg, 2000). The difference with these Living Labs and many other demo-homes, homelabs and so-called 'houses of the future' lies in the human focus of the former, whereas the latter stick to being nothing more than showcases of technology push (de Jong & Bakker, 2008). However, this human focus should not be exaggerated, as in most American Living Labs the user is merely involved as a passive study object. The findings from Living Lab research lead to innovations being developed by engineers who can test prototypes in the Living Labs, where users can evaluate them. The most known example is the MIT Living Labs group of Kent Larson[24], formerly led by the recently deceased William J. Mitchell.

In Europe, there are also some well-known examples of Living Labs according to this original American vision: the Philips Homelab in the Netherlands[25] and the Fraunhofer InHaus in Germany[26]. The StudioHome in the ID-StudioLab of the Delft University of Technology in Holland even moves the furniture and changes the interior to match the outlook of the user's own home (Pasman et al., 2005).

Within 'living laboratories' such as the MIT PlaceLab, a 1000 square foot lab, located in the USA, with al facilities of a regular home, users are observed, logged and tracked with all sorts of devices, allowing to record all their habits, activities and routines (Intille et al., 2006). Notice the importance of the **technical infrastructure** that allows tracking and logging all this data. In terms of **methodology**, this makes the Living Lab an extension of laboratory experiments, aiming to get more accurate and naturalistic user information by having more long-term data and allowing observation of everyday activities and capturing tacit knowledge (Pierson & Lievens, 2005). By building and designing the lab to resemble as closely as possible a real home, this kind of Living Lab tries to overcome the problem of the absence of a natural setting associated with traditional laboratory research. In terms of research design, most experimental and quasi-experimental designs contain a pre-test and a post-test that allow to assess the effects of certain controlled variables on the subjects (Cook & Campbell, 1976). This is combined with observation and data collection during the intervention. An

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24 http://livinglabs.mit.edu/

25 http://www.research.philips.com/cgi-bin/search.cgi?cc=1&URL=http:%2F%2Fwww.research.philips.com%2Ftechnologies%2Fprojects%2Fhomelab%2Findex.html&q=icat&wm=wrd

26 http://www.inhaus.fraunhofer.de/en.html

interesting contemporary Living Lab is the SMEDL[27] Living Lab, as it included a stationary laboratory room at the University of Siegen, which is built exactly like a standard living room (SMEDL-stat), but also connects end-users with equipment installed at their own homes (SMEDL-local), and includes research into online communities on social media platforms (SMEDL-global). This way it connects the American Living Lab tradition with the European approach (cf. Hess & Ogonowski, 2010; Ogonowski et al., 2013).

Summarizing, the American notion of Living Labs can be regarded as the actual start of Living Labs as a more delineated concept with a link to innovation. The focus lies on the infrastructural aspect, as Living Labs are used to refer to a dedicated laboratory environment made to resemble a real-life home environment. Users are studied in this environment, which can be considered as natural, but not as real-world, and the outcomes of these studies are used to generate innovation that can also be tested in these Living Labs. Users are central in the innovation process, but their role remains rather passive. The user-led and project-based/multi-stakeholder aspects from the current definition are not present yet in the American notion, nor is the active, mediating role of Living Labs. They are rather regarded as data input generators for innovative development and subsequent evaluation of the developed innovations. However, these technical infrastructures do have an implication on a methodological level, as they allow gathering more long-term and naturalistic user data. Thematically, American Living Labs deal with all kinds of innovation related to living and the home environment such as Ambient Assisted Living, eHealth, home automation, smart energy & sustainability, etc. The following concluding table summarizes the presence of the Living Lab characteristics in the predecessors.

Table 15 Characteristics in LL predecessors

	Cooperative Design (70's)	**Social Experiments (80's)**	**Digital Cities (90's)**	**American living labs (00's)**
Active user involvement	+	+/-	-	-
Real-life	+	+	+/-	+/-
Multi-stakeholder (PPPP)	+/-	+	+	-
Multi-method	+/-	+	-	+/-
Co-creation	+	+/-	-	-

[27] http://www.openlivinglabs.eu/livinglab/smedl-social-media-experience-and-design-lab

5.5 European Living Labs

In 2006 the Living Labs movement gained real momentum through European policy measures (Dutilleul et al., 2010), so we consider this year as the formal starting point of the European Living Labs movement. In this year, the European Commission funded 'Corelabs' and 'Clocks', two projects aimed at promoting and coordinating a common European innovation system based on Living Labs (EC, 2009), while this year also witnessed the birth of the pan-European network ENoLL (European Network of Living Labs), initially consisting of 19 core Living Labs (cf. infra). Living Labs were also explicitly supported in the 'Strengthening innovation and investment in ICT research'-pillar of i2010, the EU policy framework for the information society and media (Peltomäki, 2008). One of the more widespread and early definitions of Living Labs in this European sense describes them as experimental platforms that function as ecosystems where the user is studied in his or her everyday habitat and subjected to a combination of research methodologies while they test new technologies that are still in development (Niitamo et al., 2006). A major divergence of the 'European' Living Labs from the American Living Labs is that the user is now studied in his or her everyday habitat instead of recreating a natural context in a laboratory setting. In terms of methodological set-up, this implied bringing the testing facilities to the users instead of the other way round. In order to establish and differentiate this young discipline from other practices and disciplines, the first studies comparing Living Labs and studying the differences and similarities with other innovation approaches started to appear quite soon after the official birth of the European Living Labs movement through the establishment of the European Network of Living Labs in 2006 (cf. infra).

5.5.1 Early conceptualizations and studies

The most cited work positioning Living Labs amongst other Test and Experimentation Platforms (TEPs) remains a multiple case study analysis by Ballon et al. (2007). The authors identified six TEPs (Prototyping, Field Trials, Testbeds, Societal Pilots, Market Pilots and Living Labs) which they found differing on three relevant dimensions: technological readiness (low to high maturity), research focus (testing versus design) and openness (in-house activities to open platforms). According to Ballon et al. (2007), for Living Labs the commercial maturity of the innovation in development is lower than is the case within societal and market pilots. The focus is more on the design of the innovation and less on the testing compared to Field Trials and Testbeds. One major conclusion stated that Living Labs have a unique role between early prototypes and fully developed products. Living Labs are eventually defined as 'an experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered 'co-producers' (Ballon et al., 2007).

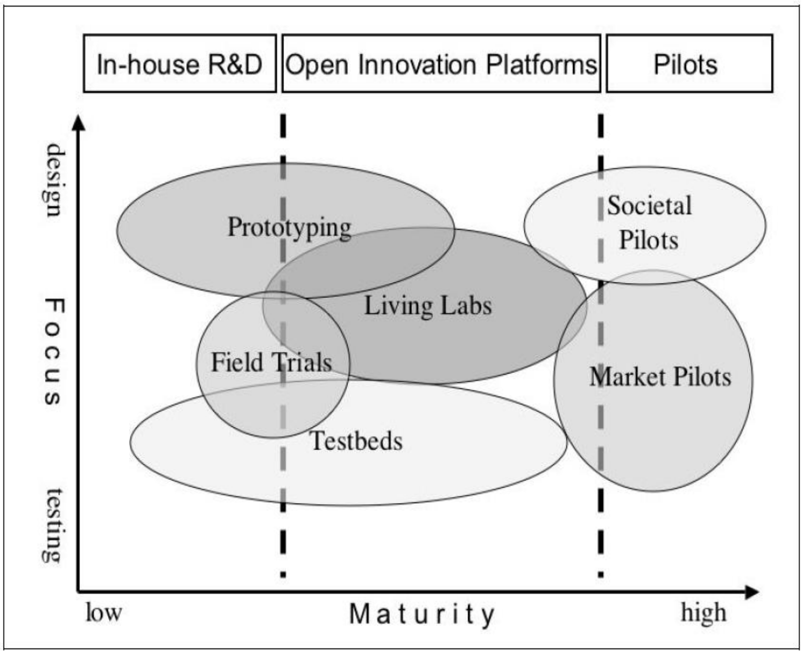

Figure 9: Classification of TEPs (Ballon et al., 2007)

However, as can be witnessed from the well-known figure depicting the different TEPs for the three given dimensions, there is quite some overlap between these six TEPs. This suggests that the boundaries between these different approaches are in practice often fuzzy and that a lot of elements within these approaches are quite similar. Moreover, there is also no reference to any of the broader innovation theories or paradigms, which adds to the idea of Living Labs as a practice-based concept, rather than a theory-driven concept. This also illustrates our proposition that Living Labs are more a practice-oriented than a theory-driven concept, something which is confirmed by Katzy et al. (2012).

A second main attempt to identify shared characteristics and communalities among the blossoming Living Labs movement can be found in Følstad (2008a). As the young field was flooded with case studies describing Living Lab-approaches, mostly in conference proceedings or special issues of academic journals (see also the next chapter), he conducted a wide literature review of ICT Living Labs and abstracted the main elements from the cases studied. He eventually identified nine distinct Living Lab-characteristics. The first five are characterizing purposes that deal with the Living Lab contributions to the innovation development process: 1. Investigate the usage context, 2. Discovery of unexpected usage and new service opportunities, 3. Co-creation with the users, 4. Evaluation or validation of new ICT solutions by users and 5. Technical testing of the innovation. Two characterizing purposes have to do with the Living Lab-context: 6. Familiar usage context and 7. Real-world context. The final two elements consist of characteristics of Living Lab-studies: 8. Medium- or long-term research and 9. Large scale research.

Next to the distinction between three high-level issues, he differentiated between common purposes and diverging perspectives. While common purposes were found to be relevant for more than ⅔ of the reviewed literature, the latter criteria were only relevant for less than ⅔, but more than ⅓, of all papers.

Table 16: Living Lab characteristics of Følstad (2008a)

High-level issues	***Identified characterizing purposes***	***Purpose***
Living Lab contributions	Context research	Diverging
	Discovery	Common
	Co-creation	Diverging
	Evaluation	Common
	Technical testing	Diverging
Living Lab context	Familiar context	Common
	Real-world context	Diverging
Characteristics of Living Lab studies	Medium- or long-term	Common
	Large scale	Diverging

To begin with, the criterion *Context research* refers to the extent to which the Living Lab enables the participating parties to investigate the usage context. Only a few Living Labs were found to facilitate context research and those who did were usually applying ethnography as their main research method. The second characteristic, *Discovery*, describes the provision of insights into unexpected ICT usages and opportunities for new service development. Next, even though *Co-creation* is considered as one of the crucial aspects of Living Labs, it was not found to be a main characterizing element of all investigated Living Labs. Still, a human-centric involvement and a collaborative method of operation represent one of the nine LL criteria. Co-creation is directly linked to the next characteristic, namely *Evaluation*. It was found to be existent in all Living Labs, with only different types of feedback methods as well as different extents of comprehensiveness. While some Living Labs settled for the mere collection of user feedback in the early stages of the design phase, others focused more on the inclusion of evaluation during later stages of the development process. In-between, so-called formative evaluation was applied, in the course of which collected feedback was passed back to the development process. The next criterion is *Technical testing* and an important aspect to focus upon, as Living Labs and testbeds are often intertwined (cf. supra). Another characteristic deals with the *Familiar context* of the LL. It refers to the extent to which users are enabled to work with the innovations in an environment, which is familiar to them. Also, the extent to which the LL takes place in a *Real-world context* (as opposed to simulations) forms a characterizing purpose of Living

Labs. Finally, the last two criteria refer to the duration of the LL studies, i.e. *Medium – or long-term*, and their scale, i.e. *Large scale*.

Notice that these elements show a lot of resemblance with the three European predecessors we discussed earlier in this chapter. *Investigate the usage context* is an element the was put forward by the cooperative design movement, and that also played an important role in the social experiments. This element is also central to the American Living Labs, with the difference that the context is recreated in a laboratory setting. The *discovery of unexpected usage and new service opportunities* is mostly linked to the social experiments, as these were intended to unveil the unanticipated uses and implications of ICT implementation. *Co-creation with the users* was initiated by the cooperative design movement, as users were put on equal footing of designers. In the social experiments, more diverging degrees of user involvement were present. *Evaluation or validation of new ICT solutions by users* is an example of one of the perspectives towards user involvement in the social experiments, and also was a part of cooperative design and of research projects in the American Living Labs. *Technical testing of the innovation* is mostly linked to the technologically driven ICT inititatives in the 'digital cities', although some of the social experiments were also quite technologically driven. The technical infrastructures with sensor networks and other equipment also facilitated this kind of technical testing, albeit in a more closed setting. The *familiar* versus *real-world* context can be seen as the main divergence between cooperative design and social experiments on the one hand, and American Living Labs on the other. The former were carried out in the real-world context, whereas the latter relied on an artificial context that was as familiar as possible for the users. For the digital city-initiatives, this distinction is less clear, as digital facilities were sometimes rolled out at the homes of the citizens, whereas in other instances this happened at dedicated spaces. Sometimes these digital assets consisted of virtual spaces, which makes the distinction between real-world and familiar even superfluous. *Medium- to long-term* is an indication of a project-like structure, which adheres to the cooperative design projects and with the ICT implementations in the social experiments. Observation and data collection in American Living Labs were also carried out over a longer period of time. The *large scale* element is more in line with the social experiments and with the digital city initiatives, as both the cooperative design and American Living Lab projects tended to be smaller in scale.

From Følstad (2008a) we gathered that four purposes were found to be common for the studied Living Lab-approaches: *discovery*, *evaluation*, *familiar context* and *medium- or long-term*. The other characteristics were regarded as diverging perspectives on Living Labs. The fact that more than half of the nine elements are not present in the majority of the analysed cases is a further proof of the fuzziness and overlap with other innovation methodologies, and shows that this was already apparent in 2008. It also is an indication that a lot of the Living

Labs are still closely related to specific predecessors, as these also differed with regards to these characteristics.

Moreover, referring back to our chapters on Open and User Innovation, these characteristics are for the most part a reflection of elements relating to the User Innovation paradigm. With the exception of *technical testing*, all other purposes related to the Living Lab contribution to the innovation development refer to user involvement or user contribution. Only the *co-creation* element was also present in the Open Innovation literature, where Enkel et al. (2009) equalled this to the 'coupled process', or the collaborative contribution of two or more actors to innovation development, although in Følstad's (2008a) characteristics co-creation is explicitly linked to user involvement. The other four purposes are linked to methodological aspects and refer to Living Labs as a research approach with two specific characteristics: a *familiar context* and *medium- to long-term* (or rather explicitly not short-term). **In the early Living Labs movement, the emphasis is clearly on User Innovation characteristics, while the Open Innovation aspects are less central**.

Although Følstad only acknowledged the presence of the characteristics in the Living Labs literature without making some kind of segmentation, in another paper in the same special issue (Følstad, 2008b) he came up with two specific types of Living Labs based on the trends he observed in the early Living Lab field: Living Labs supporting context research and co-creation and Living Labs as extensions to testbeds. Both can be traced back to previous European initiatives. The testbed-like type of Living Labs can be found in the work of e.g. Ponce de Leon et al. (2006) and Zhong et al. (2006). They use the term to describe testbeds (controlled network environments for test and validation) for ICT services. This type of Living Labs builds further on the 'smart cities'-concept and its relatives and predecessors, such as digital cities (cf. supra). He noted that these Living Labs were often linked to a geographical region, involving increasingly larger user groups, with the Arabianranta region in Helsinki as a notable example that originated from a digital city initiative, Helsinki Virtual Village, and evolved into a large scale territorial Living Lab (Kangasoja, 2007).

The characteristics of the Living Labs supporting context research and co-creation include collection of information on the usage context with sometimes ethnographic approaches to enable data collection in combination with co-creation of new ICT-services (Pierson & Lievens, 2005). These Living Labs can focus on the early development phases of needs analysis and (iterative) design, where, based on an identified problem, a solution is developed in close interaction with end-users (Thiesen Winthereik et al., 2009). This type of Living Labs is still firmly rooted within the User-centered design (UCD) paradigm, which originated from the Scandinavian cooperative design tradition (cf. surpa). An example of this kind of Living Labs is the Sølund Living Lab that deals with universal access in senior design and includes a nursing home (Thiesen Winthereik et al., 2009). However, other Living Labs of this type focus less on user-centered design and are more evaluative in nature, with a focus on the iterative finetuning of innovative products or services, tapping into the innovative capacity of test-users (Ståhlbröst & Bergvall-Kåreborn, 2008). Følstad (2008b) explicitly situates these two 'European' types next to the original American Living Labs, such as the Georgia Tech Broadband Institute's Residential Laboratory (Abowd et al., 2002) and the MIT Placelab (Intille et al., 2008) who both deal with ubiquitous computing.

However, around the time Følstad (2008 a&b) published these works, another type of Living Lab started to emerge in the literature and in practice. This fourth type is more focused towards multi-stakeholder collaboration and knowledge sharing, with less emphasis on developing and testing of new technologies or on deep end-user involvement. An early example is the European project C@R which involved several rural Living Lab pilots in order to develop certain sectors (e.g. farming, fishery,…) and look for innovative solutions (Schaffers & Kulkki, 2007). This kind of interpretation of the Living Lab-concept occurred in parallel with the expansion of the ENoLL beyond the European borders and can be labeled as Living Labs for collaboration and social development which emerged especially in developing regions and countries. Buitendag et al. (2012) define collaboration and knowledge support activities as cardinal to a successful Living Lab of this type. Coetzee et al. (2012) point out to this difference between examples of this type of Living Labs in South Africa and the 'European Living Labs'. A main distinguishing element is the emphasis on collaboration with communities, specifically rural communities, in contrast to European Living Labs' co-creation with 'users' who are mostly located in urban areas. Whereas European Living Labs operate more on a project-basis, these Living Labs are predominantly long-term and involve prolonged engagement with communities.

In the table below we summarize the four different interpretations of the Living Labs-concept that emerged from early Living Labs practice.

Table 17: Theoretical Living Labs segmentation

Original 'American' Living Labs	*Living Labs as extension to testbeds*	*Living Labs supporting context research and co-creation*	*Living Labs for collaboration and knowledge support activities*
Abowd et al. (2002), Intille et al. (2008)	Ponce de Leon et al. (2006), Zhong et al. (2006)	Thiesen Winthereik et al. (2009), Ståhlbröst & Bergvall-Kåreborn (2008)	Schaffers et al. (2007), Coetzee et al. (2012), Buitendag et al. (2012),
Laboratory made to resemble the real-world, aimed at data capturing	Test environments within which users and stakeholders can collaborate in the creation and validation of ICT services	Environments aimed to support innovation processes focusing on the early development phases of needs analysis and early design	Multi-stakeholder collaboration, focus on collaborative platforms, knowledge sharing and community development

From these early attempts at conceptualizing the European notion of Living Labs, we gather that this notion clearly differs from the American Living Labs, as Living Labs are clearly perceived as a research and innovation **approach**, more than as a (technical) research **infrastructure**. However, the 'in-situ research experimentation and observation' from the 'accidental appearances' of the word Living Lab has remained a constant. Moreover, the American Living Labs are still considered as part of the Living Labs movement, and a fourth type of Living Labs also emerged, focusing more on multi-stakeholder collaboration and problem solving, with less emphasis on the user.

Følstad played a major role in the early conceptualization of Living Labs, but failed to make a connection between the diverging Living Lab perspectives from his bottom-up analysis of Living Labs practice (Følstad, 2008a) and a segmentation of types of Living Labs, for which he provided a first indication in another paper (Følstad, 2008b), and which we extended towards a fourfold classification. Further on in this chapter (section 5.9), we will explore the active ICT Living Labs and assess whether these four Living Lab archetypes are still up-to-date. We will do this by means of the Følstad (2008a) characteristics, as we argued that these characteristics are a good reflection of the Living Lab predecessors and enables to distinguish between the four Living Lab types. First, we look into the European Network of Living Labs, as this organization played a major role in the development of the European Living Labs movement, and after this section, we will also look into the current activity level of the ENoLL Living Labs.

5.5.2 The big bang of European Living Labs: the birth ENoLL

When discussing the emergence of the current Living Labs-movement, we have to dedicate attention to the European Network of Living Labs (ENoLL), headquartered in Brussels, which played an important catalyzing role. The ENoLL is a community of Living Labs that was born in November 2006 under the guidance of the Finnish European Presidency and was intended to give rise to "a paradigm shift for jobs, growth and competitiveness" (Prime Minister's Office, 2006a). Within the so-called Helsinki Manifesto (2006) ENoLL was described as a platform for knowledge sharing and collaboration to foster common methodologies and tools across Europe that support, stimulate and accelerate co-creative innovation processes, relying on users involvement. The overall aim of the network is to support the creation of a dynamic innovation system throughout Europe. Therefore, the EU Commission allocated 40 Million of Euros, in order to promote the development of the ENoLL (Prime Minister's Office, 2006b). Essentially, the ENoLL tries to foster "co-creative, human-centric and user-driven research, development and innovation in order to better cater for people's needs."[28] The start-up of ENoLL was part of the 6th and 7th Frameworks, overseen by the Directorate-General Information Society and Media and the Directorate-General for Research. Therefore, the European commission was and still is a central actor in the network.

The following services are offered to its members: the use of the official ENoLL label with publication on the website, the use of the official network contact point in Brussels for all inquiries, communication and promotion services, project development services to initiate and apply for participation in collaborative projects, brokering services between other Living Labs or other interesting parties, policy and governance services, and learning and educational services through ENoLL workshops and conferences. Note that most services deal with networking between Living Labs in order to exchange experiences and to facilitate the start-up of new projects. In the light of our historical overview of predecessors, the ENoLL is the kind of network that was advocated for in the 1980s by the people involved in the social experiments. The network has taken the legal entity of an association and adopts an open structure, with a core of fee-paying members and partners supplemented by more informal networks of policy-makers and individual users. The association consists of effective members, adherent members and associated members. Effective members (currently 19) are legal entities that represent a Living Lab, that have passed the selection process and that pay the annual membership fee. Associated members are organizations involved in the activities of the association that pay the annual membership but that have not passed the selection process. Adherent members are organizations that represent a Living Lab, that that have passed the selection process, but that do not pay the annual membership fee and thus have no voting rights. The association is managed by a Council appointed by the General Assembly. Only the effective members can vote at the General Assembly, while each type of member can take part and be a candidate of the Council with certain restrictions. The General Assembly has all powers allowing the realization of the objectives as well as of the activities of the association. All members, effective, associated and adherent are invited to attend the Assembly. Over the past few years, the network has constantly grown in so-called waves, with up to now seven waves taking place and a total of 345 Living Labs being accepted[29]. Originally, the ENoLL consisted only of European Living Labs that were admitted to the network after a benchmarking exercise, but nowadays, next to a variety of European countries (such as Belgium, Finland, Germany, Italy, Spain and UK) other countries, as Brazil, Canada, the United States and Australia are also involved in the network. Through this international context, the ENoLL facilitates the testing of products and services in different countries with their own cultural environments.

[28] http://openlivinglabs.eu/
[29] http://openlivinglabs.eu/

In the context of innovation, this yields additional opportunities as previous research has proven that cultural differences often influence the take-off or acceptance of innovations (Steenkamp et al., 1999). Følstad (2008a) makes the observation that the opportunity to conduct real-world validation studies of testbed applications seems to be an important motivation for many of the Living Labs belonging to ENoLL, something which is also apparent in the work of Ballon et al. (2007). However, this cross-border validation of innovation is still a work in progress within the ENoLL. Within the Apollon EU project[30] some preliminary successes were reported with SMEs involved in cross-border Living Lab tests (Lievens et al., 2011), but during the 2014 ENoLL Living Lab Days, two separate workshops were held in order to come to a more sustainable offering of cross-border Living Lab services[31], as this remains non-existent outside the scope of European projects.

Moreover, exactly this very heterogeneous market in Europe with local differences in culture and consumer behavior, and the lack of cooperation between large resource intensive companies and small entrepreneurial companies, which holds the potential for synergies, have caused the so-called 'European Paradox' (Almirall & Wareham, 2011) we have described earlier, meaning that Europe is strong in terms of knowledge (e.g. patents), but underperforms when it comes to transforming this knowledge into market success (profit and innovations). Explained in concepts from the Open Innovation literature, Europe scores high in terms of exploration, but fails to translate this to actual exploitation. In a recent publication, the European Commission (2013b) noted that there is a low amount of interaction between companies, and a common physical or virtual place to meet innovation partners is lacking. Especially small companies face barriers to innovate, as compared to e.g. the US, business angels and venture capitalism are less prevalent in Europe, concerns about intellectual property (IP) protection remain, and a common culture and identity that could counterbalance these barriers is not in place (European Commission, 2013b). This holds somewhat of a paradox. Because of the 'European Paradox', the European Commission has put forwards the need for innovation networks that overcome the mentioned barriers to innovation for European companies and that create a bridge between knowledge and market, and see Living Labs as such innovation networks (European Commission, 2013b). However, as Europe already started supporting Living Labs in 2006, currently more than 300 Living Labs exist, mainly in Europe but also worldwide (European Commission, 2013b). Previous research has indicated that this has also led to a large variety of initiatives carrying the Living Labs-label in order to get European funding and applying to become a member of ENoLL (Lepik & Varblane, 2010). Remember that the funding for Living Lab-initiatives and for ENoLL were intended to solve the European Paradox. However, after almost eight years, this European Paradox still exists, despite the 345 benchmarked Living Labs, as we already noted

[30] http://www.apollon-pilot.eu/
[31] http://openlivinglabdays14.com/ws6-open-innovation-for-smes/

that during 2012, both the EU and the US showed a similar growth in R&D investments, but the US economy reached twice as much growth in sales and more than three times as much growth in profit than companies in the EU (European Commission, 2013a), with these issues being even more apparent in the ICT sector (INSEAD eLab, 2013).

For Living Labs themselves, one of the main hurdles is the project-based character of the funding, which makes it difficult for them to be sustainable and fosters the need for new business models which enable more long-term initiatives (Guzman et al., 2008). Although Living Labs are seen as having the potential to overcome the issues and frustrations linked to project-based funding (Pitse-Boshomane et al., 2008), some Living Labs are explicitly short-term. Ståhlbröst (2012) names these initiatives ‘Living Lab as a project’ and defines them as Living Labs that exist during a project’s lifetime to support the innovation process in that project and that close when the project ends. This raises some issues with regards to the ENoLL and the Living Labs that are member of this network. First, the number of ENoLL Living Labs, currently 345, has always been increasing since ENoLL’s inception. Within the literature and sources of ENoLL there is no trace of this kind of ‘stopped’ or ‘dead’ Living Labs because the project in which they were conceived ended. Therefore, there is an urgent need to revise and review the number of Living Labs and to filter out ‘dead’ initiatives. Second, there is also a remarkable trend when we analyze the growth of ENoLL during the seven waves. If we plot the number of Living Labs entering ENoLL in each wave, we come to the following graphic:

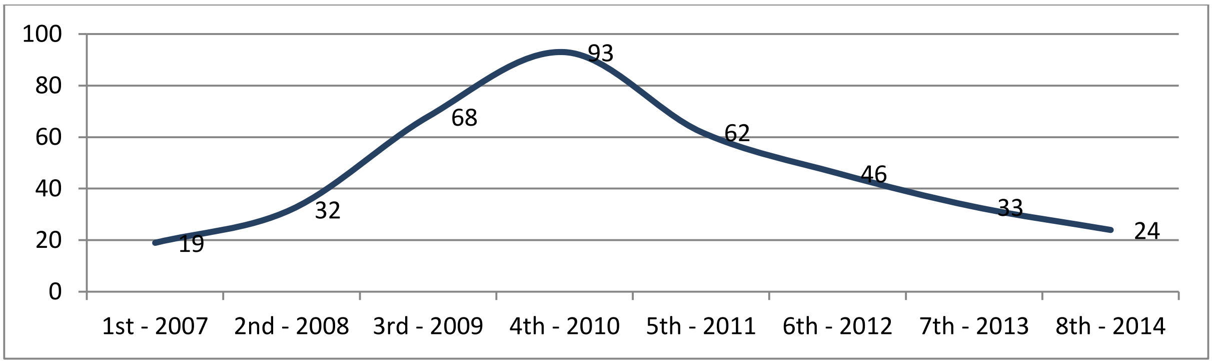

Figure 10: Evolution of ENoLL entrants

Note that the years mentioned represent the year when the proposal to enter the network was filed, the eventual accession to the network occurred during the following year. The first wave of Living Labs yielded the first 19 Living Labs, which formed the core of the network. Since then, every year a new wave was launched, calling for applications to initiatives to enter the network with an ENoLL team of voluntary reviewers assessing the applications. The second wave in 2008 resulted in 32 new Living Labs being added to the network, the third wave this number was more than doubled with 68 new Living Labs admitted and in 2010, an all-time high of 93 (out of 109 eligible applications) Living Labs joined ENoLL after passing the review process. However, from 2010 onwards, the number of new Living Labs started to drop. This can be partly explained by the fact that the admission criteria and the review process became more strict from 2010 (Garcia, 2014). Since then, three independent reviewers score each proposal on a set of criteria regarding necessary Living Lab characteristics (organization, openness, resources, users & reality, and value). From this year onwards, numbers of the submitted proposals are available. The fifth wave resulted in 62 Living Labs (out of 78 eligible proposals), the sixth wave in 2011 in 46 entries (out of 72 eligible proposals) and in 2012, only 25 new Living Labs (out of 33 proposals) entered the network. So next to the declining numbers of Living Labs entering the network, due to more strict evaluation, the total number of applications also went down.

An open question remaining is whether all the Living Labs from the previous waves are still active or not. As Ståhlbröst (2012) noticed that some Living Labs are only established to carry out a single innovation project, and there have not been any re-assessments of the existing Living Labs at the time of writing, we expect that the total number of active Living Labs is lower than stated. Regarding the evaluation process, for the eight wave, the following subelements were discerned for the five Living Lab characteristics[32]:

Table 18: ENoLL evaluation criteria

Organisation	1. Evidence of expertise gained from the LL operations
	2. Business-citizens-government partnership - strength & maturity
	3. Organization of LL governance, management & operations
	4. Interest and capacity to be active in EU innovation system
Openness	5. Level of own commitment to Open Innovation process
	6. IPR principles supporting capability and openness
	7. Openness towards new partners and investors
	8. Channels (web etc.) supporting public visibility and interaction
Resources	9. Availability of required technology and/or test beds
	10. Business model for LL sustainability
	11. International networking experience and capability
	12. People/positions dedicated to Ll management & operations
Users & Reality	13. Measures to involve users
	14. Reality of usage contexts, where the LL runs its operations
	15. User-centricity within the entire service process
	16. Quality of user-driven innovation methods and tools
Value	17. Evidence of co-created values from Res Dev and Innovation

[32] http://livinglabs.regione.puglia.it/documents/10180/13090/brochure_EnoLL.pdf/9e045060-d4ca-4271-bd37-8d381a4d7cf3

	18. Values/Services offered/provided to LL actors
	19. Full product lifecycle support - capability and maturity
	20. LL covers several entities within value-chain(s)

This evaluation is done by Living Lab experts from all around Europe with as a goal to ensure that Living Labs that enter the ENoLL are compliant according to the general concept of Living Labs (Molinari, 2011). The 20 subelements are assessed, but a certain threshold value is to be reached for the five characteristics. The evaluation is only done based on the documentation provided by the applying Living Labs, which make the evaluation mainly a "desk evaluation" that does not take into account the actual situation of the Living Lab.

In comparison with the characteristics of Følstad, we can discern elements from both the User Innovation (13, 14, 15 & 16) and Open Innovation (2, 4, 5, 7, 18, 19 & 20) literature among the five general characteristics and among the 20 subelements. This indicates a clear shift towards an Open Innovation and innovation network approach for Living Labs with less exclusive emphasis on the user aspect. The Public-Private-People partnership element is also present, as well as the reality of the usage context, although these are not decisive elements to be approved as a Living Lab. This is also not completely in line with the ENoLL's own Living Lab definition (cf. supra), where Co-Creation, Exploration, Experimentation, and Evaluation were regarded as main activities[33]. However, this also leaves the door open for initiatives of the fourth Living Lab type (with a focus on multi-stakeholder collaboration and knowledge exchange) and for American Living Labs. In order to explore this dual stance, in the remainder of this chapter, we will turn to the current pool of ENoLL-affiliated Living Labs in order to tackle the two problems we encountered within the current state-of-the-art of Living Labs practice. First, we will look into the current activity level of the ENoLL Living Labs, as a declining growth and issues with the sustainability suggest that a large part of the ENoLL affilitated Living Labs is currently inactive. Therefore, we start by performing a high-level analysis of the 345 ENoLL-affiliated Living Labs. By means of an exploratory content analysis of the Living Lab-pages on the ENoLL website, of dedicated websites and of other online sources, we assess the current level of activity of all these Living Labs.

Second, we will also explore the current diversity of the different ENoLL Living Labs. We will do this by coding the active ENoLL ICT Living Labs. We chose these thematic Living Labs as the ICT sector is regarded as crucial for the potential solving of the European Paradox (INSEAD eLab, 2013), and because the Living Labs and Living Labs projects from our in depth case study in chapter 7 also involve ICT related Living Lab activity. For this exploration, we chose to use the characteristics of Følstad as a framework because of the bottom-up character of these characteristics, and in order to be able to compare our results

[33] http://openlivinglabs.eu/

with the analysis of Følstad (2008a), and because we argued that these characteristics are a good reflection of the Living Lab predecessors and enables to distinguish between the four Living Lab types that were distinguished in the early Living Lab bottom-up conceptualizations.

5.6 ENoLL activity analysis

As a first empirical investigation into the large variety of Living Labs in the European Network, we have coded all Living Labs that have their own page on the official ENoLL website[34] for all Living Labs from waves 1 to 7. These pages can be accessed through a webpage[35] with a map locating all Living Labs and a table containing all Living Labs which link through to a dedicated page for each Living Lab, containing contact information, a summary of the Living Lab goals, organization and activities and links to the official ENoLL application documents. For our analysis, we have used the ENoLL table as the primary source for all Living Labs currently considered as ENoLL Living Labs. Subsequently, we visited all dedicated pages and used the links to the 'official' webpages of the Living Lab itself. The analysis was carried out in January and February 2014. The data was collected, coded and translated into a number of graphs and tables. First we checked whether the link to the dedicated site(s) still worked. If this was not the case, or when there was no link mentioned, we looked for an alternative link by using the name of the Living Lab as search term in Google.

When visiting the dedicated site of the Living Lab, we looked for traces of recent activity by checking whether there were projects or cases on the site, whether there were recent events planned and whether the site had been update recently. When the last update or sign of activity was situated before January 2013, we considered the Living Lab to be inactive. In case the active links referred to a general website of a university, company, city or organization, we looked for links referring to Living Lab activities and, where possible, used the website search function with "Living Lab" or the name of the specific Living Lab as search terms. We also used the same criterion, i.e. activity or updates from 2013. For some Living Labs from the last wave, established later than January 2013, no activity was mentioned on the website yet, but we decided to code these Living Labs as 'active'. It remains to be seen whether these initiatives succeed in developing sustainable activities, projects and cases in the future. While going through all the online material, we also made notes when encountering unexpected or notable cases.

For the Living Labs initially coded as inactive, we conducted a second data collection round in the first two weeks of March by sending an e-mail to all contact person, also mentioned on the Living Lab profile on the ENoLL website. In this e-mail we asked the representatives

[34] http://openlivinglabs.eu/
[35] http://openlivinglabs.eu/livinglabs

whether the Living Lab was still active, and in case the Living Lab was in fact inactive, what the reasons were for this inactivity.

A first finding is that there are only 333 Living Labs mentioned on the ENoLL-website, as opposed to the number of 345 Living Labs that is mentioned[36] or the 'over 340 accepted Living Labs' mentioned elsewhere on the ENoLL website[37]. From the 345 accredited Living Labs, 12 Living Labs seem to have 'vanished'. First, we found that one Living Lab was mentioned twice. Second, when going through the original Excel documents from waves 4 to 8, we discovered that in wave 4 only 82 Living Labs were admitted instead of 93, the number that is communicated in all official documentation (Garcia, 2014). Therefore, we propose to correct the number of total admitted Living Labs to ENoLL since its inception (up to wave 7) to 333.

When going deeper into the 333 Living Labs with their own page, it appears that this number is even more an exaggerated estimation of the actual Living Lab activity. From our first analysis, we conclude that only 192 (57.7%) show traces of recent activity. In other words, 42.3% of the 333 ENoLL Living Labs is inactive. What is even more striking, is that out of the 19 effective ENoLL members, which make up the board of ENoLL, two Living Labs are currently inactive (the Flemish Living Lab platform and HumanTech Living Lab).

For the second analysis, all Living Labs labeled as inactive with available contact details were sent an e-mail (N: 134, as for 7 inactive Living Labs no contact details were available). Out of these 134, 24 e-mail addresses appeared to be invalid, and 84 did not reply, despite sending two reminders. In total, we received 26 replies, with 17 Living Labs claiming to be active and 9 confirming the inactivity. **As a final result, we conclude that out of the 333 listed Living Labs on the ENoLL website, 124 appear to be inactive, which totals 37.2%.** Based on data on the website or information provided by e-mail, 17 of these inactive Living Labs were Living Lab projects, as indicated by Ståhlbröst (2012; cf. supra), although we believe this number will be definitely higher. Besides ended projects, lack of funding or lack of external projects coming to the Living Lab are the main reasons mentioned in the e-mails we received.

Within the sample of active Living Labs, we noticed that quite a lot of the Links on the Living Lab pages link to the websites of technology parks, business incubators and research institutes, offering services to entrepreneurs, start-ups and companies, and sometimes facilitating knowledge sharing, but without apparent end-user involvement and without the 'Living Lab' label being used[38]. It seems that some of the original Living Labs have evolved into other, more sustainable activities without bearing the Living Lab-name anymore. This is

[36] http://www.scribd.com/doc/165349533/7th-Wave-Member-List
[37] http://www.openlivinglabs.eu/aboutus
[38] E.g. the LEVER Living Lab from Thessaloniki: http://www.technopolis.gr/mainpage

for example apparent in some community-driven websites, where initiatives have led to user empowerment and user-driven initiatives[39]. These cases have been labeled as active Living Labs. It remains an open question whether these Living Labs would still pass the review process as it is today, but it shows that Living Lab constellations are able to evolve and find their own way to cope with the issue of sustainability. For the research institutes, the Living Lab activity is mostly connected to (European) projects that run for several years or the Living Lab-activity is centered around a research infrastructure similar to the American Living Labs. We used the same criteria for these Living Labs: when the projects were still running or the infrastructure was still used, the Living Labs were coded as active. The table below gives an overview of all 50 countries that have at least one Living Lab according to the ENoLL website. We have calculated the percentages for all countries within the total number of 333 Living Labs and did the same for the 209 active Living Labs. When taking into account only the active Living Labs, the number of countries involved in ENoLL drops to 42, a significant decrease of the international character.

Interestingly, the Scandinavian countries do not excel in terms of quantity, as was the case in the Living Lab predecessors (cf. supra). Spain (60) and France (51) clearly lead in terms of quantity, followed by Italy (28), the UK (18) and Portugal (17). Finland (16) is the first Scandinavian country in the list on the 6th place, followed by Germany (13), Brazil (12) and Sweden (10). Spain also appears to be the leader in terms of 'dead' Living Labs, as from the 60 Living Labs, only 37 were coded as being active. The Scandinavian countries win a few places because the difference between recorded Living Labs and active Living Labs is smaller, but the first four countries in terms of quantity remain France, Spain, Italy and the UK, with Finland now in fifth place with 11 active Living Labs.

Table 19: Living Lab activity and distribution per country

All Living Labs	N = 333		Active Living Labs	N = 209	
Spain	18.0%	60	**Spain**	17.7%	37
France	15.3%	51	**France**	17.2%	36
Italy	8.4%	28	**Italy**	8.6%	18
UK	5.4%	18	**UK**	5.7%	12
Portugal	5.1%	17	**Finland**	5.3%	11
Finland	4.8%	16	**Portugal**	4.8%	10
Germany	3.9%	13	**Germany**	4.3%	9
Brazil	3.6%	12	**Sweden**	3.8%	8
Sweden	3.0%	10	**Colombia**	3.3%	7
Colombia	2.7%	9	**Belgium**	2.4%	5
Belgium	2.4%	8	**Slovenia**	2.4%	5
Hungary	1.8%	6	**Canada**	1.9%	4

[39] E.g. the Digital Ardennes Living Lab: http://www.ardennestv.com/ardennes-tv.html

Slovenia	1.8%	6	**Brazil**	1.4%	3
Switzerland	1.8%	6	**Poland**	1.4%	3
Canada	1.5%	5	**Switzerland**	1.4%	3
Greece	1.5%	5	**Austria**	1.0%	2
Netherlands	1.5%	5	**Cyprus**	1.0%	2
China	1.2%	4	**Denmark**	1.0%	2
Mexico	1.2%	4	**Egypt**	1.0%	2
Norway	1.2%	4	**Hungary**	1.0%	2
Poland	1.2%	4	**Ireland**	1.0%	2
Austria	0.9%	3	**Mexico**	1.0%	2
Egypt	0.9%	3	**Netherlands**	1.0%	2
Taiwan	0.9%	3	**Norway**	1.0%	2
Bulgaria	0.6%	2	**Taiwan**	1.0%	2
Cyprus	0.6%	2	**Turkey**	1.0%	2
Denmark	0.6%	2	**Australia**	0.5%	1
Ireland	0.6%	2	**Bulgaria**	0.5%	1
Malta	0.6%	2	**China**	0.5%	1
South Africa	0.6%	2	**Croatia**	0.5%	1
Turkey	0.6%	2	**Czech Republic**	0.5%	1
Australia	0.3%	1	**Greece**	0.5%	1
Croatia	0.3%	1	**Japan**	0.5%	1
Czech Republic	0.3%	1	**Lebanon**	0.5%	1
Iceland	0.3%	1	**Luxembourg**	0.5%	1
Japan	0.3%	1	**Mozambique**	0.5%	1
Latvia	0.3%	1	**Paraguay**	0.5%	1
Lebanon	0.3%	1	**Republic of Cameroon**	0.5%	1
Luxembourg	0.3%	1	**Senegal**	0.5%	1
Mozambique	0.3%	1	**Serbia**	0.5%	1
Paraguay	0.3%	1	**South Africa**	0.5%	1
Peru	0.3%	1	**Tunisia**	0.5%	1
Republic of Cameroon	0.3%	1	**Iceland**	-	
Romania	0.3%	1	**Latvia**	-	
Saudi Arabia	0.3%	1	**Malta**	-	
Senegal	0.3%	1	**Peru**	-	
Serbia	0.3%	1	**Romania**	-	
Trinidad and Tobago	0.3%	1	**Saudi Arabia**	-	
Tunisia	0.3%	1	**Trinidad and Tobago**	-	
USA	0.3%	1	**USA**	-	

Summarizing, our analysis has showed that the stated number of 345 ENoLL Living Labs is a large exaggeration, as we found out that only 209 Living Labs can be labeled as being active. First, for some reason the official number of admitted Living Labs for wave four is only 82 instead of 93, as became apparent when looking at the original evaluation documents. Moreover, the international character of ENoLL is also less prominent if we take into account the activity level. From the responses of inactive Living Labs, and from the finding that a lot of the initial Living Labs are no longer active, we gather that the sustainability of Living Labs seems to be a major issue. The fact that a lot of Living Labs are born out of a EU-project funding can be seen as a major cause. As appeared when looking at the number of Living Labs entering the network since 2006, we have also witnessed a decline in the number of applications as well as accepted Living Labs since 2010. Therefore, we would argue for more follow-up of the activity level of the ENoLL Living Labs, in order to have a better overview of the actual Living Labs activity, and also more focus on the sustainability of Living Labs.

However, **this empirical review of the activity level of ENoLL Living Labs only gave a general indication of the current Living Lab activity**. In order to get a more in-depth insight into the actual practice and into the variety of approaches being implemented, we conducted a more content-based analysis on the active ENoLL ICT Living Labs, in an attempt to validate the four types of Living Labs we gathered form the early conceptualization efforts: American Living Labs, Living Labs as extension to testbeds, Living Labs supporting context research and co-creation, and Living Labs for collaboration and knowledge support activities.

5.7 A Segmentation of ICT Living Labs

In order to validate the fourfold typology we developed based on our literature review, and fill the gap Følstad (2008a) left with his overview of Living Labs characteristics, we conducted an empirical assessment of our literature based typology and Følstad's Living Lab characteristics. The units of analysis are the active ICT Living Labs registered at the European Network of Living Labs, which was discussed in more detail in the previous sections. Cooperation with the network enabled us to access the non-public registration documents and facilitated contact with a key responsible at each Living Lab, resulting in a unique data set. The data collection took place in two steps. The first step - "Living Lab Characteristics" - encompassed a quantitative assessment of Living Labs, based on the nine characteristics established in Følstad's (2008a) review (cf. supra). Two coders reviewed the publicly available material and the internal registration documents, and independently assessed the characteristics of all 64 Living Labs on scale from 1 (low) to 4 (high). The coding scheme can be found in annex. The second step augmented the data from the first step with interviews with key informants at the Living Labs in order to resolve unclarities in terms of the coding. The analysis of the data followed two steps which paralleled the data collection. Step 1 ("Living Labs characteristics") encompassed the assessment of 64 Living Labs. The coding of the experts showed high reliability (Krippendorff α >.8), except for co-creation and technical testing (α >.6). Disagreements were re-examined and dissolved. To uncover higher-order characteristics among the nine Living Labs characteristics, and cluster the Living Labs, we conducted K-means clustering with an ordinal scaling level in IBM SPSS Statistics 21 for a four cluster solution, similar to our fourfold typology. In order to elaborate upon the data, the interviews were used as a means to clarify and add to the understanding.

5.7.1 Results

The table below gives the results of the K-means clustering. For the description we use the cluster means of the original nine characteristics. Within Cluster 1, the highest means for all user contribution items can be found. The same goes for familiarity and real-world context, but the size and duration are relatively small. This implies intense user involvement and co-creation with a small set of users for a shorter period of time. In contrast, cluster 2 consists of Living Labs with the lowest user contribution and lowest degree of realism in terms of familiarity and real-world context. Size and duration are however significantly higher. Cluster 3 shows the second highest means for user contribution and for familiar and real-world context. This cluster has the highest values for duration and size, indicating a long-term involvement of a large group of users. Cluster 4 consists of Living Labs in laboratory conditions that however resemble familiar usage contexts with a rather low user contribution.

User samples are rather small, but the duration of the Living Labs has the second highest value of all four clusters.

Table 20: Characteristics and Descriptions of Living Lab Clusters

K-Means Clustering Dimensions	**Følstad Living Lab Characteristics**	**Cluster 1:** ***Small scale & real-world user co-creation***	**Cluster 2:** ***Long term knowledge sharing & collaboration***	**Cluster 3:** ***Large scale & long term with moderate user involvement***	**Cluster 4:** ***Long term user studies in lab context on a small scale***
User Contribution	Unexpected use	2.79	1.71	2.05	1.88
	User co-creation	3.37	1.86	2.52	1.94
	User validation	3.53	1.86	2.48	2.12
Contextual Reality	Familiar context	3.58	1.71	3.38	2.59
	Real-world context	3.21	1.14	2.62	1.88
	Large user sample	1.28	2.17	3.71	1.88
	Use context	2.95	2.71	2.00	1.41
	Technical testing	3.21	1.86	1.95	2.88
	Long-term duration	3.11	3.50	3.95	3.81
	Sample N = 64	*19*	*7*	*21*	*17*

In the light of the fourfold typology we gathered from the early Living Lab conceptualizations, we can elaborate upon the discovered clusters. Cluster 1 clearly resembles the 'European' notion of Living Labs with a focus on co-creation of products and services with users based on real-world experiences. Testing is also an important aspect amongst these Living Labs. This observation, together with the small scale and the shorter duration point to Living Labs that are more project-based. With 19 out of the 64 Living Labs being classified in this cluster, this is the second biggest population within our sample. As an example we can mention the **LeYLab** Living Lab[40] where a small sample of homes (around 100) were equipped with a fibre-to-the-home infrastructure and some of them with testing devices such as tablets or media PCs connected to their TVs. This Living Lab is also one of the Flemish ICT Living Labs which we will study in chapter 7. Some Living Lab cases were initiated during the running time of the project (2 years) where small groups of test-users co-created and validated innovative applications on the Living Lab-infrastructure. Cluster 2 clearly stands out from the other three. With only seven Living Labs, it is by far the smallest. With the low user involvement and the low emphasis on testing, this cluster resembles the Living Labs for collaboration and knowledge sharing. An example of this type of Living Lab

[40] http://www.leylab.be

is **Siyakhula Living Lab** in South-Africa, a collaborative project aimed at enhancing and developing rural areas by providing them with ICT-infrastructure[41]. Within cluster 3, the largest cluster in our sample, we can discover some of the elements from the testbed-like Living Labs from our typology. User involvement is moderate, but runs over a long time period and with the largest user sample in comparison to the other clusters. Through a technological testbed-like infrastructure, a large user sample can be involved in co-creation and testing of ICT-services. An example for this third type is **Botnia Living Lab**[42] where more than 6.000 (potential) test users are available to try out innovative applications and services. Already more than 100 projects have taken place. The final cluster, consisting of 17 Living Labs, is very similar to the American Living Labs from our typology. In a laboratory context with some familiarity in term of usage context, user behaviour is observed and recorded, with less focus on co-creation. As an example, we can mention the **SMEDL Living Lab** which we discussed earlier on. This Living Lab, aimed at exploring and developing innovative home entertainment technologies, includes a stationary controlled testbed designed like a living room where all activity is logged and recorded (Hess & Ogonowski, 2010), but also a panel of connected households and a community platform (cf. supra). Because of the heavy infrastructural component, these American Living Labs are mostly active for a longer time period, but only allowing smaller user samples to be involved.

We can conclude that our empirical assessment of the 64 active ICT-Living Labs from the ENoLL-community more or less confirmed the four types of Living Labs we discovered earlier in this chapter. These four types are: American Living Labs, testbed-like Living Labs, Living Labs focused on intense user co-creation and Living Labs mainly as facilitators for multi-stakeholder collaboration and knowledge sharing.

Reflecting back to the Living Lab predecessors, the original American Living Lab still exist, also in a European context. In our sample, this is even still one of the three largest groups. This type of Living Lab is very suitable for user-centered design purposes, although actual co-creation remains rather low. The small-scale and real-world user co-creation Living Labs can be seen as an extension of the domestication/mutual shaping literature and of the participatory design-predecessors. The focus is in real-life user involvement, aimed at innovation according to design principles. The large-scale and long-term Living Labs with moderate user involvement can be considered as the extensions to testbeds from e.g. the digital city-projects. The Living Labs for knowledge sharing and collaboration, who were not mentioned by Følstad (2008b), also still exist, but appear to be a minority. A link with the predecessors of Living Labs might be their relation to the social experiments with a policy oriented goal. This type of Living Lab is more focused towards solving more profound or 'wicked' problems, and therefore gathers relevant actors and stakeholders from the domain.

[41] http://siyakhulall.org/

[42] http://www.testplats.com

The focus is less on concrete innovation projects, but on a long term collaboration aimed at solving certain issues and reaching policy goals.

5.8 Conclusion

At the beginning of the chapter, we identified an apparent gap in the Living Labs literature. A lot of studies have been devoted to the broad usage and interpretation of the concept, but there is no material yet investigating the antecedents and roots of Living Labs. Therefore, we first dedicated more attention to the historical evolution. After some early wordplays in (scientific) literature, the concept of Living Labs got a more concrete interpretation at MIT as a research facility aimed at capturing contextual user feedback and data in a real-life like setting, but retaining control by placing the research in a laboratory setting. In Europe, this notion of Living Labs got translated and embedded within previous experiences and initiatives regarding innovation and ICT implementation.

First, cooperative design, as was implemented in the Scandinavian projects in the 1970s and 1980s, steered away from the idea that user involvement is restricted to observing users, as the users participated on equal footing with designers and researchers during the development and concrete implementation of information technology (IT) artifacts. This initial vision had a strong political and socio-deterministic nature, something which was weakened in the translation towards participatory design. Another important element is the real-life context that has an influence in the design process. This is further highlighted in the user-centered design tradition, which evolved out of both cooperative and participatory design, with methods such as contextual inquiry. The iterative nature of the development process is also present in all three approaches. It is interesting to note that there is also a different interpretation and approach of participatory design in Scandinavia and in the US, similar to the difference in American and European Living Labs, albeit that the Scandinavian approach preceded the American translation. The American take on participatory design also focused on including different stakeholders in the design process. The Scandinavian cooperative design projects of the 1970s had two important aspects in them related to Living Labs: the user-centered aspect and the real-life context. Moreover, this also led to the establishment the Participatory Design approach and the User Centered Design tradition, which are still often used within Living Labs (cf. the next chapter).

The social experiments in Europe during the 1980s carry already quite some elements and characteristics from the European Living Labs. First, similar to the Scandinavian experiences with cooperative design in the 1970s, the social experiments were a European phenomenon. Second, the appeal of social experiments, together with the European policy and funding support, resulted in a wild growth of initiatives being awarded the label without much consideration. In the 1980s, some attempts were made to bridge this gap by organizing conferences on social experiments to facilitate exchanging experiences and best practices.

This plea for cooperation can be seen as an early echo of the eventual European Network of Living Labs, which was founded only in 2006, 20 years later. The social experiments also emphasized the multi-stakeholder aspect, as there was a large variety of different actors involved: national and local public institutions, national and local private organizations, and end-users. The role of the end-user was also considered in these initiatives, but there was no conclusive stance towards the nature of this role: users could function as mere testers or respondents, but could also be involved on equal footing (co-creators) or as innovators themselves. The degrees of freedom and the differences between the various approaches are put forward as inherent in the concept. There is also a broad diversity in terms of themes and application domains, and attempts were made to structure and define the field, something which shows a lot of parallels with the current Living Lab-context.

The digital city-initiatives are, more than the previous two predecessors, explicitly multi-stakeholder as they connect citizens (users), policy makers (public organizations) and private organizations (businesses). Thematically these initiatives also cover a broad range, albeit with a link to city life. In terms of user involvement, the user is seen as potentially innovative, with the technical infrastructure as a trigger for this creativity. However, the conclusion at the start of the 2000s was that this creative potential had not been attained yet. In the context of Living Labs, the infrastructural component of the digital city-initiatives could serve perfectly as a testbed infrastructure. Like smart cities evolved from digital cities utilizing their infrastructure to connect stakeholders and allow collaboration, a lot of Living Labs evolved from the technology driven testbeds and from the previous European experiences with cooperative design in the 1970s and from the social experiments with IT in the 1980s. We also see the growing importance of user involvement from virtually non-existing in digital cities to an active collaborator in smart cities. The ambiguity of the digital city-concept is very similar to the ambiguity of the social experiments and of Living Labs. What seems to unite these approaches, is a stronger will for action than for thought and conceptualization. This focus on action makes it even more important and relevant to conduct more in-depth research, based on previous experiences, and to focus on conceptual clarity.

Out of the overview of the three predecessors of the current Living Labs movement, we gathered that the cooperative design movement formed the basis for the currently still very active User Centered Design research stream. The social experiments seem to have vanished in their original form and can be regarded as the true ‘grandparents’ of the current Living Labs movement. In terms of literature, there are hardly any traces left, despite perhaps the literature on Triple and Quadruple Helix models that deal with Public-Private partnerships (cf. supra, Arnkil et al., 2010; Etzkowitz & Leydesdorff, 2000). The digital city-concept can also be seen as a predecessor of the currently much hyped ‘smart city’-concept, but this term is currently also seeking its theoretical frameworks and foundations (Baccarne et al., 2014).

Finally, the European reaction on the technological deterministic diffusion of innovations perspective put the focus on the user as an important shaping actor. The contextual embedding of innovation is seen as a multi-facetted process, requiring long(er)-term research. Compared to the works of von Hippel, the focus shifted also on the post-innovation stage and on the complexity of technological innovations. Instead of a user-led versus company-led perspective, a mutual shaping stance was also suggested. These elements are still present in the current Living Labs movement, as becomes apparent in Almirall & Wareham's (2011) notion of the Living Lab as an 'innovation arena' where different meanings and interpretations clash over a longer period of time, enabling tacit knowledge to surface. However, some of the issues encountered in these previous experiences and initiatives are also still present, such as the diversity of initiatives. This can be considered as a form of wealth, but this also makes it harder to propose a clear image of what constitutes a Living Lab and what does not. Based on the experiences and learnings of these predecessors, **European Living Labs have given a re-interpretation of their American counterparts, emphasizing the active involvement of users, the real-life context and the multi-stakeholder approach**. Together with support from European policy, this has led to an explosion of various European initiatives. However, it remains a challenge to fully capture the value of this diversity of the different approaches. Moreover, **there are signals that the Living Lab hype has passed its initial peak of inflated expectations and that the label has been used for a (too) large variety of initiatives**, similar to the evolutions we witnessed with the social experiments. Based on a high level empirical analysis of all Living Labs mentioned on the ENoLL website, we discovered that at least close to **40% is inactive**. From the few answers we gathered from inactive Living Labs, a lack of funding or interest from participating actors were the main reasons for the ceased Living Lab activities. This lack of funding is mostly the result of the ending of a project, which shows that the **sustainability of Living Labs is a threat and weakness**, and that Living Labs need to become sustainable beyond the European project funding. We purposively used 'at least' as without a doubt there are even fewer active Living Labs carrying out Living Lab projects and research. Only from the 4th wave on, a rigid peer review process was installed in order to evaluate new proposals of potential members wanting to join the network. Living Labs part of the network before this wave have never been subjected to this kind of peer review, and once in the network, reviewed Living Labs are never subjected to any kind of review or assessment again. We believe that a better follow-up of its members would benefit ENoLL and would also increase the value of the ENoLL 'quality label'. At the same time, in order to avoid ENoLL becoming a small 'elitist' club of Living Labs, more possibilities should be available for initiatives not having passed the peer review yet or not adhering to the criteria. We also propose to tailor the evaluation criteria more towards Open and User Innovation characteristics, but also taking into account the different levels of analysis we will propose in the next chapter. Finally, we concluded this chapter with an empirical assessment of 64 active ICT-Living Labs from the

ENoLL-community. We did this in order to fill the gap that was left by the work of Følstad. He proposed nine Living Lab characteristics with some of them diverging between the different Living Labs, and suggested the occurrence of different types of Living Labs, but did not link the characteristics with the different types. Therefore, we first suggested four different types of Living Labs out of the literature, and subsequently performed a fourway segmentation of the 64 ICT Living Labs according to the nine characteristics. This resulted in a four cluster solution that more or less confirmed the previously identified **four types of Living Labs based on early research into Living Labs practice with still a strong link to the predecessors**: American Living Labs, larger testbed-like Living Labs, smaller Living Labs focused on intense user co-creation and the more recent Living Labs as facilitators for multi-stakeholder collaboration and knowledge sharing. **In terms of the User and Open Innovation frameworks, the first three types are mainly targeted at user involvement which would link them more to User Innovation, whereas the latter Living Lab can be linked more to Open Innovation, as this type is focused on collaboration and knowledge sharing between the Living Lab stakeholders**. This kind of Living Lab is also divergent from the other three Living Labs in terms of initial focus, as they tend to focus on the network and the effects of the network. The user, or rather a user community, is merely one of the stakeholders, whereas the other three emphasize user involvement as central tenet of the Living Lab. These three Living Labs differ mostly in terms of size, duration and usage context, which can be 'real-world' or in a lab made to resemble the real world. However, this typology does not offer a lot of explanatory value for the outcomes of the Living Labs, for the projects running in these Living Labs or for the methodologies that are used during these projects. This requires an analysis on multiple levels within the Living Lab constellations, and also more profound insights in the operations of the Living Lab.

Summarizing, we consider the following characteristics as essential and defining for Living Labs: **active user involvement, real-life experimentation, a multi-method approach, an innovation process based on co-creation, facilitated by a multi-stakeholder organization that can be described as a Public-Private-People partnership**. This definition differentiates Living Labs from other popular approaches and frameworks to innovation such as the Lean Start-up (no multi-stakeholder organization), User Centered Design (no real-life experimentation) or crowdsourcing (no multi-method approach). However, instead of comparing Living Labs to other approaches, we will look into the current Living Labs theoretical knowledge base and **propose a more detailed framework and model for describing and analyzing Living Labs that also allows to structure and relate the different elements and characteristics** that compose Living Labs, and look for links and anchor points with the key concepts and frameworks we gathered from the Open and User Innovation paradigms. We will also assess whether these key concepts and frameworks are already present in the current Living Labs literature.

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6. LIVING LABS AS A RESEARCH CONCEPT

In the previous chapter, we focused on Living Labs from a practice based perspective, as we illustrated they emerged rather from (European policy) practice and predecessors than out of theoretical paradigms or frameworks. This induced us to look into the current Living Labs practice within the European Network of Living Labs. The graph regarding the increase of ENoLL Living Labs showed a retrograde tendency in terms of applications and Living Labs being accredited, but our review of the activity of the current members also revealed that at least close to 40% is inactive or 'dead'. Moreover, a content analysis of the active ICT-related Living Labs indicated that certain Living Lab characteristics differed quite substantially between four Living Lab archetypes that emerged from Living Labs practice. Where some Living Labs seem to focus more on collaboration and knowledge exchange, others are focused on more large-scale technical testing, on small-scale, but intense user co-creation or on user observation in a laboratory setting, which shows that the current Living Labs are still firmly rooted in their predecessors which we also discussed in the previous chapter. This also draws parallels with the 'social experiments' of the 1980s that also experienced a sudden 'hype', with a wild growth of initiatives and the concept being used in a (too) diverse way, followed by a slow decline and a silent retreat of the concept. We concluded the previous chapter with the following main elements and characteristics we consider as essential in Living Labs: active user involvement, real-life experimentation, a multi-method approach, an innovation process based on co-creation, facilitated by a multi-stakeholder organization that can be described as a Public-Private-People partnership. However, the relation between these elements and an overarching framework are still missing. Therefore, within this chapter, we will look into the existence and evolution of Living Labs as a research concept, and construct a clarifying framework and model to describe and analyze Living Labs. This model should contain all the mentioned characteristics and also relate to the key concepts and frameworks we gathered form the Open and User Innovation literature. First, we construct a sample of the most cited Living Labs papers. This will allow to assess the depth as well as the breadth of the research field, and to give an overview of the nature of the publications that have been written and the research that has been carried out. Next, based on some inconsistencies we discovered in the Living Labs literature, we propose our own distinction in terms of levels of analysis. We continue by looking at the sample of papers in a threefold way. First, we look for the appearance of Open and User Innovation combined. Subsequently, we assess the presence and usage of the Open Innovation and User Innovation frameworks and concepts separately.

6.1 Methodology

In order to get an overview of the State-of-the-Art of academic and empirical research into Living Labs, we conducted an exploratory review of the available literature. Hereto we constructed a sample of the most cited Living Labs papers. We used the Google Scholar academic search engine[43] and looked for articles by using the search string "Living Lab" (end of October 2014). This yielded more than 6.500 results. Subsequently, we narrowed the number of articles down by only including articles where "Living Lab" was mentioned in the title in order to weed out the articles where "Living Lab" appeared 'accidentally' (cf. the previous chapter) or only occurred on a side note. This resulted in 563 articles. From this sample, we chose to include only journal or conference papers (excluding books, book chapters, blogposts, thesisses or other citations) with a direct link to the abstract and only articles with a citation count of more than 10. This led to a total sample of 45 articles (see attachments for the full list). In order to get an overview of the number of Living Labs papers in top ranked journal, we did a similar exercise in the Web of Science database, looking for all articles that had "Living Lab" in the title. This led to 50 articles in total. In the following table we give an overview of the total number of articles from our three searches, organized per year. In terms of time intervals, we used 2006 as a turning point, as this year marked the establishment of the European Network of Living Labs and more formal support for Living Labs from the European Commission. The papers published before 2006 were merged into one category, while we give an overview of the the rest of the sample per year.

Table 21: Sample overview per year (October, 2014)

Publication year	Articles in sample (Google Scholar + 10 citations)	Articles in total (Google scholar)	WoS articles
Until 2005	4	18	3
2006	3	9	0
2007	5	15	3
2008	7	52	3
2009	6	69	8
2010	9	74	8
2011	5	65	6
2012	4	95	7
2013	2	92	8
2014	0	74	4
Total	**45**	**563**	**50**

[43] http://scholar.google.be/

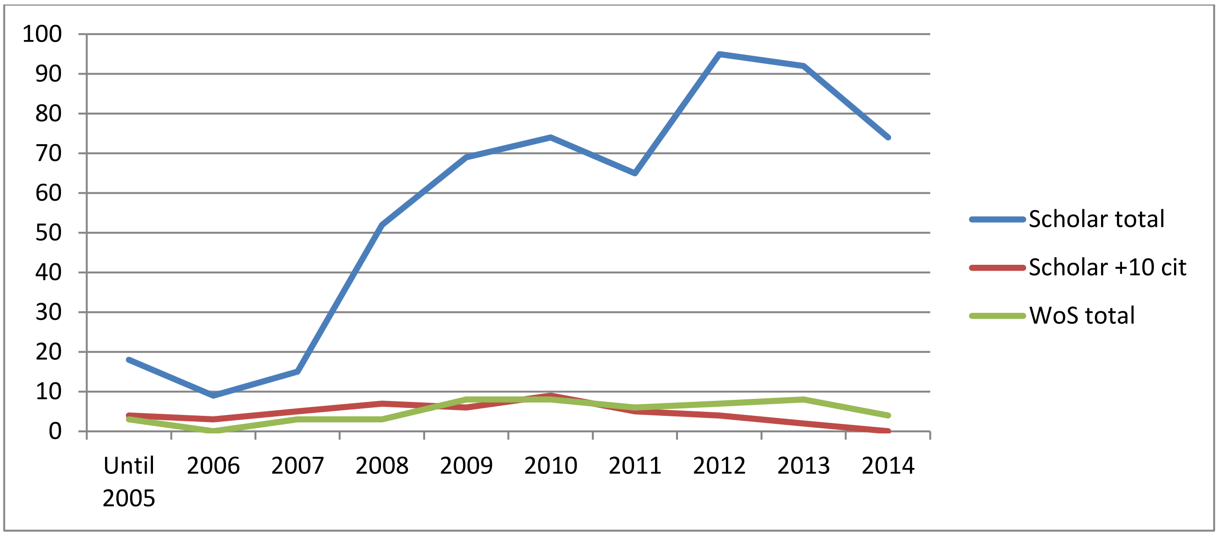

Figure 11: Living Labs papers evolution

In terms of the total articles, we see a clear 'explosion' of research after the establishment of ENoLL, somewhat similar to the growth of ENoLL itself in the first years. The years 2009-2011 seemed to mark a stagnation in the number of published papers, whereas 2010 was the top year of new Living Labs entering the network. However, as the number of new Living Labs started to drop significantly from 2011 onwards, the number of papers started to increase again in 2012 and seems to have stabilized again. What looks more problematic, is the evolution of papers that effectively generate impact. In terms of papers with a citation count of more than 10, no year has yielded more than 10 papers, with a maximum of 9 papers in 2010 being cited more than 10 times.

In terms of Web of Science-papers, we also get the image of a research field 'in development'. When we select all articles in the Web of Science database that have "living lab" in the title and exclude Only 50 papers in total have been published in journals (21) or conferences (29) that are abstracted in this influential database from the almost 600 papers with Living Lab in the title that have been published. Moreover, when we look at the citation count of these papers, only 2 have more than 10 citations in other WoS-publications: Wolfert et al. (2010) with 24 citations and De Moor et al. (2010) with 11 citations. The majority of the WoS publications (33) even has no citations at all. Moreover, the overlap with our Google Scholar most cited sample is rather scant, with only 8 papers appearing in both list (cf. also the attachments): Budweg et al. (2011), De Moor et al. (2010), Hlauschek et al. (2009), Liedtke et al. (2012), Schuurman et al. (2011), Svensson et al. (2010), Wadhwa (2012), and Wolfert et al. (2010). Therefore, we decided to continue our analysis with the top-cited Google Scholar articles.

For the 45 Google Scholar papers with a citation count higher than 10 the total citation count is 1943, which means an average of 43 citations per paper. Only 5 papers are cited more than 100 times: Abowd et al., 2002 – 135 cit.; Eriksson et al., 2005 – 176 cit.; Niitamo et al., 2006

– 142 cit.; Almirall & Wareham, 2008 – 124 cit. and Følstad, 2008 – 182 cit. Note that none of these papers is also on the WoS.

For Open Innovation, West & Bogers (2013) conducted a similar literature overview which resulted in 287 papers in SSCI journals (Web of Science papers), with the first 10 papers being cited at least 500 times, with Chesbrough's book (2003) even cited more than 8000 times, and Chesbrough being (co-) author of most of the top-cited papers. The same is true when looking for literature with the terms 'User Innovation' and 'lead user', with von Hippel as a dominant figure and easily more than 10 articles with over 400 citations, although the Open Innovation literature is clearly dominant in terms of quantity.

Based on these general statistics, we can conclude that the Living Labs movement in terms of theory and research has taken off since 2006, at least in quantity of published papers. However, **in terms of quality and impact, the academic field of Living Labs is still rather insignificant**. Regarding the authors, 39 papers were authored by European scholars, five by American scholars and one paper originated from Australia (Third et al., 2011). This is further proof that the Living Labs field is clearly dominated by Europeans. However, there is not a single author very 'dominant' as in the Open and User Innovation literature, with five authors (Almirall, Wareham, Ståhlbröst, Eriksson and Feurstein) (co-) authoring 3 papers. This is also a further indication of the scatteredness of the Living Labs field. We will continue the rest of our analysis with the 45 Google Scholar 10+ cited papers. We chose to use this sample as it has some clear advantages. The selection criteria are clear and unambiguous, which enables later reproduction (e.g. for future comparative studies). Moreover, the sample size allows to have a more in-depth knowledge of all the papers, while at the same time representing a fair share of the total amount of papers (8%). However, we also acknowledge some limitations that come with our selection methodology. Papers that do not have "living lab" in the title are excluded (e.g. Ballon et al., 2007), although based on our knowledge of the literature, this has only a minor impact. Perhaps more impact is generated by including the criterion of 10+ citations. This tends to limit the inclusion of the most recent Living Labs papers, as it takes some time to get cited by even newer publications. However, this would raise the issue on how to measure or assess the quality of these more recent publications. Therefore, we chose to keep our initial criteria and propose future research should adhere to these criteria to include more recent literature that by that time has reached a significant degree of impact.

6.2 Results & discussion

When going through all the papers, two important issues arise. First, only a small minority of the papers reports on well-grounded empirical research on Living Labs. The majority of the papers are descriptive single or multiple case studies, or conceptual papers relying on desk research, without a rigid methodology being used or explained.

In our sample, 18 out of 45 papers are merely project descriptions with only limited conceptual value (Abowd et al., 2002; Baida et al., 2007; Schwittay, 2008, Hlauschek et al., 2009; Krieg-Brückner et al., 2010; Hess & Ogonowski, 2010; Budweg et al., 2011, Schuurman et al., 2011; Liedtke, 2012; Wadhwa, 2012; Schwartz et al., 2013; Ogonowski et al., 2013) or they describe a single case study where a 'Living Lab approach' is used, but without Living Labs themselves being the subject of the research (Haymaker & Chachere, 2006; Scott et al., 2009; Wolfert et al., 2010; Bliek et al., 2010, Ryu, 2010; Third et al., 2011). Remarkably, all American papers and the single Australian paper are to be found in this category, which is another indication that Living Labs are largely a European phenomenon. Also, the Ryu (2010) paper is the only downright negative paper in the whole sample, as it describes the power relations a large company can exert in the process of ICT introduction in developing countries. All other 44 papers approach Living Labs in a neutral or overtly positive way, which is an indication of the absence of a critical attitude towards Living Labs as a concept. In the Open and User Innovation literature we also encountered mostly positive case studies, but in both fields some critical papers have also emerged. To this day, no real 'critical' Living Labs paper has been published, which is a further proof of the rather low impact of the field in other literature streams.

Table 22: Living Labs paper type

Paper type	Number of papers
Descriptive papers	18
State-of-the-Art papers	4
Conceptual & methodological papers	16
Empirical paper	7

Subsequently, we can discern a category of four papers that contain multiple Living Lab cases, but merely as high-level descriptions and illustrations. First, we have the oldest paper from our sample by Markopoulos and Rauterberg (2000) who give an overview of the American Living Labs that were blossoming at that time, with also examples from this kind of Living Labs in Europe[44]. Next, we have the widely cited papers by Eriksson et al. (2005) and Niitamo et al. (2006) who give an overview of the developing European Living Labs

[44] Note that the authors were also European and connected to a Dutch Living Lab.

field, also including some of the American examples. As a fourth paper in this category, we have Schaffers et al. (2007) who discern the Living Labs for rural development, which coincides with the fourth type of Living Lab we detected in the previous chapter: Living Labs for multi-stakeholder knowledge sharing and collaboration.

Besides these four 'state-of-the-art' papers, we have a rather large sample (16 or just over 1/3 of all papers) that deal with methodological and conceptual contributions to Living Labs, based on single case studies or purely conceptual papers. Pierson and Lievens (2005), Kusiak (2007), Følstad (2008b), Levén and Holmström (2008), Feurstein et al. (2008), Schuurman and De Marez (2009), Bergvall-Kareborn et al. (2009a&b), Santoro and Conte (2009), Pallot et al. (2010) deal with user contribution and project methodologies for Living Labs. Some papers base themselves on more research data, such as Schumacher and Feurstein (2007) who report on a Living Labs survey, albeit in a very descriptive way. Mulder et al. (2007 & 2008, basically two times the same paper) report on a brainstorming exercise of Living Lab practitioners and maps different methods and tools on a 'harmonization cube', while Svensson et al. (2010) base themselves on user contribution in more than 100 user interaction intstances in three Living Lab projects to inventarize different methods. Ponce de Leon et al. (2006) and De Moor et al. (2010) deal with testbeds in the context of Living Labs, and how to intergrate these, with De Moor et al. (2010) dealing specifically with Quality of Experience as methodology which can support Living Labs and vice versa.

However, only seven papers dig deeper into the Living Labs phenomenon with a larger sample, a more rigid methodological approach or a more in-depth analysis of the cases studied. First, there are two papers containing literature reviews: the Følstad (2008a) paper which we discussed in detail in the previous chapter, and Dutilleul et al. (2010). Although their methodology for selecting the papers is not very clear, the latter paper reaches some interesting conclusions, as Dutilleul et al. (2010) discern five different meanings given to Living Labs in the papers they studied:

1. an innovation system consisting of organised and structured multi-disciplinary networks fostering interaction and collaboration
2. real-life or 'in vivo' monitoring of a social setting generally involving experimentation of a technology
3. an approach for involving users in the product development process
4. organisations facilitating the network, maintaining and developing its technological infrastructure and offering relevant services
5. the European movement itself

Referring back to the fourfold typology of Living Labs from the previous chapter, the first meaning resembles the Living Labs for multi-stakeholder knowledge sharing and collaboration. The second meaning can be associated with the 'extension to testbed'-type of

Living Labs with a more long-term monitoring and with less active user involvement, but also with the American Living Labs if this monitoring occurs in an laboratory setting made to resemble real-life. The third meaning focuses more on methodologies for user involvement and is compatible with the small scale Living Labs focusing on real-world user co-creation. The fourth and fifth meaning are merely eponymous, indicating the organization driving the Living Lab activities or as a term to describe all (European) Living Lab activity.

6.2.1 Levels of analysis

The final paragraph of the previous section raises the issue that not all Living Labs papers are using the Living Lab-concept to identify the same phenomena. The first interpretation from Dutilleul et al. (2010) looks at Living Labs from a systemic or network perspective, which is also the case for the fourth and fifth interpretation. The second is more related to a project structure where several elements constitute the Living Lab character of the project. Living Labs as an 'approach for user involvement' considers more the methodological level within a project: which methods or tools should be used to involve users during innovation development. We also witnessed these different levels in the clusters of papers, as the four state-of-the-art papers clearly considered the Living Lab 'constellations', whereas the 18 papers seem to report Living Labs on a project level. The 16 empirical and methodological papers mix these levels, as some tend to focus on the methodological level, whereas others look on a project or constellation level to abstract lessons and findings.

Moreover, we see these levels of analysis also present in the five papers that we regard as the strongest of the sample in terms of methodology and depth of their analysis. Westerlund and Leminen (2011) and Leminen et al. (2012) make this distinction implicitly, as in the first paper they take the intermediary project level as they discern different ways to manage different levels of user contribution, whereas in the second paper, they report on the constellation level by discerning different actors with specific roles in a Living Lab (cf. infra). Almiral and Wareham (2008, 2011) make the distinction explicitly, as they state that parallel to a macro vision of Living Labs, they focus in a micro vision on the interaction between actors within innovation projects. In Almirall et al. (2012) they only focus on the methodological level, no longer taking into account the macro level.

Therefore, with the above in mind, we propose to make an explicit disctinction between these levels of analysis. Different than Almirall and Wareham (2008, 2011) who distinguish a macro and micro perspective, we propose to distinguish three levels of analysis:

On a macro level, a Living Lab is a public-private-people partnership consisting of different stakeholders, organized to carry out Living Lab research and Living Lab projects. We propose the term *Living Lab constellation* to refer to this level. **On the meso level, we discern the Living Lab innovation projects** that are being carried out within the Living Lab constellation. We can also refer to this as a *Living Lab project*. The **research**

activities that are deployed in a Living Lab project we propose to label as the **micro level activities** in Living Labs. Mostly, this consists of a specific Living Lab methodology in order to ‘cultivate user-led insights’ and ‘surface tacit, experiential and domain-based knowledge such that it can be further codified and communicated’ (Almirall & Wareham, 2011). The following table clarifies the different levels of analysis.

Table 23: Levels of analysis

Level	*Description*
Macro level	Living Lab constellation consisting of actors (PPP-partnership) and/or infrastructure
Meso level	Living Lab innovation project
Micro level	Living Lab methodological research steps

As we discussed in the previous chapter, Ståhlbröst (2012) noticed that some Living Labs exist where the Living Lab constellation is set-up for only one innovation project, which merges the macro and meso level, but as we saw in the previous chapter and as we will further argue in the next chapter, we regard these ‘Living Lab as a project’ initiatives as problematic in terms of sustainability and sub-optimal in terms of added value being generated for the actors involved. We will illustrate this by means of the case studies of the Flemish ICT Living Labs (macro level) in the next chapter that were purposefully established for facilitation of Living Lab innovation projects (meso level). We will also analyze 21 of these Living Lab projects that ran inside these Living Lab constellations. Finally, we will also look into the methodological aspects of these 21 cases (micro level). Before turning to these case studies on the three identified levels of analysis, we will further explore the theoretical state-of-the-art in our sample of papers. First we will look into these three levels of analysis. To this end, we analyzed the nature of the findings and implications of the paper for Living Labs, and at the type of case that were studied (if there were any). Based on this information, we coded the level of analysis based on the definition we gave to the three levels. Note that some papers deal with multiple levels of analysis (e.g. Almirall & Wareham 2008 & 2011, cf. supra).

Table 24: Levels of analysis in papers

Level	**N**
Macro	29
Meso	15
Micro	20

In terms of the levels of analysis, the focus is clearly on the macro level, with 29 papers looking at the Living Lab constellation. In total 20 papers deal with the micro level, referring to specific methodological aspects of Living Labs. A minority of the papers (15, only one third of the sample) deals with the meso level or concrete Living Lab innovation projects. Moreover, the majority of these papers is merely descriptive as they concern giving an overview of a project without much analysis regarding the outcomes or regarding implications for Living Labs (e.g. Bliek et al., 2010; Wadhwa, 2012). The majority of the papers only takes into account one level (29), while 16 papers combine multiple levels of analysis. Remarkably, the first papers with multiple levels of analysis appear in 2008, the year Almirall and Wareham (2008) explicitly distinguished between a macro and a micro level view in their analysis. Moreover, before 2008, none of the papers took into account the meso level, dedicating attention to the Living Lab constellation and/or infrastructure, or to the methodology.

6.2.2 Theoretical frameworks

We also assessed which theoretical frameworks were used in the paper. Therefore we examined the theoretical and introductory parts of the paper and looked which frameworks or paradigms were mentioned as foundations for Living Labs. In accordance to our own theoretical frameworks, we looked for indications of the Open Innovation and User Innovation frameworks. From the predecessors of Living Labs we also gathered that the cooperative design movement evolved into User-Centered Design and Participatory Design, so we also looked for indications of these literature streams. In practice, we looked at the occurrence of the 'Open Innovation', 'User Innovation', 'user-centered design' (UCD) and 'participatory design' (PD) expressions, but also for citations of prominent authors associated to the fields such as Chesbrough or von Hippel.

Relating to the different levels of analysis, we would expect that papers taking a macro perspective would rather use Open Innovation as a theoretical framework, as at this level Living Labs are considered organizations or networks consisting of different actors. For the micro perspective, we would expect User Innovation or UCD/PD as main framework as on a methodological level, Living Labs are an approach to involve users in innovation processes. On the meso level, all frameworks seem to be relevant as a Living Lab innovation project consists of different actors collaborating for innovation, including end-users. At this level, we see the Living Lab constellation being put to use, with the innovation projects advancing along the different steps of the Living Lab methodology. As we discovered that the macro level was clearly dominant, we would expect Open Innovation to be the most widely used theoretical paradigm in our sample. The table below gives the numbers of articles where the proposed frameworks are used, together with the number of articles where none of the theoretical foundations were used.

Table 25: Dominant framework

Paradigm	N
Open Innovation	11
User Innovation	17
UCD / Participatory design	19
None	18

Surprisingly, Open Innovation is only explicitly referred to in 11 papers, despite the dominance of articles taking a macro perspective. This can be explained by the fact that in a lot of these papers, terms like open collaboration, Public-Private-People partnership, or even Open Innovation are used without any referral to literature from the Open Innovation domain. **A lot of the Living Labs papers seem to take the use of Open Innovation for granted, without reflecting in terms of the Open Innovation literature base or without apparent knowledge of this literature stream**. Papers like Schuurman and De Marez (2009), Svensson et al. (2010) and Pallot et al. (2010) equal Open Innovation with user involvement and open collaborative innovation, something which was also discussed in West & Bogers (2013). **In 18 articles, none of these frameworks was referred to**, whereas 17 papers referred to the User Innovation literature. The UCD/PD framework is the most cited with 19 papers, which is an indication that **the 'cooperative design' predecessor still has a large influence on the current Living Labs movement**. Moreover, the large amount of papers without reference to these frameworks is remarkable, but also congruent with the previous finding that 18 papers within our sample are for the largest part descriptive without much attempt at theory building. Among the earlier papers with a reference to design thinking, we find especially American authors with references to participatory design and requirements-driven innovation (Abowd et al., 2002; Haymaker & Chachere, 2006; Kusiak, 2007). In Europe, the Scandinavian authors have maintained a strong connection between Living Labs and design thinking (Følstad, 2008a&b; Levén & Holmström, 2008; Bergvall-Kåreborn et al., 2009a).

In the remainder of this chapter, we will now explore the occurrence of Open and User Innovation and the related key concepts within our sample, and look how these paradigms have been linked to Living Labs. We will dedicate special attention to the empirical papers from the sample that have not been discussed yet.

6.2.3 Living Labs literature with Open and User Innovation combined

As we have argued in the introductory chapter, we consider Open and User Innovation as two distinct, but complementary frameworks that make sense of distributed innovation processes. Where the Open Innovation paradigm takes the perspective of a private actor and examines the benefits of engaging in distributed innovation, the User Innovation stream looks at distributed innovation processes from the perspective of the user and looks under which circumstances users can contribute to innovation processes with knowledge or own innovations. We set it as a goal within this PhD to explore these two literature streams as theoretical foundations and anchor points for Living Labs, which we did in chapters 3 and 4, but also to consider Living Labs as a phenomenon where both streams come together. Therefore, we looked into the occurrence of Open and User Innovation literature in the framing of the Living Labs papers from our sample (cf. supra), and were able to distinguish 7 papers in total where both perspectives are used: Schaffers et al. (2007), Almirall and Wareham (2008, 2011), Levén and Holmström (2008), Bergvall-Kareborn et al. (2009a&b), and Dutilleul et al. (2010).

The oldest paper (Schaffers et al., 2007) is one of the identified ‘state-of-the-art’ papers from the early start of the European Living Labs movement and describes a ‘new’ type of Living Lab, with more focus on stakeholder collaboration and knowledge sharing. In the previous chapter we also discovered this type in our fourway segmentation. Therefore, the attention from Living Labs as purely ‘user-centered’ and ‘user-driven’ shifted towards a more networked approach, hence Schaffers et al. (2007) ground their experiences in the European C@R-project (cf. supra) in the Open and User Innovation paradigms. The issue of the sustainability of Living Labs is raised, and they argue to develop a ‘business model’ for Open Innovation in ‘rural’ Living Labs, taking into account the various dimensions of partnership creation and operation across the different Living Labs development stages, which makes the link with Open Innovation apparent. Only when these ‘business model issues’ are tackled, the Living Lab operations can generate innovation through users or user communities involved in the Living Lab.

Almirall and Wareham (2008, 2011) explicitly regard Living Labs as a means to overcome the ‘European Paradox’ between exploration and exploitation by surfacing tacit, experiental and domain-based knowledge in so-called innovation arenas in real-life environments, but separated by a project structure. This adheres to our proposition of Living Labs as a tool for distributed innovation driving on co-creation between different actors, including users. Almirall and Wareham (2008) further suggest that these arenas are supportive instruments for entrepreneurial users, which also merges the User Innovation and Open Innovation perspectives. Based on a cross-case analysis, Almirall and Wareham (2011) conclude that Living Labs have two main functions, which can also be linked to both paradigms. First, they should close the pre-commercial gap by generating initial demand for the innovation in development (user involvement for exploitation), and second, they should be able to orchestrate the actions of the involved actors in order to align the inputs for the innovation process (knowledge exchange for exploration). However, as we will see in the next section, the ‘exploitation’ perspective is mostly absent in the Living Labs literature, although this is an essential part for solving the European Paradox. Moreover, based on the Open and User

Innovation literature, we would expect that exploitation might also occur between the actors participating in an innovation network, whereas (certain types of) users are regarded to be able to contribute to the innovation process, which is a form of knowledge exploration.

Levén and Holmström (2008) deal with the process of value creation in Open Innovation systems. They regard user involvement as essential to enhance ICT-innovation. They also use the 'arena' metaphor for Living Labs and consider them a response to the opportunities identified through Open Innovation models, but also as an opportunity to move university research out in the wild. Therefore they propose the following model to visualize the actors and activities in Living Labs.

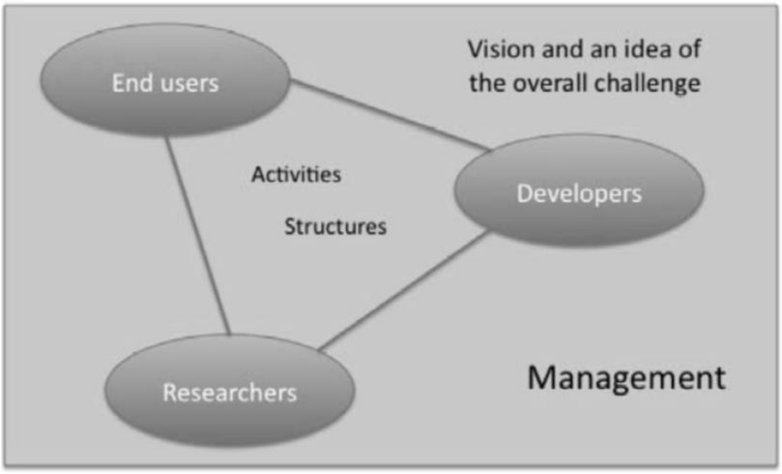

Figure 12: Living Lab actors from Levén and Holmström (2008)

Co-creation is the central value creating process in Living Labs, and university researchers are considered a mediator between end-users and developers, something which is also argued in the work of Almiral and Wareham (2008, 2011). Based on two cases, Levén and Holmström (2008) also dedicate attention to the balance between exploration versus exploitation, and point out to the fact that some sort of innovation system management should be facilitated in Living Labs in order to guard this balance and to foster an optimal exchange of knowledge between the participating actors. They suggest that universities play a crucial role in the well-functioning of the innovation system, but fail to shed light on how this management should be executed in practice and how a balance can be attained. In the next section, we will dig deeper into this matter as we introduce an extension of this Living Labs actor model by Leminen et al. (2012).

Bergvall-Kåreborn et al. (2009a&b) take a radically different approach towards positioning Living Labs among the Open and User Innovation frameworks. They explicitly distinguish Living Labs from Open Innovation, as they state that Living Labs are business to consumer (B2C), focus on the product or service and generate input for the whole innovation process, whereas they consider Open Innovation to be business to business, focusing on the business model and generating input for ideas and technology.

In Bergvall-Kåreborn et al. (2009a) five Living Lab key components are identified: the (ICT) *infrastructure* to facilitate cooperation and co-creation between the stakeholders, the *management* of the interaction and activities, the *partners and users* that participate in the Living Lab, and the *approach* which stands for the methodology, methods and techniques that are used in the Living Lab. They further distinguish five Living Lab principles: influence, openness, realism, value, and sustainability. This is based upon the authors' experience in 30 research projects within two Swedish Living Labs (Botnia and Halmstad Living Lab). However, it is not quite clear how these 'principles' should be used to increase the value or effectiveness of Living Labs or Living Lab projects. The level of analysis is also unclear. Do these principles apply to a Living Lab project (the unit of analysis of their own observations) or to the Living Lab constellation? These issues are left unanswered.

In Bergvall-Kåreborn et al. (2009b) they dig deeper into the 'approach' component or the Living Lab methodology. Again, they propose five key principles to guide the research steps in Living Lab projects: continuity, openness, realism, empowerment of users, and spontaneity. Subsequently, they present their own FormIT methodology for systems design and illustrate this method by means of a case study.

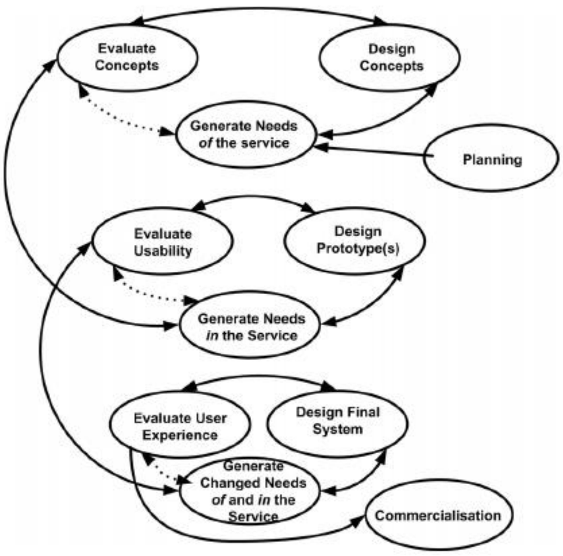

Figure 13: FormIT Methdology by Bergvall-Kåreborn et al. (2009b)

The methodology is rather similar to user-centered design methods, with more emphasis on evaluation and testing of prototypes. However, again it remains unclear how these 'principles' should be taken into account in practice. It also remains very much hypothetical that these methods are 'better' than other innovation approaches, and only successful cases are presented, something which can be put forward as **a criticism towards the majority of Living Labs papers: the lack of critical attitude towards their own methods and *modi operandi***.

However, the final paper building on both the Open and User Innovation paradigms by Dutilleul et al. (2010) raises some critical issues with regards to the Living Labs movement. They base themselves upon a literature review of Living Labs papers, although they never specify how they selected them. As we already noted previously in this chapter, they unveiled five different ways in which Living Labs were used, indicating an inconsistent usage of the concept, not taking into account the different levels of analysis that can be discerned within the phenomenon. Regarding Open Innovation, they consider Living Labs as multi-business collaborations. They see it as a challenge for Living Labs to maintain their openness towards external partners whilst also generating value for business actors active in the Living Lab. The management role is better awarded to a public actor, as it is easier for them to maintain a neutral stance. Regarding user involvement, they see some issues with regards to user motivation to participate, as they state that most literature implicitly assumes that users are motivated and willing to participate. Dutilleul et al. (2010) see it as a future challenge for Living Labs to achieve and sustain the necessary levels of user cooperation with as motivation better solutions to their problems or better design.

6.2.4 Living Labs and Open Innovation

From chapter 3 on Open Innovation, we gathered that Open Innovation processes deal with knowledge exchange between actors. Referring back to the initial goal for the promotion of Living Labs within the wider European innovation system, which was to help solving the European Paradox, or the imbalance between knowledge exploration and exploitation, we would also expect Open Innovation to be more prominent as framework for conceptualizing Living Labs. In order to 'solve' the European Paradox, Living Labs should be able to facilitate the process of exploitation. Therefore, we looked at the Living Lab definitions, and more specifically the goals that were mentioned for the Living Lab activities that were described in the paper. We coded all papers for the three Open Innovation processes of exploration, exploitation and retention, which we defined in chapter 3 (Licthenthaler & Lichtenthaler, 2009; van de Vrande et al., 2009):

Exploration: innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments

Exploitation: innovation activities to leverage existing knowledge or technological capabilities outside the boundaries of the organization

Retention: maintaining, storing and reusing knowledge over time outside of an organization's organizational boundaries

Besides the word exploration itself, we considered words such as experimentation, study (of user behavior), testing,… as indicators of exploration goals. For exploitation, we regarded words and phrases like ‘creating initial demand’, adoption, technology transfer, implement, and business models to refer to an exploitation goal. For retention, indicators such as knowledge and information sharing, multi-stakeholder communication and rethinking were used. This resulted in the following outcome.

Table 26: Open Innovation processes

Proces	N
Exploration	45
Exploitation	15
Retention	7

All papers (45) define Living Labs and Living Lab activities as an exploration of new knowledge, whereas only one out of three (15) mentions exploitation as a motive for Living Labs, which is surprising as in the previous section it was argued that exploration and exploitation should be balanced. This is also a clear mismatch with the original intentions described in the Helsinki Manifesto (2006) of Living Labs as facilitators of knowledge exploitation. The exploitation motive of Living Labs is the most common in the more thematic Living Labs (e.g. Baida et al., 2007; Hlauschek et al., 2009; Wadhwa, 2012) or Living Lab projects where an innovative infrastructure is rolled out amongst a population (e.g. Schwittay, 2008; Ryu, 2010; Third et al., 2011; Bliek et al., 2010; Schwartz et al., 2013). The fact that knowledge retention is the least common is not a real surprise, as this process was also the least studied within the Open Innovation literature. The seven instances where retention was an explicit goal, were in thematic Living Lab constellations where stakeholders from a certain sector intend to collaborate and exchange knowledge regarding future opportunities (Baida et al., 2007; Wolfert et al., 2010), two projects aimed at sustainable innovation with the creation of user awareness (Scott et al., 2009; Liedtke et al., 2009), the literature review of Dutilleul et al. (2010) who refer to the regional knowledge sharing opportunities of Living Labs, and the two papers by Mulder et al. (2007 & 2008) that incorporate the outcomes of a brainstorming session of Living Lab practitioners in an attempt to create shared tool and methodology set for Living Labs. This is an indication of the imbalance in the attention for the Open Innovation processes in the current Living Labs literature, something which calls for more in-depth research. We will tackle this issue in the next chapter. Moreover, the fact that only 11 papers explicitly refer to Open Innovation as a defining paradigm, but that in all papers references to knowledge transfers between actors can be found, suggests that Living Labs are emanations of Open Innovation. This calls for a better conceptualizing of Living Labs that allows to frame them in terms of Open Innovation.

We continue our overview of Open Innovation in the Living Labs literature by looking more closely to the papers that explicitly position Living Labs within the Open Innovation literature. Almiral and Wareham (2008) argue that Living Labs have a transversal role in Systems of Innovation affecting all groups of activities, as they function as innovation intermediaries (cf. also chapter 3). What makes them novel compared to other intermediaries, is the actor they mediate: the users. This mediation consists of three new activities: 1) Living Labs provide services around user experience and involvement to companies in the context of projects, aiming to obtain products that relate better to users' needs, concept validation or to capture new ideas that could improve a product or a service, 2) Living Labs support lead users as entrepreneurs providing networking, technical expertise, project management and sometimes funding, 3) Living Labs organize the user involvement in the innovation process by maintaining groups, setting up projects and creating societal involvement. This is in line with the work of Kusiak (2007) who states that within a Living Lab all stakeholders of a product or a service are invited to participate in the development process. The Living Lab thus acts as an innovation intermediary by aggregating all external inputs and translating them into requirements for innovation. This extends the view of Almirall and Wareham (2008) on Living Labs as innovation intermediaries, as they not only mediate the user, but also other stakeholders participating in the Living Lab. As some kind of aggregator of various external inputs, translating them into requirements, the 'Living Innovation Laboratory' supports innovation of products and services that are validated in collaborative, multi-contextual, empirical real-world environments (Kusiak, 2007). Regarding involvement of multiple actors of the innovation ecosystem, Almirall and Wareham (2008) see Living Labs as especially relevant in situations with multiple stakeholders, conflicting interests, and a large 'space of solutions'. In these cases, the innovation problem may only be adequately addressed by involving all actors and stakeholders through their active participation. This way, Living labs provide the solution by tapping into tacit knowledge to be incorporated into products and services, and validated in real-life environments.

This all seems to make perfect sense and gives some indications to when a Living Lab-approach seems to be fitting, although a lot of issues are left untouched. What actor should govern the Living Lab? How is the stakeholder participation facilitated? How to exactly structure and outline the innovation process? These answers are largely left unanswered, and based on his later work (Almirall et al., 2012), it appears that different Living Labs use quite different methodologies in terms of user involvement, without even dealing with the issue of other stakeholder involvement.

Regarding the actors that participate in a Living Lab, we already discussed the intergration model of Levén and Holmström (2008) that includes researchers, end-users and developers. The researcher is focused on the production of new knowledge. He/she contributes to the Living Lab with knowledge or studies of technologies or methodologies that are relevant to the Open Innovation process. In exchange for his/her contribution, the researcher will gain from the Living Lab-approach in terms of cases and information available through the cooperation with the other actors. The developer is a stakeholder that aims to develop products or services able to fulfill the end-user needs. Therefore, he/she searches for information and knowledge about those needs and opportunities that are important to the end-user. Nevertheless, its primary focus is his/her own market and business opportunities. He contributes to the Living Lab with new products, services and solutions as well as with important and competent management in the innovation process as a whole. The end-user is a stakeholder looking for better ways to satisfy his/her needs and better ways to handle his/her current situation. The end-user can contribute to the Living Lab by expressing his/her needs, usage experience and as end-user of the services or products resulting from the innovation system. As suggested by Dutilleul et al. (2010, cf. supra), the management role should be played by a public stakeholder with a ‘neutral’ attitude in terms of business. Therefore, we can increase the number of stakeholders by adding ‘authorities’ or ‘public organizations’.

However, the most complete account of stakeholder roles in Living Labs, building further on these previous works and based on an analysis of 26 Living Labs from Finland, South-Africa, Spain and Sweden, comes from Leminen et al. (2012). They obtained data form these Living Labs by conducting 103 semi-structured interviews with informants from 39 different organisations participating in these Living Labs. The interviewees included senior managers, project managers, researchers, project coordinators and users. This same data set is used for another paper by this author team that we will discuss in the next section. Based on this empirical investigation and on previous Living Labs literature, Leminen et al. (2012) propose four different Living Lab stakeholders based on their role: utilizers, enablers, providers and users.

- ***Utilizers*** aim to develop their businesses within the Living lab ecosystem, mostly through short-term Living Lab cases. Their focus is on developing and testing their new products and services. These utilizers use Living Labs as a strategic tool to collect data on test-users of their products or services and collaborate with all stakeholders in the Living Lab ecosystem, including the end-users. These actors drive short-term Living Lab projects and can be regarded as short-term, ad hoc ‘consumers or partners of the Living Lab’.

- ***Enablers*** can be various public sector actors, non-governmental organizations, or financiers, such as towns, municipalities, or development organizations. This actor provides (financial) resources or policy support in order to start-up and maintain the Living Lab operations.

- ***Providers*** provide the other actors in the Living Lab with their product or service portfolio. They take care of the (material) infrastructure used for the Living Lab operations. Providers are mainly private companies that enter into Living Labs to co-develop new products, services, and solutions to their own business or industry needs, and focus more on long-term results. They attain these goals through their involvement in general Living Lab operations and (possibly) in the Living Lab cases, driven by utilizers.

- ***Users*** are the 'end-users' that are being involved in the Living Lab-operations and in the (short-term) Living Lab cases. In some Living Labs, existing user groups or user communities are involved, while in others the Living Lab operations themselves facilitate the formation of a Living Lab user community.

This stakeholder-model for Living Labs once more stresses the close connection of the Living Lab-concept with the Open Innovation paradigm, as it demonstrates the (supposed) symbiotic nature of the stakeholder roles. This is also reflected in the works of Almirall and Wareham (2008) who identify Living Labs as the first attempt to organize and structure user participation in real-life environments according to the Open Innovation paradigm.

In the typology of Leminen et al. (2012) academic researchers are considered providers because they provide the necessary expertise on user research. Other research such as Levén and Holmström (2008), but also the Triple and Quadruple Helix literature, stresses the importance of universities as a distinct actor in the innovation ecosystem (Perkmann & Walsh, 2007; Etzkowitz, 2008; Arnkil et al., 2010; Cosgrave et al., 2013). Moreover, the contribution of academia is not limited to user research, as it can also include research on technical topics related to the focus of the Living Lab, or policy and business research. Therefore, we distinguish **researchers** as a separate type of actor within the Living Lab constellation. Based on the various roles of the Living Lab actors and the central role of the infrastructure, we propose the following theoretical illustration of a Living Lab constellation.

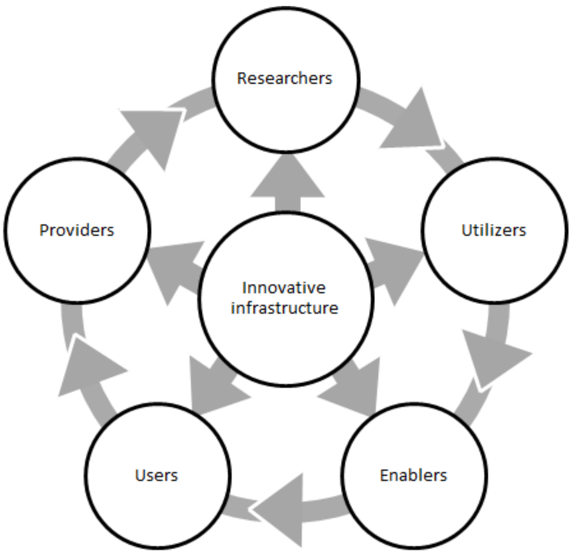

Figure 14: The anatomy of a Living Lab constellation

We will use this illustration as an analytical tool to analyze the four Living Lab constellations (the actors that constitute the Living Lab network, i.e. the macro level) in the next chapter. This way, we build further upon the work of Leminen et al. (2012), as they merely described the different roles they discerned based on the analyses of the interviews and other data they gathered from the Living Labs they studied. Moreover, no references have been made yet to other theoretical concepts and frameworks we gathered from the Open Innovation literature such as network paradoxes as defined by Klerkx and Aarts (2013). We will incorporate this in our empirical case study in the next chapter. Once more, this is an indication of the dominance of Living Lab practice over Living Lab theory, as this model was constructed based on the actual practice within these Living Labs.

6.2.5 Living Labs and User Innovation

We now turn over towards the appearance of User Innovation within our sample of Living Labs papers. As within the Living Lab definitions user involvement and user co-creation are essential characteristics, we looked in our sample for the degree of this user involvement. From the chapter on User Innovation and from some of the papers within our sample, we gathered that user contribution can differ in terms of the degree of involvement. As key framework, we chose the categorization of Kaulio (1998), who discerns innovation/design for, with and by users. *Design for* denotes an innovation approach where user involvement is limited to passive user feedback, gathered through Voice of the Customer-methods or user behavior studies, as were conducted in the American Living Labs. *Design with* denotes an innovation approach based on co-creation, as users and manufacturers work together in an iterative manner, where the locus of innovation can be seen as shared between both involved actors. *Design by* refers to an innovation approach where users innovate themselves, which is in line with the Lead User-approach and the CAP, as the locus of innovation resides with the user.

Table27: User involvement mode

Design…	N
For users	11
With users	34
By users	0

We looked at all articles and assessed what the dominant mode of user involvement was for the Living Lab activities that were described in the paper, or in the case of conceptual papers how the user contribution was defined. Not surprisingly, desing with users, or the co-creation stance, was dominant in the majority of the papers (34). None of the papers described activities where the ‘innovation by users’-mode was dominant, although it was described in some papers (cf. infra). However, it is remarkable that the majority of the papers refers to co-creation with end-users, but only 17 papers mention User Innovation as anchoring paradigm. Apparently, the current Living Labs do not support true User Innovation, or at least do not see this as the dominant form of user contribution. Design for users, where the user only plays a passive role in the innovation process, is the dominant mode in 11 papers, including the American Living Labs and the real-life testbeds with passive user observation or simple evaluation, and some papers that deal with Living Lab projects where technologies are rolled out amongst a group of users with technical testing in real-life as main goal.

Regarding the rest of the papers that dealt with the User Innovation paradigm explicitly, we would expect that the roles and characteristics of end-users in Living Labs would be described and researched in greater detail because of the user-centric nature of Living Labs. However, when going through the literature, this was not really the case. Lead User methods are mentioned in the context of Living Labs when overviews of methods to be used are presented (e.g. Pallot et al., 2010; Kusiak, 2007), but how this should exactly be approached remains unclear. In the works of Almirall et al. (2012), the Lead User concept also pops up with no clear specification on how to implement this, except for ‘selection of relevant users’ (Almirall et al., 2012). The Lead User method is also displayed as separate from Living Labs, with a slight overlap. The same goes for Pallot et al. (2011), who consider the Lead User-method as one of the user involvement techniques that are being used in Living Labs. Interestingly, Almirall and Wareham (2008) consider Lead User entrepreneurs as an important stakeholder group in Living Labs, something which is also mentioned by Pallot et al. (2011). **This means that Lead Users are sought to be involved in Living Lab projects to contribute to the innovation process, but that Living Labs are also enablers of User Innovation by Lead Users as they provide services that allow entrepreneurial Lead Users to develop their innovation.**

In terms of methodology, we already mentioned the FormIT methodology by Bergvall-Kåreborn et al. (2009b), but this methodology was specifically designed for ICT service design and does not take into account any user characteristics. However, none of the above provides a more tangible methodological framework to implement these user involvement methods or user types. In the majority of the literature, Living Labs are considered as ‘empty boxes’ where different methods and tools can be used, and which should adhere to certain criteria, but more guidance towards designing and managing Living Lab projects is scarce.

The most detailed attempt at drafting a more generally implementable Living Lab methodology, starting from a user innovation point of view, can be found in the work of Pierson and Lievens (2005) who also suggest taking into account user characteristics. They describe different elements constituting the set-up of a Living Lab-project, based on a multiple case study research. Their analysis unveils the following five elements which consist of the following steps:

Table 28: Living Lab methodology according to Pierson & Lievens (2005)

Contextualization	an exploration of the technological and social implications of the technology or service under investigation; technological scan and state-of-the-art study
Selection	identifying potential users or user groups; this can be done on a socio-demographic level, based on selective or criterion sampling, allowance for theoretical variation of previously defined concepts
Concretization	an initial measurement of the selected users on current characteristics, behavior and perceptions regarding the research focus, in order to enable a post-measurement
Implementation	the operationally running test phase of the Living Lab; research methods: direct analysis of usage by means of remote data collection techniques (e.g. logging), indirect analysis based on e.g. focus groups, interviews, self-reporting techniques…
Feedback	an ex-post-measurement of the users (same techniques of initial measurement) and a set of technological recommendations from the analysis of data gathered during the implementation-phase

Note that this general Living Lab-methodology shows quite some overlap with the Lead User-methods we discussed earlier. Characteristics, behavior and perceptions regarding the domain-focus of the innovation are explicitly mentioned as important criteria, as well as the identification of potential users or a potential user group. However, we feel that this already narrows the scope too much, as users that are not likely to become actual adopters or users of the innovation might also provide useful inputs.

The pre- and post-measurements of the users stress the ability of a Living Lab methodology to assess changes in attitudes, habits, practices,… regarding the innovation in development and allows to uncover the 'added value'. Reflecting back to the original American notion of Living Labs, this methodological set-up remains very similar to the traditional quasi-experimental design (Campbell & Stanley, 1966). The first three stages can be considered as the 'pre' stage, the implementation phase as the 'intervention' and the feedback phase as the 'post' stage, with the difference that this is carried out in a non-laboratory or real-life environment.

Table 29: Methodological design Living Lab research

Pre-test	*Intervention*	*Post-test*
- Contextualization - Selection - Concretization	- Implementation	- Feedback

From the literature on User Innovation, we also gathered that there are some barriers to user involvement and user contribution. It was suggested that contextualization and triangulization could be used to overcome these barriers. Taking into account the described quasi-experimental design and the real-life experimentation, Living Labs might be able to overcome these barriers. However, the literature itself is silent regarding these possibilities or regarding concrete outcomes.

6.3 Discussion & conclusion

Out of this overview of the theoretical state-of-the-art of the field of Living Labs, we have gathered that the practice-based side is much further developed than the theoretical side. In terms of empirical research and academic publications, Living Labs have received some attention, but this attention is virtually absent in top ranked journals. **There is also a lack of empirical, more quantitative and comparative studies that focus on the added value of Living Labs**. For the few studies that base themselves on empirical research into Living Labs, it remains difficult to make general comparisons or conclusions as most of the studies are not clear regarding their level(s) of analysis. Therefore we have proposed three distinct levels of analysis for Living Labs: the macro level, which concerns the Living Lab constellation, the meso level, which entails the innovation projects that are carried out within these constellations, and the micro level, which consist of the methodological steps that are carried out within these projects.

However, in the Living Labs literature, neither Open nor User Innovation is the dominant paradigm. Referring back to the Living Labs predecessors, it is the User Centered Design that originated from the Participatory Design movement that is still dominant. Strikingly, 18 out of 45 papers refer to no framework at all, remaining merely descriptive. User Innovation occurs more frequently than Open Innovation, but it seems that in recent papers Open Innovation is more and more adopted within the Living Labs literature. This is in line with the trend we also discovered in the previous chapter on Living Labs practice, where we noticed the emergence of a new type of Living Lab constellation, based on multi-stakeholder collaboration and knowledge sharing, rather than on user involvement.

However, in the Living Labs papers that deal with Open Innovation, for the most part this is equaled to open collaborative innovation, as it is argued that Open Innovation stresses user involvement and that Open Innovation takes place in a process of co-creation with internal and external parties. This ignores Open Innovation processes such as licensing and buying, which do not involve any form of co-creation at all. For example, this is also apparent in Westerlund and Leminen (2011) who see Open Innovation as a driver for user involvement and mention open source and crowdsourcing as alternatives to conventional in-house development. Based on their research, we proposed five distinct stakeholder roles within Living Labs: users, utilizers, providers, enablers and researchers. Despite the fact that Open Innovation is far from the dominant reference framework in Living Labs literature, we could find references to knowledge transfers between actors in all of the papers. As we considered this as one of the key characteristics of Open Innovation, we can conclude that Open Innovation is implicitly present witin Living Labs. Referring to the 'European Paradox', or the apparent gap between knowledge exploration and exploitation, at least in the literature there is also an imbalance in Living Labs. All of the Living Labs papers refer to knowledge exploration processes, whereas only one out of three papers mention exploitation processes. At least in terms of the Living Labs theory, there seems to be an issue with overcoming the European Paradox as there is too much focus on exploration.

Regarding User Innovation, 17 papers explicitly refer to this paradigm as theoretical foundation, but in all papers user involvement is a given which also shows that User Innovation is at least implicitly present in the Living Labs literature. Regarding the degree of user involvement, one of the key frameworks we identified in the User Innovation literature, 'design with users' is dominant in the majority of the papers, whereas 'design for users', or the classical 'voice-of-the-customers' techniques, is the main user involvement mode in 11 papers.

However, based on the literature, there is no general methodogy towards user involvement in Living Labs, and the literature from the User Innovation paradigm is rarely extensively mentioned or implemented in the context of Living Labs. The Lead User concept pops up from time to time, but no clear method on how to implement this is provided. The only main difference in user involvement approach between Living Labs was so-called open user involvement (self-selection) versus closed user involvement (selecting users with certain characteristics). The most clear definition sees Living Lab projects as a quasi-experimental approach with a 'pre' and a 'post' assessment of users with an intervention stage. This adheres to the three principles of Dell'Era and Landoni (2014), as this allows to capture the use context, the artifact can be seen as the intervention with the innovation or another stimulus (Proxy Technology Assessment, Prototype,…), and the user is actively involved in multiple stages (triangulization). **Our main conclusion is that in terms of methodology and user characteristics, the Living Labs literature is rather silent and positions Living**

Labs too much as an 'everything is possible' concept that resembles an empty box, in the sense that you can put whatever methodology or research approach inside. It remains a given that users are involved in Living Labs, but although co-creation was said to be the central process in Living Labs (Levén & Holmström, 2012), 11 papers mentioned 'innovation for users' as the dominant interaction mode. For the 34 papers where 'innovation with users' is dominant, no clear co-creation methodology is put forward. Therefore, within the current Living Labs literature, it remains unclear whether Living Labs hold value in terms of structuring user involvement according to User Innovation theory.

However, based on the previous, we wish to extend the framework with the levels of analysis towards a more encompassing model of Living Lab activity. In this chapter we gathered that in terms of theoretical frameworks, Open Innovation seems to be fitting to study the interactions and knowledge exchanges within the Living Lab constellation (macro), whereas User Innovation would be able help defining and chosing the most appropriate ways of user involvement on a methodological level (micro). On the meso level, we see both streams merge as the outcome of an innovation project can be influenced and shaped by both the Living Lab constellation as well as the Living Lab methodology.

Table 30: Living Lab three layer model

Level	Definition	Research paradigm
Macro	Living Lab constellation consisting of organized stakeholders (PPP-partnership)	Open Innovation: knowledge transfers between organizations
Meso	Living Lab innovation project	Open & User Innovation: real-life experimentation, active user involvement, multi-method and multi-stakeholder
Micro	Living Lab methodology consisting of different research steps	User Innovation: user involvement & contribution for innovation

This leads us to propose an update of our Living Lab definition from the introduction, taking into account the three levels. We defined Living Labs as an organized approach (as opposed to an ad hoc approach) to innovation consisting of real-life experimentation and active user involvement by means of different methods involving multiple stakeholders, as is implied in the Public-Private-People character of Living Labs. With our three-layered model, we propose the following definition: Living Labs are an approach to innovation consisting of three separate, but interrelated levels of analysis. On the macro level, Living Labs are a Public-Private-People partnership organized to exchange knowledge and conduct innovation projects. We regard these Living Lab innovation projects, that are characterized by active user involvement, co-creation, multi-method and multi-stakeholder, as the meso level. These projects consist of different research steps that are aimed at generating user input and contribution to the innovation process, which we consider to be the micro level. Open Innovation can be used to study the knowledge tranfers on the constellation level, whereas User Innovation can provide insights into user contribution and user involvement methods.

Therefore, based on our model, we consider the main distinguishing Living Lab characteristics to be situated at the meso level. This does not match with the current focus in the Living Labs literature, as 29 papers or almost two out of three take into account the macro level, whereas 20 papers deal with the micro level. Only a minority of one out of three takes into account this meso level. Moreover, the majority of the papers only takes into account one level (29), while 16 papers combine multiple levels of analysis. This focus on the macro level is also not consistent with only 11 papers mentioning Open Innovation as theoretical foundation.

A final observation is the lack of critical papers on Living Labs (only one out of our sample of 45) and the lack of research clearly assessing the added value of a Living Lab approach on neither of the three levels of analysis. Katzy and Turgut (2010) state that for the innovation performance of individual Living Labs a valid research methodology still needs to be developed. According to them, the measurement of the efficiency of Living Lab processes and structures would serve two purposes: legitimating the (EU) research budget that has been used to stimulate the establishment of Living Labs, but also for potential modification of the concept or certain aspects of it. Therefore, in the next chapter we will analyze a subset of Living Labs on all three levels, taking the Open and User Innovation paradigms as foundations for this analysis, and assessing the outcomes that were generated on the three levels: the outcomes for the actors and the innovation network in which they operate, refered to as the Living Lab constellation (macro), the outcomes for the instigators of innovation projects taking place in these constellations (meso), and the outcomes in tems of user contribution related to the methodology and research steps in these projects (micro).

References chapter 6

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7. FLEMISH LIVING LABS

Within this PhD, we have now arrived at the final chapter before the general conclusions and recommendations chapter. From the previous two chapters on Living Labs, we gathered that a clear conceptualization of Living Labs is still lacking. Some definitions and papers tend to stress the user involvement and User Innovation aspect, others focus more on the multi-actor and Open Innovation elements, while a substantial amount of papers even does not connect to any other literature stream at all. Moreover, despite the fact that Living Labs are around for quite some time, and that Open and User Innovation as frameworks have received a considerable amount of research attention, there is only very few literature linking Living Labs explicitly to either of these, nor is there a lot of research that clearly assesses the added value of Living Labs for innovation development. Katzy et al. (2013) plead for research into the measurement of the efficiency of Living Lab processes and structures in order to modify and optimize the concept, also to legitimate the (EU) research budget which has been used to stimulate the establishment of Living Labs. Moreover, we also illustrated that the Living Labs literature is not consistent nor clear in terms of the level of analysis, which also makes it harder to compare between Living Labs research and practice.

Therefore, within this chapter, we will look into a sample of Living Labs and Living Lab innovation projects, applying our theoretical lens that distinguishes between three levels of analysis (macro, meso and micro), and linking the occurrence of Open Innovation and User Innovation characteristics to the three levels. From these perspectives, we will also assess the (potential) added value of the Living Lab on these three levels by proposing different success criteria. These success criteria enable to assess the impact of variables and characteristics we abstracted from the Open and User Innovation literature and which we will test in an exploratory manner within our studied cases.

On a macro level, the level of the Living Lab constellation, we will look at three Flemish ICT Living Labs that have been established simultaneously in 2010 and which all three have stopped in their original constellation in the course of 2012-2013, and at the composition and modus operandi of iMinds Living Labs, the iMinds division that took over all Living Lab activities based on the experiences of the three ICT Living Labs in which iMinds Living Labs was involved as research partner. We chose these cases for our analyses for two main reasons.

First, as senior researcher within iMinds Living Labs, responsible for methodology, I have been involved in all four Living Lab constellations right from the start and experienced their set-up and eventual decline first-hand. Moreover, I am still in this position at the current iMinds Living Labs constellation. This also allowed me to collect all necessary primary and secondary data by having direct access to relevant documents and people involved in these Living Labs. Second, iMinds Living Labs has played an important role in the Living Labs community and is regarded internationally as a 'best practice' example (Almirall et al., 2012; Dell'Era & Landoni, 2014), something which is reinforced by the fact that iMinds Living Labs also acts as secretary of the ENoLL. Therefore, the availability of rich data, first-hand experiences and the leading role of iMinds Living Labs in the Living Labs landscape warrant the choice for these four cases on the macro level. We will look at these four initiatives from an Open Innovation perspective, perceiving them as (temporary) Open Innovation networks that exchange knowledge. On this macro level, we consider the end-users as one of the actors participating in the Open Innovation network. As user involvement and user co-creation activities occur on the project-level (meso) and on the methodological level (micro), we take a User Innovation perspective on these two levels. However, on the meso level, both Open and User Innovation aspects are taken into account within our analysis, as a Living Lab project consists of different research steps involving end-users, different actors of the Living Lab constellation, and the Living Lab infrastructure. On the macro level we will also look at the Open Innovation processes in the light of the European Paradox, or whether Living Lab stakeholders are able to pursue knowledge exploitation in Living Labs.

Table 31 Living Labs theoretical model

Level	Definition	Studied cases	Analyzed concepts
Macro	Living Lab constellation consisting of organized stakeholders (PPP-partnership)	4 Living Lab constellations	Open Innovation processes Open Innovation network paradoxes
Meso	Living Lab innovation project	21 Living Lab projects	Open Innovation capabilities Degree of user involvement
Micro	Living Lab methodology consisting of different research steps	107 research steps	Real-life context Multi-method

The project and methodological levels, or the meso- and micro-levels, are covered by means of a multiple case study analysis of 21 Living Lab projects that have ran within the four Living Lab constellations and that consisted of 107 research steps. We will look whether the Living Lab characteristics real-life experimentation, multi-method and active user involvement have an impact on the innovation development process. Our studied sample holds all the Living Lab projects that were carried out in the time frame from the start of the three ICT Living Labs until April 2014 when the data collection was finished. Cases that were still in progress are not included, as well as cases for which the instigator did not participate in an interview (only the Okeez project from FLELLAP and the WeePeeTV project from LeYLAb could not be included for this reason) because of the lack of data. Projects where the researcher (as actor in the Living Lab) did not participate (e.g. the LeYLab internal eHealth and Media cases) are also not included because we do not consider these projects as 'true' Living Lab projects, but rather as activities taking place within the Living Lab constellation. For the analysis on the meso level, we take the instigator-perspective, whereas for the micro-level, we take an instigator and researcher perspective, looking at the methodological properties in relation to the perceived outcomes for the instigator. This way, we will put our three-level conceptual Living Labs model to the test.

First, we set the scene by sketching a brief history of Flemish Living Labs and iMinds Living Labs, the Living Lab division of iMinds. After this introduction, we will present the methodology and all of our cases that will be used in the analysis on the three levels. We will do this by first introducing each Living Lab constellation, and then the 21 Living Lab projects that have taken place in these constellations. We will then look into these cases from an Open Innovation prespective (macro level), from an Open and User Innovation perspective at the meso level (project), and from a User Innovation prespective at the micro level (methodology).

7.1 Introduction: A brief history of Flemish Living Labs

Like in the rest of Europe, Living Labs in Flanders started as isolated and small-scale initiatives with different thematic and research approaches, as a result of the European Living Lab predecessors (cf. chapter 5). With governmental support, the first large-scale Living Lab in Flanders was started in 2003 under the name I-City[45], following in the footsteps of other European initiatives that started a few years earlier and that were to become the founding members of the ENoLL like Arabianranta[46] in Finland (established in 1998), and Botnia[47] Living Lab in Sweden (established in 2000). The initial consortium partners of I-City were the Flemish Government, Microsoft, Telenet, Siemens, Concentra, Fujitsu-Siemens, Research Campus Hasselt and IBBT (the former name of research institute iMinds). In 2003 the project started rolling out the infrastructure to build a wireless city in Hasselt and Leuven. Mobile internet, smartphones and WiFi were not common at the given time and one of the goals of the project was to convince people that (mobile) ICT applications can create significant added value. Besides WiFi-hotspots and a mobile application platform, around 750 PDAs (personal digital assistant, the predecessor of the smartphone) were distributed amongst a panel of about 1.100 test users. In July 2004, I-City and its infrastructure became an independent non-profit organization. The rest of the consortium functioned as a partner ecosystem in which partners could contribute applications to be tested by the end-users.

[45] http://www.tietoyhteiskuntaohjelma.fi/ajankohtaista/events/en_GB/1147340579176/_files/76296442071811758/default/pierson_201106.pdf
[46] http://www.openlivinglabs.eu/livinglab/helsinki-living-lab-forum-virium-helsinki
[47] http://www.openlivinglabs.eu/node/125

Looking back, the model and outlook very much resembled Apple's app store, only predating it by two years (see picture).

In 2005, all infrastructure was put in place and I-City as a project was officially launched with the intention to have 4.000 active users the coming four years and to produce several university spin-offs (Vanden Abeele, 2005). In 2006 I-City was also one of the founding members of the European Network of Living Labs (cf. supra).

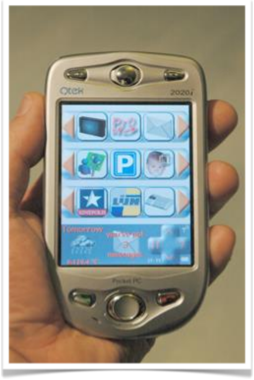

Figure 15: Image of tested devices in I-City

However, by 2008 I-City as an organization went into liquidation because of declining interest of partners willing to test out applications and changing market conditions, such as the appearance of the iPhone and the Apple ecosystem (Dupont & Telen, 2008). The market interest of other companies in co-creating and testing out mobile applications in the I-City constellation was also low, as no 'external' Living Lab projects took place in I-City, only some testing and research activities in larger scale collaborative iMinds (partly funded) projects such as ROMAS[48].

In terms of I-City as an Open Innovation network, this illustrates that a 'dynamic stability' (cf. infra) had not been attained, as the network slowly bled dry in terms of financial resources without generating new projects with actors from outside the network. However, in these two years a shift had occurred within I-City, as because of the low interest of external organizations to test applications in the Living Lab, the management and communication with the test-users was put more to the front, as the panel members seemed to be quite enthusiastic about the project despite the lack of new services[49]. Out of these test users, around 120 users emerged who showed an exceptional enthusiasm towards testing, proposing ideas and developing applications themselves, which were labeled as 'alphas' or 'alpha users' (Delvaux, 2008).

[48] http://www.iminds.be/en/projects/2014/03/13/romas
[49] http://www.iminds.be/en/blog/p/detail/operation-of-living-labs-in-flanders-i-city-and-ibbt-to-merge-into-a-powerful-instrument-at-the-start-of-2009

All technical knowhow and especially the knowhow regarding panel management, together with most of the employees of I-City, were taken over by iMinds and integrated in the newly established separate iMinds Living Labs department, which acted as a facilitator of Living Lab research. This was accompanied by the decision of the Flemish government to appoint iMinds as the coordinator of new ICT Living Lab projects in Flanders in order to avoid redundancy because of its expertise within I-City and in some of its research groups (Moerman, 2006; Ceysens, 2008). The funds that were awarded to I-City initially were also reserved for these new ICT Living Labs, a total of 6.2 million Euro. It was argued that iMinds already covered all of Flanders within its geographical scope and should be able to replicate the local successes of I-City in terms of end-user involvement.

The integration of I-City in iMinds Living Labs indicates an important shift. It was acknowledged by the people and companies active in I-City that the most important asset of the Living Lab was no longer the material infrastructure (the WiFi network, the PDAs,…) but rather the test-users themselves and being able to mobilize test-users for different research steps and setting-up Living Lab projects to help develop innovations. In terms of the literature on **Triple and Quadruple Helices**, this decision can be regarded as an acknowledgement of the importance of the users/citizens as fourth helix by the Flemish policy makers, and of user involvement in general as an essential component of innovation processes.

Based on the lessons learned from I-City and other Living Lab initiatives in which iMinds Living Labs was involved, and with the intention of valorizing the insights and investments made regarding Living Labs, the Flemish government decided to launch an open call through IWT (Institute for the Promotion of Innovation by Science and Technology in Flanders[50]) for ICT Living Labs with iMinds in a coordinating role (Ceysens, 2008). Eventually, this resulted in three different Living Labs, in which iMinds Living Labs had the role of Living Lab facilitator. These Living Labs are the Flemish Living Lab Platform (FLELLAP or Vlaams Proeftuin Platform - VPP in Dutch), LeYLab and Mediatuin. We will discuss the establishment and emergence of these Living Labs more in detail, but first we briefly introduce the structure and organization of iMinds Living Labs, iMinds’ Living Lab facilitator.

[50] http://www.iwt.be/english/welcome

7.2 iMinds Living Labs: iMinds Living Lab facilitator

iMinds is a research institute founded by the Government of Flanders, Belgium, focusing on applications of ICT and broadband technology[51]. It is composed of 21 top-of-class research groups, divided over five research departments, and involves the entire Flemish media and ICT business community. The distributed research institute iMinds unites more than 1.000 researchers from the five largest Flemish universities (Ghent, Leuven, Brussels, Hasselt and Antwerp). There is a central staff of more than 100 people, but most of the researchers are affiliated to iMinds, remaining embedded in their respective research groups and universities. The research includes a.o. technological research on networks, devices and content, together with research on user practices, domestication, usability, adoption, business modeling and regulation. iMinds also focuses on supporting idea owners and businesses to introduce their innovations to the market through training, business bootcamps, seed funding programs, co-working areas, an incubation program, international exchange programs and more. iMinds wants to create a lasting and positive impact on society through ICT innovation. This goal is to be reached through demand driven, interdisciplinary research in collaboration with technology suppliers and users, stimulating entrepreneurship and aiming at research excellence in domains with a high societal relevance. This has led to a large ecosystem of researchers, companies and ICT-related organizations manifesting itself around iMinds. Therefore, iMinds can be considered as an example of **distributed innovation**, as through its various programs, projects and facilitation services it enables the actors in the ecosystem to tap into relevant research and knowledge in order to innovate, with as the eventual goal to position Flanders as an internationally acclaimed ICT region and to develop human capital.

The iMinds division iMinds Living Labs, which was originally called iLab.o, is a test and experimentation facilitator that performs Living Lab research for achieving policy and business goals using stakeholder co-design[52]. iMinds Living Labs is a founding member and secretary for ENoLL[53]. iMinds Living Labs works closely with the Digital Society Department from iMinds, a Business, User and Policy Research collaboration between the Free University of Brussels and the University of Ghent[54]. iMinds Living Labs was selected in the First Wave of European Living Labs in 2006. It has set up and supported a large number of Living Labs in Belgium, ranging from Fibre-to-the-Home Networks, Cross-media labs, service platforms, electric vehicles, etc… At the time of writing, iMinds Living Labs can offer innovators a representative test user panel of over 20.000 users, a dedicated Living Lab back office platform, business model tools and application prototyping expertise. The

[51] http://www.iminds.be/en/about-us
[52] http://www.iminds.be/en/succeed-with-digital-research/living-lab
[53] http://openlivinglabs.eu/livinglab/iminds-ilabo
[54] Only very recently – in the course of 2014 – research group CUO of the Catholic University of Leuven was also added to the Digital Society research department.

concept of iMinds Living Labs is to achieve business and societal innovation related to ICT, using an iterative model of stakeholder co-design. Under the brand name 'iLab.o' it was established in 2005 as a nucleus for Open Innovation activities and as a repository of relevant knowledge and expertise. It sets up, coordinates, facilitates and carries out Living Lab research using various Living Lab settings. The objective is to overcome systemic failures in the innovation process by involving users at an early stage of the development phase, and by creating a trusted environment where small as well as large business stakeholders can meet, and test out innovative products, services and business models.

In practice, iMinds Living Labs sets up medium- to large-scale trials outside the lab environment involving different stakeholders. Within these trials representative users get the chance to test ICT innovations over a longer period of time in their daily, professional as well as private, environment. This allows for researchers to assemble user feedback and to systematically observe, monitor and analyze user behavior in a natural environment. One element makes iMinds Living Labs stand out when compared to most other Living Labs: a panel-based approach. As we gathered earlier in this chapter, this is a direct consequence of the experiences within I-City. When the knowhow and people from I-City merged with iMinds Living Labs, this also included the panel members. As iMinds Living Labs was also involved in other Living Lab projects that also needed test-users, the need for a larger panel arose. As at that moment, the iMinds research group MICT had already conducted two large-scale surveys in order to establish a Flemish media and ICT monitor, the idea popped up to merge this initiative into the Digimeter, with support from iMinds Living Labs in order to recruit a representative sample of the Flemish population to conduct a yearly survey that would allow to monitor evolutions[55]. In order to facilitate panel recruitment, every survey respondent was asked at the end of the survey if they could be contacted for other research activities. As the Digimeter was set-up as a yearly representative questionnaire where respondents were recruited in real-life by iMinds Living Labs's panel management (e.g. in shopping streets, on market places, during music festivals,…), this facilitated a rapid increase in panel members opting in to the iMinds Living Labs Living Lab panel. In order to manage this rapidly growing panel, more technical profiles and developers were recruited to build a panel management tool, labeled as LLADA[56]. (Living LAb Data Aggregator). With these tools, iMinds Living Labs ensures a constant inflow of panel members with up to date data regarding their media habits, adoption of technologies,… etc. Besides these yearly surveys (called Digimeter[57]), all data from Living Lab research is also collected with this tool. This way, the user profiles of the Living Lab panel members are updated every time they participate in Living Lab research. A necessary prerequisite for this panel approach to

[55] http://www.digimeter.be/overons.php
[56] At the time of writing, a new and improved version is being developed, called PanelKit.
[57] www.digimeter.be

function optimally is a rigorous panel management. It can be argued that instead of putting 'the user' or 'the customer' at the center of the innovation process, the Living Lab-approach of iMinds Living Labs puts a well described panel at the center of the innovation process.

The record and experience of iMinds Living Labs are built on a decade of Living Lab pioneering work: from the first Living Lab test of interactive digital television in 2003, over the world-first Living Lab testing of an eReader device with e-ink technology in 2004, to the first national Living Lab television services and Living Lab for interactive mobile medical monitoring in 2007[58]. Mobile smartphone-based services were tested and developed in collaboration with I-City, and this Living Lab, also a First Wave ENoLL graduate, was integrated into iMinds Living Labs in 2009 (cf. supra). More recently, iMinds Living Labs has coordinated the successful Apollon EU Pilot Project (ended in May 2012), is coordinating the EPIC EU Pilot, and participates in high profile projects like SmartIP, the Future Internet PPP-Coordination and Support Action Concord and the new Project SPECIFI, promoting a Creative Ring for enabling Creative Industries. Within the context of our research, iMinds Living Labs was also the coordinator of the three ICT Living Labs that are the subject of our comparative case study, FLELLAP, LeYLab and Mediatuin. The experiences in these Living Labs also had as a side-effect that a lot of SMEs and start-ups became interested in doing a Living Lab project. This resulted in a dedicated team of researchers, business developers and panel managers dealing specifically with Living Lab SME cases. The majority of the Living Lab projects that are studied in this chapter are start-up or SME cases.

7.3 General methodology

As an empirical data gathering and analyzing technique, we used the case study technique, a common method in social sciences to describe and explore poorly understood processes and events. Case studies are especially suited because of their emphasis on detailed contextual analysis of a limited number of events or conditions and their relationships (Eisenhardt, 1989). Yin (1984) defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used. Given the complexity of the studied phenomenon, the multiple levels of analysis (Living Lab constellation, Living Lab project, Living Lab methodology, characteristics of the instigator, knowledge flows, etc.), this research design seems most appropriate.

Within a case study design, careful consideration should be dedicated to the selection of the cases to be included in the analysis (Dion, 2003). We tackled this by analyzing all three ICT

[58] http://www.openlivinglabs.eu/livinglab/iminds-ilabo

Living Lab constellations, together with iMinds Living Labs, and all projects that were finished at the time of writing to which we had first-hand experience as researcher and where the instigator agreed to be interviewed. This makes a slightly larger sample of cases than usual, but this enables also a more quantitative, yet still exploratory, analysis coupled with more in-depth qualitative investigation. Therefore, the case studies are prospective (in which criteria are established and cases fitting the criteria are included as they become available) nor retrospective (in which criteria are established for selecting cases from historical records for inclusion in the study), but can be labeled as comprehensive for the analyzed time frame, from 2010 to 2013, which is in line with the "sustained period of time" criterion for data collection of Shepard (2001). The time frame also allows to include a more evolutionary perspective of the analyzed cases and of the different levels of analysis. To this end, we also included an overview of the historical developments that led to the establishments of the three Flemish ICT Living Labs. This allows to better frame these events and to position the different cases and levels of analysis.

Finally, our study also shows some elements of an action research design (Susman & Evered, 1978) as we participated ourselves in the cases studied as researchers, embedded in real projects and interacting in real-life settings with the different actors participating in the Living Labs and in the Living Lab projects in order to help solving problems and learn from this experience (Ottosson, 2003). This position provided the author with in-depth, rich insights and access to all sorts of data sources. This unique position allowed to constantly shift between reflection and theorizing on the one hand, and actively doing and putting into practice on the other hand.

For our analysis we were able to use a wide variety of data sources as first-hand involved actor in the Living Lab operations and Living Lab projects. We also conducted in-depth interviews with key informants from the Living Lab constellations, and semi-structured interviews with representatives of the 21 instigators of the cases and with the researchers that were active in these projects. A list of all documents, respondents and interview guides can be found in the annexes.

The interview guides were pretested with colleague Living Lab researchers from iMinds Living Labs. The results were also discussed with them. For the analysis of all interviews, we used the technique of affinity diagramming, which originates from the User Centered Design tradition (Beyer & Holtzblatt, 1999) and allows to discover emerging themes and topics in the research data. We did this by extracting quotes from the transcribed interview and grouping quotes that dealt with similar topics. The data from the closed questions were analyzed using IBM SPSS Statistics 21, which allowed to add some quantitative data to the qualitative results, although the sample size (21 cases) remains relatively low. With this methodological design, we were able to identify key cases and outliers in terms of the topics and themes that emerged out of the interviews (Thomas, 2011). This enables us to explore the Living Lab constellations, projects and methodologies both from the theoretical frameworks and concepts from the Open and User Innovation paradigms, but also allows to add to the current understanding and research gaps from both paradigms.

7.4 Case descriptions

In this section, we will describe all the cases that will be subjected to our analysis. We start with the description of the Living Lab constellations on a macro level and subsequently discuss the projects that took place in each of the four Living Labs. For each of these projects, we will also describe the different research steps (micro level) that were taken during the project. In total, four Living Lab constellations are introduced with 21 Living Lab innovation projects and 107 research steps. The description of the 21 innovation projects is structured as follows:

Project name: This is generally the name of the innovation in development or the name of the (start-up-) company.

Duration: Here we give the starting and ending month of the project in the format MM/YY.

Instigator: This is the organization or company that has taken the initiative to start the Living Lab project. In terms of actor role, the instigator is the utilizer of the Living Lab (cf. infra).

Goal: Here we summarize the main goal for the instigator to engage in the Living Lab project, as gathered from the instigator interviews. We discern between the two Open Innovation processes of exploration, or the gathering of relevant new knowledge, and exploitation, or putting knowledge and/or technologies to productive use.

Funding Model: We describe what subsidy system or other source was used to fund the project.

Summary: This gives a general overview of the project.

Methodological overview: By means of a table we describe the different research steps that were taken during the project. Different colour codes indicate specific characteristics of the research steps. This will be dealt with in more detail within the micro level analysis. The research steps in **grey** indicate that no users were involved in this research step. If secondary user data was used (e.g. reusing research data from previous projects), the research step was also marked in grey. Research steps in **blue** indicate user involvement without contextual innovation knowledge being gathered, so-called ‘voice-of-the-customer’ techniques, associated with the ‘innovation for users’-stance (Kaulio, 1998; cf. infra) without any exposure to the innovation itself or to the (envisioned) usage context. In terms of methodology, this can be regarded as a *pre assessment*. The boxes in **yellow** indicate a research step where the user is exposed to the innovation or to a representation of the innovation. These research steps mostly consists of field trials, proxy technology assessments or related research steps, and can include data gathering techniques such as logging, observation or contextual interviews. In terms of methodology, this can be regarded as the intervention. Finally, the **green** boxes indicate gathering user information and knowledge after the exposure to the innovation. In terms of methodology, this can be regarded as a *post assessment*.

Outcome innovation process: Here we indicate the progress that has been made in terms of the innovation development process during the Living Lab project. The first phase indicates the state of the innovation at the start of the project, whereas the second phase indicates the state at the end of the project. This data was gathered from the interviews of the instigators. We discern between the following stages in the innovation development process: *1 idea phase, 2 concept phase, 3 prototype phase, 4 pre-launch phase, 5 launch phase, 6 post-launch phase.*

Outcome Living Lab satisfaction: We summarize the main positive and negative outcomes of the Living Lab project as perceived by the instigator. We gathered these statements from the interviews.

Outcome market: This indicates the current market state of the innovation.

7.5 Flemish Living Lab Platform (FLELLAP) – Vlaams Proeftuin Platform (VPP)

FLELLAP officially started in October 2010, to support the development of innovative information, communication and entertainment (ICE) products and services[59]. Its mission was to boost the valorization of ICE research and development in Flanders and to support joint value creation for all involved stakeholders. FLELLAP is a consortium of several industrial partners (Telenet, Fifthplay, Androme & Alcatel-Lucent) and the **iMinds Living Labs** department.

Telenet[60], one of the major telecom operators of Flanders, was coordinating the initiative. It is a traditional telecom operator that delivers cable television, high-speed Internet access and fixed and mobile telephony services, mainly via their cable network. **Androme**[61] and **Fifthplay**[62] are two innovative SMEs. The former offers high-quality software solutions to large multinationals and SMEs, the latter develops and produces innovative technologies for

[59] http://vlaamsproeftuinplatform.be/en/about-us/
[60] http://www.telenet.be
[61] http://www.androme.be/
[62] http://www.fifthplay.com/

energy management, health monitoring and builds upon the integration of technologies in buildings and cities and is 100% owned by Niko[63], a hardware company. The last named industrial partner, **Alcatel-Lucent**[64], is a worldwide solution and service provider, which also operates the renowed research and development center Bell Labs.

Initially, as was stated in the project proposal, the Living Lab focused on three domains: Smart Cities (FifthPlay), Smart Grids (Alcatel-Lucent) and Smart Media (Telenet), with each partner dedicated to one field and Androme providing technical support where necessary. This way FLELLAP would consist of three Living Lab constellations with each its dedicated infrastructure and a separate panel of test users. However, due to multiple reasons, that will be dealt with later on, this ambition was never realized. No active Smart Grids or Smart Media panel was recruited, while the Smart Cities panel was smaller than predetermined (50 households and 250 end-users). This was mainly because of the lack of clearly defined internal Living Lab projects and also because of shifting goals and priorities among the consortium partners.

For the Smart Media theme, Telenet had initially foreseen to roll out 100 3D TVs for user testing with content and various applications, but after FLELLAP had started, it was decided internally that 3D was no longer a priority for Telenet, something which was announced during the first steering committee meeting by a Telenet representative. Eventually, Telenet did an in-house user test with 3DTV, but the size of this project was much smaller than planned and this took place only during the later stages of FLELLAP. As became clear later on in the project (cf. infra), their focus had turned towards other television services, such as the development of a second screen streaming application, YeloTV, together with Androme[65]. This project was carried out outside the scope of FLELLAP, but resulted in a small scale user test with FLELLAP panel members which took place in 2013, near the end of the Living Lab.

Alcatel-Lucent intended to integrate its testing laboratory for energy monitoring applications, but around the time FLELLAP started, an internal company re-orientation, imposed by the international management, caused less commitment towards the Smart Grids theme and towards exploiting this technical lab. As for the Smart City theme, FifthPlay took care of 50 tablets and gateways that were preconfigured to run the InCitys platform that was developed by FifthPlay, but in the meantime FifthPlay had also enabled a connection of the platform with a smart plug from its product portfolio which enabled to monitor the energy consumption. This way, FifthPlay also partly covered the Smart Grids topic, which potentially interfered with the leading role of Alcatel-Lucent within this thematic domain

[63] http://www.niko.eu/nlnl/niko/over-niko/niko-group/
[64] http://www.alcatel-lucent.com
[65] http://www.androme.com/index.php/news/35/70/Telenet-lanceert-digitale-tv-over-wifi

(although their focus was exclusively on B2B-applications). In terms of the infrastructure roll-out, only the FifthPlay project needed users, for which 250 people were recruited in the city of Sint-Niklaas, of which 50 were eventually equipped, as it was the intention to roll out extra services from (local) external utilizers on the platform. Telenet also acted as a provider by offering a specific modem (DOCSIS 3.0 modem) and free internet to the participants of the field trial. However, the collaboration between Telenet and FifthPlay could not be considered as successful, as FifthPlay looked at Telenet as a potential competitor (service deliverer, cf. infra). It is worth mentioning that the tablets were preconfigured to run the InCitys platform and could not be used for other applications, something which was not the case in LeYLab (cf. infra).

As in terms of panel recruitment and user research not much activity was planned, the researchers and the panel managers decided to build a larger panel that could be used when external utilizers would come to FLELLAP to initiate Living Lab project. This was realized by conducting surveys on fixed time intervals that covered different aspects of the three thematic domains. This way, one larger panel of 2.015 users was built up, allowing for data gathering and profiling of this user panel for external Living Lab projects. By doing this FLELLAP re-positioned itself towards a panel-based Living Lab in which the end-user became the major asset. Besides the smaller Telenet projects with 3D TV and YeloTV, this panel was used in three external cases in the Smart Media domain: Fietsnet, MuFoLive and OKEEZ. As we could observe in chapter 5 in the ENoLL analysis, FLELLAP applied for membership during the fifth wave and is still listed as one of the 21 effective members to this date, despite the fact that the Living Lab constellation ceased to exist in the course of 2013.

The internal Telenet cases are not covered in our case analysis as the results and tests were for the most part an internal Telenet matter. The Okeez case is also not covered because we had no first-hand experience in this case and because we were not able to schedule an interview because the company had moved to the United States. The other three cases, InCityS, Fietsnet and MuFoLive, will be covered in the project analysis.

7.5.1 FLELLAP innovation projects

InCitys

Duration: 10/11 – 12/12
Living Lab: FLELLAP
Instigator: Fifth Play(SME - Subsidiary of the Niko Group)
Goal: **Exploitation** of the InCitys platform and potential related applications

Funding Model: internal FLELLAP project

Summary: FifthPlay is a Flemish SME and a wholly-owned subsidiary of the Niko Group and was the instigator of the InCityS project. Therefore, it is both an SME and (part of) a large company. The innovation consisted of a virtual network that is intended to bring the local community (residents, local traders, regional press, local government, civil society and associations) in Sint-Niklaas closer together in a very easy way. InCityS was a partnership between the city of Sint-Niklaas, Fifthplay and the Flemish Living Lab Platform. Therefore, multiple actors of the ecosystem surrounding the innovation were active partners of the project. The platform was rolled out in Sint-Niklaas in 50 homes, with 250 test users and 25 traders testing the platform for a longer period of time. The heart of InCityS was a digital touch screen (including iPad) that is positioned in a central location in the home (kitchen, living room). Using this touch screen, the inhabitants of Sint-Niklaas were able to access personalized news reports and weather information. Traders, associations and service providers were to offer their products and services directly to the occupants through this same touch screen. Finally, the energy use in the home (electricity, water, gas) was also monitored so that the occupants would be more aware of their consumption and use energy more efficiently, and so reduce their environmental impact. Therefore, the innovation can be seen as B2B2C, as both intermediary partners (shops, service providers,…) as citizens are users of the platform. This 'complexity' can also be seen as the reason for the ecosystem involvement in the project, coupled with the 'complexity' of the roll-out of the application in a field trial-setting, as without sellers and traders, the platform has much less to offer to the citizens and vice versa. During the field trial, some surveys were held and a co-creation session took place. After the field trial, a validation survey was held. Instigator FifthPlay mentioned they learned a lot from the field trial, which showed for example that they were initially targeting the wrong population. Instead of elderly people, that appeared to be enjoying going out for shopping, young families with children were a more suiting population. However, the field trial itself suffered from technical issues and from a lack of shops and local retailers being present on the platform.

Methodological overview:

FifthPlay	Survey end-users	Long term field trial	Logging and occasional surveys	Focus group	Post-survey

Outcome innovation process: 2 - 6

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Added value	Open Innovation with other Living Lab actors did not work
User's active participation	

Outcome market: At this moment, there is a commercial version of the platform available called Nuvonet, but this has not been a big market success. The project also resulted in a strategic partnership with Electrabel and the market launch of the so-called Smartbox, based on the smart plugs that were tested during the field trial. This service offering was launched accompanied by a large marketing campaign and appears to be a moderate success.

Fietsnet

Duration: 12/11 – 04/12

Living Lab: FLELLAP

Instigator: Fietsnet (not-for-profit organization)

Goal: **Exploration** of the potential of a mobile application

Funding Model: None, this case was carried out 'for free' with research resources from FLELLAP

Fietsnet is a not-for-profit organization that hosts an online platform consisting of a map of Flanders containing all biking routes included in the so-called 'Knooppuntennetwerk'. Every node in this network has a unique number which makes it possible to plan a trip from location A to location B by following a set of node numbers. On the Fietsnet website it is possible to plan these kind of trips as the optimal route is calculated between two or more locations. However, Fietsnet is only available through this website, while this is not an optimal channel to consult while biking. Therefore, Fietsnet wanted to investigate the potential of a mobile application. The current 'habits & practices' were taken as a starting point to assess the potential and the 'needs & wants' regarding a mobile application of Fietsnet. Within this project, which ran in the FLELLAP, a survey was held, followed by a segmentation of the current Fietsnet users. Based on this segmentation, co-creation sessions were held and mock-ups were created together with users. However, the instigators were not involved at all during the project, as the results were only presented to them after all research activities had been carried out. This makes Fietsnet an outlier case, as besides no actor of the ecosystem being involved in the project, even the instigator itself did not have any say whatsoever in the research activities. This can partly be explained by the genesis of the project. As there were no external projects running at this moment, and there were no immediate prospects for other projects, the FLELLAP researchers took the initiative to start this project 'for free' in order to demonstrate the Living Lab methodology and to activate some of the panel members. However, the researchers also decided to carry out the project by themselves without much involvement of the instigator, which resulted in the outcomes being hard to understand and implement for the people of Fietsnet.

Methodological overview:

Fietsnet	Survey end-users	Co-creation with end-users	Persona segmentation

Outcome innovation process: 2 –2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Interesting concept	Lack of communication between Fietsnet and the research partner iMinds
Close to market	Management of expectations
Results	Sharing information and of panel members
	No collaboration with Telenet was possible to develop the ideas

Outcome market: At this moment, Fietsnet is still in the shape as it was before the Living Lab project. The idea for a mobile application still exists, but lack of resources and funding have resulted in no further action being taken.

Mufolive

Duration: 01/13 – 04/13

Living Lab: FLELLAP

Instigator: SampleSumo with MuseScore as a supporting provider

Goal: **Exploration** of the potential of the MuFoLive collaborative concept

Funding Model:

The MuFoLive project wanted to explore the possibilities of combining the technologies of two innovative Flemish start-ups in the domain of music, musicians and score following: MuseScore (digital music scores) and SampleSumo (audio following and recognition technology). The project was initiated by the latter. The idea was to combine these technologies to allow an automated score following system for live performances of musicians. This was enabled by first conducting a survey amongst musicians, followed by a single field trial with a prototype, accompanied by an observation. Afterwards, a focus group was held and a closing event with stakeholders and a demonstration took place. This project was carried out in the FLELLAP Living Lab and because of the collaboration of another start-up, one actor of the innovation ecosystem was involved as a partner. The MuFoLive concept was received well by the musicians and the field trial was successful, but the results also indicated that the business potential was too low to build a sustainable business on short notice.

Methodological overview:

MuFoLive	Survey	One time field trial with observation	Focus group	Closing event with stakeholders

Outcome innovation process: 3 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Collaboration with different actors	-
Funding Mechanism	
Networking	

Outcome market: At this moment, the SampleSumo company, the main instigator of this project, is reduced from three to one single person running it and is looking for additional funding or venture capital to continue its operations. Therefore, this project is on hold at the moment.

7.6 LeYLab

LeYLab, abbreviation of "Light and You Lab", started in September 2010 for a total duration of two years as a response to the public call for ICT Living Labs as described previously. The infrastructure was operational by July 2011 and located in two geographical restricted areas (city areas Buda and Overleie) in the city of Kortrijk. By building a Living Lab environment for Next Generation Access (NGA), based upon fibre, testing innovative applications and services was made possible, as fibre-to-the-home (FttH) offers unprecedented testing facilities in terms of bandwidth and quality of service. Therefore, the goal of LeYLab was to stimulate innovation and to measure the potential of new services for the personal lifestyle and living environment of the test users. Initially, LeYLab focused on three thematic domains: Multimedia, eHealth Homecare and Gaming. However, the third topic was never developed because of issues with the OnLive streaming games platform[66] that was going to be tested in LeYLab, but that suffered from severe delays until it was suddenly launched in July 2012[67] without any testing in LeYLab.

The initial aim was to connect 300 addresses to the network. Eventually, LeYLab disposed a core panel of 292 users for a total of 115 connected addresses. Besides 98 households there were also 17 local organizations (e.g. schools, shops, companies,...) connected. Amongst the panel members, 43 test users were provided with a Samsung Tablet and 36 with a miniPC

[66] http://www.onlive.be
[67] http://www.zdnet.be/fun/141852/belgacom-lanceert-gamingdienst-onlive/

which allowed to consume services on the flatscreen of the test-user. Contrary to the tablets in FLELLAP, the LeYLab devices were completely open to any usage by the panel members.

In order to set-up the Living Lab innovation network, a consortium of eight private partners was composed with three public organizations and one public authority. Compared to FLELLAP and Mediatuin, this was clearly the largest and most complex consortium, also because of the thematic use cases. Therefore, when discussing the stakeholder roles within the Living Lab, we will do this separately for the general operations and for the two thematic use cases.

Alcatel-Lucent[68], a multi-national technology company who was also active in FLELLAP, although its actual contribution there remained low, took the project lead and provided the necessary equipment for the in-home usage of the fibre connection (modem, router,…). They were also responsible for the monitoring of the network (logging) and for the integration of all services and devices within the network. The Living Lab manager was also from Alcatel-Lucent, but unlike in FLELLAP, he was not an external consultant but a full-time employee. **Belgacom**[69], the largest telecom provider in Belgium, deployed the fibre infrastructure and supervised the network. This was facilitated by the **city of Kortrijk**[70] who enabled the permits needed to install the network, started the communication loop with the potential test users and engaged local stakeholders for the Living Lab initiative. All research activity, panel recruitment and panel communication was executed by **iMinds Living Labs** from the **iMinds** research institute. These four parties were active in both thematic domains and can be considered as responsible for the general Living Lab operations. Regarding the deployment of the network, a necessary precondition for all Living Lab operations and eventual Living Lab cases, this took more time than expected. Time and effort for convincing people to participate and for effectively putting the fibre in the ground and installing the necessary devices in the homes of the users were underestimated by the consortium partners.

The other actors from the consortium could be allocated to one of the thematic domains, as they were involved in one of the two thematic projects that were predefined before the Living Lab was set-up. These projects were meant to provide applications to the test users, so they could start testing, and as showcases to attract external utilizers to the Living Lab. Zeticon[71] (small university spin-off with media asset management system), Videohouse[72] (medium-sized AV technology provider, medium-sized company) and Focus WTV[73] (medium-sized regional broadcaster, SME) were gathered to set-up an innovative media database allowing to

[68] www.alcatel-lucent.be
[69] www.belgacom.be
[70] www.kortrijk.be
[71] www.zeticon.com
[72] www.videohouse.be
[73] www.focus-wtv.tv

share and archive multi-media content through the fibre network. Androme[74] (medium-sized ICT support, also active in FLELLAP), In-Ham[75] (small public sector organization concerning eHealth), U-Sentric[76] (medium-sized university spin-off offering usability testing), OCMW Kortrijk (public health organization from the city of Kortrijk) and Televic Healthcare[77] (medium-sized eHealth technology company) were involved to develop the eHealth thematic side of the Living Lab by enabling remote communication through the TV or other devices between healthcare workers and people in need of healthcare.

However, besides the slow deployment of the Living Lab infrastructure, both use-cases also suffered from various other difficulties. These resulted in the media case being up and running only during the final months of the Living Lab, although this offered a thorough technical testing which provided valuable input for Zeticon's media asset management platform Mediahaven[78]. This included a technical test with Barco and the Budascoop (a local movie theater that was also connected to the FttH-network), and a field trial with the city of Kortrijk, all with the support of Alcatel-Lucent and Belgacom. However, no user research was carried out in these tests so the researchers and panel managers were not involved. Despite the difficulties encountered, at this moment Zeticon offers three distinct Mediahaven services to customers (the city of Kortrijk is among their customers) and is also active in the European Specifi-project (cf. infra). The eHealth use-case also suffered quite some difficulties, but these had a more severe impact on the outcomes. The television calling system was not implemented at all because of difficulties integrating the solution with the fibre infrastructure and because of the lack of panel members who were targeted by the solution (people requiring daily home care). There is also no sign of this technology in the current product offering[79]. However, the eHealth thematic use-case did result in a further exploitation of the infrastructure through the European Care4Balance-project[80], which includes Televic Healthcare, Alcatel-Lucent and iMinds as Flemish research partners and LeYLab as infrastructure partner for recruitment and testing.

The aforementioned issues regarding the internal Living Lab projects also affected the generation of external Living Lab cases as the lack of cases and research material made it hard to convince external utilizers to come to the Living Lab. Therefore, the researchers defined some smaller internal projects to activate the panel members and to test co-creation methodologies. Eventually, three external Living Lab cases ran in the Living Lab: Poppidups (a virtual puppetry application playable online with cards containing a unique QR-code),

[74] www.androme.com
[75] www.inham.be
[76] www.usentric.be
[77] www.televic-healthcare.com
[78] http://www.mediahaven.com/
[79] http://www.televic-healthcare.com/en/product_families
[80] http://www.care4balance.eu/content/project-overview

Cloudfriends (a network optimization application that also included WiFi configuration based on user feedback) and WeePeeTV (an over-the-top streaming TV application). In all three cases users were involved in testing, evaluating and co-creation of the innovative applications. CloudFriends and WeePeeTV will not be discussed because at the time of conducting the instigator interviews, the CloudFriends case was not finished yet and WeePeeTV had gone bankrupt and was not available for an interview. Because of the lack of user research in the eHealth and MultiMedia internal cases, these are also not considered in the case based analysis. We have included a final internal case, labeled as Belgacom OnCloud, where a cloud-application was tested and validated within the LeYLab user panel and beyond, instigated by consortium partner Belgacom.

LeYLab also applied for membership during the fifth wave and got accepted as member of ENoLL. At the time of writing, the FttH network is still up and running and the test-users still have all equipment, but officially the LeYLab Living Lab has ended in 2013. The infrastructure is also active in the European project Specifi[81] with the city of Kortrijk, Alcatel-Lucent, Belgacom, Zeticon and iMinds as project partners, and in the European project Care4Balance[82] with iMinds, Televic Healthcare and Alcatel-Lucent.

7.6.1 LeYLab innovation projects

OnCloud: 03/12-07/12

Instigator: Belgacom

Goal: **Exploration** of the potential of a cloud service

Funding Model: Own resources

Within this project, that ran in the LeYLab Living Lab, the large Belgian telco Belgacom wanted to explore the potential and user interest in a cloud service. Besides this, Belgacom also wanted to assess the quality of the cloud application provided by an external developer. Users were involved through an intake survey with adoption potential assessment, a co-creation session, a field trial and a post assessment survey. During the field trial, test-users received additional data bundles and smartphones to stimulate the (mobile) usage of the cloud service. There was also a dedicated online feedback forum for test-users, which was not used very often. For the recruitment of end-users, the LeYLab panel was used, but there was also a call for participation launched beyond the LeYLab panel. The other LeYLab infrastructure was also not explicitly used, so the actual connection to LeYLab was rather low. Belgacom funded the case with own financial resources. No other actors from the ecosystem were involved in this case, not even the external developer of the application.

[81] http://www.specifi.eu/
[82] http://www.care4balance.eu/content/project-overview

Instead, during the co-creation session, the people from Belgacom that were present introduced themselves as the developers of the application in order to allow the participants to talk freely regarding telcos. After the project, it was not clear what happened with the results of the project, as Belgacom did not communicate this to any of the LeYLab partners, but eventually, by the end of 2013, Belgacom launched a cloud service for its customers[83].

Methodological overview:

Belgacom OnCloud	Survey	Field trial	Online feedback forum	Co-creation with testers	Post survey

Outcome innovation process: 2 - 3

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Applicability of the panel of families	Panel was limited in size
	Limitation of financial resources

Outcome market: At this moment, Belgacom offers its own cloud service to its customers. The developer of the current application is not the same as for the field trial application, as a lot of issues and problems surfaced during the testing.

Poppidups – 10/12 – 02/13

Living Lab: LeYLab

Instigator: Prophets

Goal: **Exploration** of the market potential of the Poppidups concept

Funding Model: KMO Portefeuille

The Poppidups-project concerned a virtual puppetry-show where puppets came to life on a screen by moving a playing card with a QR-code in front of a camera. The game was developed by Prophets, a digital marketing agency, and fell beyond the scope of the core activities of the company. The idea originated from some of the employees and the CEO of Prophets because they felt the need for more ‘play’ without ‘goals’, as a reaction against the contemporary competitive nature of (digital) gaming. Each movement performed with the figure in front of the webcam is followed by the character on the screen. The ‘plays’ performed by the children can also be recorded and shared on YouTube, and there is also a

[83] http://www.belgacom.com/be-en/newsdetail/ND_20131121_Cloud.page#.VGUjjPnF_jY

possibility to play together online. LeYLab was chosen as Living Lab because of the logging possibilities and also because the LeYLab manager made the first contact with Prophets.

The research steps consisted of a user survey with adoption potential estimation, a usability expert review by one of the LeYLab consortium partners (acting as a provider in this project), and an exploratory co-creation session regarding the current habits and practices of parents and their children's playing behavior, followed by a demo of Poppidups with the possibility to give feedback. The co-creation session was held with users from LeYLab, but the survey was also spread through other channels to gather more responses. The outcomes of these research steps were taken into account and resulted in an improved beta-version being rolled out for the field trial. Users from LeYLab and other users that had filled out the survey were invited to participate and received playing cards and a login account. After some weeks of testing, a co-creation session was held with test-users (also mostly from LeYLab) and a post assessment survey was sent to all testers. The project ended with a separate field trial in a local school from Kortrijk to assess the potential of Poppidups in this setting, with a co-creation session after a few weeks of testing. Besides this final step, no other ecosystem actors were involved. This was also partly intentional, as they wanted to stay under the radar in order not to be copied by larger players.

The most important results of the Poppidups project were that there is some interest and enthusiasm for the innovation, but the willingness-to-pay is rather low and the foreseen age range was smaller than expected. The Living Lab resulted in abandoning their initial B2C ambition, as the user interest and willingness-to-pay appeared to be lower than expected. A B2B-approach might work, and was something which Prophets wanted to pursue, but not without losing sight of their current business.

Methodological overview:

Poppidups	Survey user	Usability expert review	Co-creation session	Field trial users	Co-creation testers	Post assessment testers	Field trial school	Co-creation school

Outcome innovation process: 3 - 3

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Detailed feedback	Limited amount of testers
Interesting groupsessions	Limited amount of loggings

Outcome market: As there are still almost no resources available to explore this B2B strategy, the whole project is on hold at the moment.

7.7 Mediatuin (Media garden) Living Lab

Like the other two ICT Living Labs, the Mediatuin Living Lab constellation (translates something like 'media garden') was established in October 2010. Compared to the other Living Labs, Mediatuin was significantly smaller in terms of funding, but it had a more delineated focus on cross media formats and innovations, with special attention for radio and music related innovation. This can be explained by the outlook of the consortium. The lead was taken by **REC Radiocentrum**[84], a NGO dedicated to the education and coaching of young media talent with a focus on radio and audio visual content creation. Other than REC, the consortium consisted of three industrial partners: the SME **SonicAngel** (a music label working with a crowdfunding platform), **Netlog** (at that time a very popular Flemish social network site, especially amongst teenagers, has now evolved into Twoo, a dating site) and **Telenet**[85], the Flemish telco that had the lead of FLELLAP. Research partner was **iMinds**.

As main 'infrastructure' Mediatuin recruited a dedicated panel with a large-scale survey on all kinds of radio and music related topics. In total, this resulted in a dataset of 7.216 people with 2.057 end-users agreeing to be involved in Living Lab projects. Special attention was dedicated to the content of the intake/profiling survey by gathering input from all consortium partners. This way, the results would generate knowledge that was of interest for everyone involved in Mediatuin. Moreover, this clear thematic focus would allow the data and findings to be (re-)used in external and internal Living Lab projects. Besides the data reports being spread and presented on various occasions, the Living Lab manager from REC and the main researcher from iMinds also engaged in extensive business development activities, this way also capturing the market needs in terms of research and innovation development. This approach clearly worked, as after a year, the first two external projects were initiated (Streemr and Jukebox21). Both projects dealt with music innovations, so the 'data infrastructure' could be used within these cases. The Kianos and Future Legends cases were also in the same thematic domain, but the other Mediatuin Living Lab projects (Planza, Qwison, Hoaxland and La Mosca) steered away from these topics. Within these projects more emphasis was put on the Living Lab methodology, based on the outcomes and examples of the first projects, and on the funding schemes that could be used within a Living Lab project. This appeared to be a major lesson learned, as it was believed that for each 'theme' a separate panel was needed (cf. supra). The fact that the majority of the external cases did not fit the initial Mediatuin theme suggests that they were attracted to engage in a Living Lab-project for different reasons. This also became apparent in the FLELLAP and LeYLab Living Labs, as despite the presence of a specific infrastructure and thematic panels, only few external cases could be attracted. We will dig deeper into this when discussing the

[84] http://www.radiocentrum.be/
[85] www.telenet.be

iMinds Living Labs Living Lab constellation and also when analyzing the Living Lab projects on the meso level (cf. infra).

Besides these external projects, only one internal project was successful: the SonicAngel case. This project was carried out by the iMinds researchers (who also used students) and REC as panel managers, but with no involvement of the other Mediatuin actors. The outcomes served as input for the business development activities, and also facilitated convincing the first instigators of external projects. Because of a lack of interest of top management within Telenet for digital radio through IDTV, the intended internal case never took place, despite the user interest that appeared from the survey data. The Netlog case regarding community radio also failed because at the time Netlog's popularity started to fade, priorities were set differently. This led to the daily Living Lab operations taken care of by only two consortium partners: REC and iMinds. It is striking that in Mediatuin, the external projects were much more successful than the internal projects, where this was completely the opposite in FLELLAP and LeYLab. After a little more than two years, Mediatuin as a brand disappeared and the modus operandi was embedded within iMinds Living Labs, with as the most noticeable exponent the Living Lab manager being hired as full time business developer for all national Living Lab activities by iMinds Living Labs.

7.7.1 Mediatuin innovation projects

Future Legends - 09/11 - 06/12

Living Lab: Mediatuin

Instigator: REC (not-for-profit organization)

Goal: **exploration** of urban youngsters media behavior in order to create specific media formats targeted to them

Funding Model: Own resources of the partners + Mediatuin project budget

The Future Legends projects was a collaboration between the city of Ghent, Digipolis, REC and iMinds and was conceived within the Mediatuin Living Lab. This way, the ecosystem surrounding the innovation participated in this project. The goal was to explore the media behavior and the needs and wants of the so-called 'urban youngsters', as previous research had showed that they did not find their preferred music and other media content in the 'traditional' media channels. The idea was to create a media format or other offering that would meet the needs of this target group. For urban youngsters, initially the following criteria were defined: Dutch is their spoken language and the Urban Music perception and culture are central to their lives. These young people are often low skilled and mostly, but not exclusively, of immigrant origin. To this end, a dedicated panel of urban youngsters was recruited and surveyed in the cities of Ghent, Antwerp, Genk and Mechelen. Concrete objectives of this project were to get to know these urbans better, let them participate in the media production process and this way try to reach a larger group of urbans with a co-created media format. Besides the data from the Flemish urban panel, the following research activities were held in Ghent: a kick-off event to get the name 'Future Legends' known amongst the target population, workshops embedded in their lifestyle (the topics came out of the intake survey) with observation, a media diary study, a cultural probe research and a closing event with observation, featuring performances of urban youngsters with skills they learned in the workshops (such as DJ'ing, producing,…).

Methodological overview:

Future Legends	SotA ecosystem & user	Expert interviews	Survey	Workshops with observation	Media diary study	Cultural probe research	Closing event with observation

Outcome innovation process: 2 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Reaching the target group	Government related delays
Researcher understood the target group	Composition of the radio brands in the survey
Flexibility of iMinds	

Outcome market: On the market. Driven by REC, an urban crowdsourced radio station was established: Chase (http://www.chase.be/). This initiative was based on the results of the Living Lab research which showed that urban youngsters were looking for a platform to demonstrate their skills and talents, and that in terms of music they did not find what they were looking for in the current media landscape. Chase tries to fill this gap by giving young urban talent a chance in the different radio shows and also uses a cross media format. Very recently, a collaboration with local television broadcaster AVS (who also did a project with Mediatuin) has been announced in the form of ChaseTV[86].

SonicAngel – 10/11 – 12/11

Living Lab: Mediatuin

Instigator: SonicAngel (SME)

Goal: Exploration of mobile extension of the SonicAngel platform and strengthening the market position.

[86] http://www.avs.be/doe-mee/chase-tv

Funding Model: Mediatuin project budget

SonicAngel is an SME that has an online crowdfunding platform for music bands and also acts as a label for the bands that get funded through this platform. As the number of fans actually participating and engaging in crowdfunding is still rather limited, SonicAngel wanted to explore how they could optimize their platform and what strategies could be used to strengthen their market position. This case was an internal Mediatuin project, so it was funded through the internal Mediatuin budget.

For this project students were used to carry out the research activities. With the extra manpower, the whole ecosystem surrounding music crowdfunding was involved in some way, from concert promoters, musicians, music experts, to fans. However, none of the actors from the ecosystem participated in the project as a 'partner', they were only used as respondents. This was done with a SotA and segmentation based on the Mediatuin dataset, a user survey, user interviews, ideation sessions and stakeholder interviews. This resulted in a video prototype of a new mobile application being developed. Interestingly, the students took two different roles in this project. They were both researchers, carrying out all research activity and analyzing the data, but they also acted as users or subjects of the research, as they actively participated in some sessions and interviews. This was possible because of the large group of students involved in this project (20) and because students were also a targeted user group for SonicAngel.

Because of the quite radical and disruptive output of the Living Lab project, the development of the new SonicAngel platform took way more time than expected. SonicAngel also wished to explicitly tackle all issues and recommendations. Therefore, the launch of the new platform has been postponed.

Methodological overview:

SonicAngel	SotA market & user	Segmentation users	Co-creation users	Interviews users	Stakeholder interviews

Outcome innovation process: 6 - 2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Input from different actors	Adjustments exceeded the predetermined available time

Outcome market: At this moment, according to the website the new site is still to be launched 'soon'.

Streemr – 01/12 – 04/12

Living Lab: Mediatuin

Instigator: Streemr (Start-up)

Goal: **Exploration** of user feedback with regards to a solution for recording radio programs

Funding Model: KMO Portefeuille

Streemr is a start-up from a serial entrepreneur that provides a solution for recording radio programs through a cloud based recording application. The recordings can be played on multiple devices and can be downloaded or streamed directly from the cloud. At the start of the project, Streemr was exclusively intended for a B2C-market.

As one of the first 'paying' projects, also running in Mediatuin, this turned out to be a rather straight-forward Living Lab project. No other ecosystem actors were part of the project. First, a State-of-the-Art segmentation was made based on the Mediatuin intake survey. This was followed by an online survey regarding radio and music habits and practices, also assessing the adoption potential through the PSAP-method. Next, all participants of the survey were invited to test a minimum viable product that was developed based on the results so far. Based on user feedback and some technical issues that arose during the field trial, Streemr was adapted.

Methodological overview:

Streemr	SotA market & user	Survey	Field trial with logging	Co-creation with testers

Outcome innovation process: 2 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
User insights & user contacts	Unable to predict Streemr's possible future directions
Confirmation of results	
Final presentation	

Outcome market: Currently, there still is no full blown market launch of Streemr, although the service is still available in silent beta to be used. However, at the time of writing, a follow-up project is being scheduled in order to prepare an international launch, but the focus has shifted towards B2B instead of B2C, as Streemr is now intended as a solution for smaller radio stations to offer an online on demand functionality.

6. Jukebox21 – 02/12 – 6/12

Living Lab: Mediatuin

Instigator: Jukebox21 (Start-up)

Goal: **exploration** of the idea of a jukebox system that better fulfills the needs and expectations of the music consumer through technological innovation

Funding Model: KMO Portefeuille

Jukebox21 was a start-up that wanted to develop a jukebox system that better fulfills the needs and expectations of the music consumer through technological innovation of the 21st century. Their innovation consisted of a modern variant of the classic jukebox through a mobile application and a physical touchscreen device through which the bar visitors can request and queue songs for a small fee. As the systems was intended to be sold to bar tenders so that every bar had its own specific playlist to choose from, this can be labeled as a B2B2C model. However, no other ecosystem actors were involved in the project. This was because Jukebox21 chose to tackle the pubs and bartenders themselves, so this project exclusively focused on the end-consumer. Because of the music theme, the Mediatuin was chosen as a Living Lab to carry out this project. This project was conceived around the same time of the Streemr project, and both used the KMO Portefeuille funding[87], which was also the first time it was used for Living Lab projects. The idea to do this was proposed by an innovation advisor from Innovatiecentrum Gent[88], an organization funded by IWT to help companies find their way through the subsidy mechanisms. In a later stage, this organization also referred a lot of companies to iMinds Living Labs because they were convinced that this approach could help some of the companies that consulted them.

In the Jukebox21 project, data from the Mediatuin survey was used as a basis for the definition of some profiles that could be mapped on the concept. A competitor analysis was made and potential end-users were surveyed, also assessing the adoption potential and the willingness-to-pay. These results were further elaborated in a co-creation session.

The Living Lab project gave valuable feedback to the instigator and showed that there was an interest amongst end-users to use the system and that there was a willingness-to-pay. After the project, a proposal was made for a follow-up Living Lab project which included extensive field trials and A/B testing designs in order to clearly delineate and finetune Jukebox21 and the adequate pricing strategy. However, before the follow-up project was setup, the content provider of the Jukebox21 system went bankrupt. The people taking care of the take-over were able to save the company, but did not show interest in the Jukebox21 project.

[87] http://www.agentschapondernemen.be/artikel/wat-de-kmo-portefeuille
[88] http://www.innovatiecentrum.be/contact/gent.html

Methodological overview:

Jukebox21	SotA market & user	Survey	Co-creation users	Business model analysis

Outcome innovation process: 2 - 3

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Limited amount of resources needed	Reliability
Methodological foundations	A need for more discussion moments
Online surveys as a quick way to check and validate some premises	
Networking	

Outcome market: The Jukebox21 project was stopped and the involved entrepreneurs parted ways to pursue other goals.

Qwison – 09/12 – 12/12

Living Lab: Mediatuin

Instigator: Aconos (SME)

Goal: **Exploitation** of the services of Aconos as a consulting firm and of the project idea

Funding Model: KMO Portefeuille

Qwison is a concept that wants to unite a customer loyalty program for local shops and a location-based restaurant information system. This concept was thought of by the SME Aconos. Through the Qwison platform, customers of local shops can gain loyalty points and exchange them for restaurant visits. The system is aimed at reducing the number of loyalty cards customers have on them and wants to allow local shops to participate in a shared loyalty program. Moreover, the system also allows for restaurants to post their 'daily specials' and gain more customers. Qwison is also aimed at using social network sites for recommendations and sharing of experiences. This can be labeled as a B2B2C concept, and was the first Mediatuin case that went outside of the 'music' domain. This case was the result of the business development approach of Mediatuin that dedicated more and more attention to the methodology instead of on the infrastructure.

The main goal of the Living Lab project was to study the whole ecosystem in which Qwison would function, with the intention to reveal the right use cases, triggers and values for all target groups concerned. This was necessary because of the complexity of the concept.

However, no other actors were directly part of the project as partner, they were only surveyed or involved during different research steps. Also, the methods being used to survey the 'business users' were similar to the regular user, but this appeared to be more time-intensive (e.g. surveying local shopholders by tablet).

First a SotA was held regarding the user and a competitor analysis was made. This was followed by a user survey and surveys with crucial stakeholders (restaurants and local retail). This enabled comparing the adoption intention of these three groups. After this step, experts were interviewed and a stakeholder co-creation session was held, concluding the project with a business model workshop by an iMinds expert. Based on the Living Lab-project, the instigator got an idea of the interest of the different users and stakeholders in the Qwison-ecosystem. Especially the end-user/customer was interested in the Qwison-concept. However, results for the restaurants and shop holders were less satisfactory. After the project, the instigator looked for partners to realize Qwison, but did not succeed to attract partners or extra funding.

Methodological overview:

Qwison	SotA market & user	Survey users	Survey stakeholders	Expert interviews	Stakeholder co-creation	Co-design session	Business model workshop

Outcome innovation process: 1 - 2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Understanding of the partners	'Next steps: what's next' missing
Funding mechanisms	
Market confrontation	

Outcome market: At this moment, the company Aconos itself is on hold.

La Mosca – 9/12 – 2/13

Living Lab: Mediatuin

Instigator: La Mosca (SME)

Goal: **Exploration** of the possibility of a new business model through a self-owned platform offering the La Mosca city games

Funding Model: IWT Feasability study

La Mosca is a Flemish SME that started providing location based games, also called citygames or GPS games, in 2007. These games were played on borrowed devices that contained the game, which led them to use event organizers to sell their games. However, as more and more people started to own smartphones and tablets that were suited to play these games, La Mosca saw an opportunity to eliminate this intermediary and offer their games directly to end-users through a platform and an app. However, this shift in business model also held some technical and user acceptance risks, as the dedicated control person was eliminated from the equation. Therefore, La Mosca wanted to validate and test their future offering of smartphone games with end-users in a real-life setting. This project was carried out in the Mediatuin Living Lab and was a result of the specific IWT call for feasibility studies making use of the ICT Living Labs. Because of the large media panel, this Living Lab was considered to be the most compatible.

The project started with a SotA regarding the user and a competitor analysis. This was followed by a user survey sent out to the Mediatuin panel and was also spread through social media because the response rate from the panel alone was not very high. After the survey, two co-creation sessions were held, together with an expert usability review and a usability labtest with end-users from the co-creation sessions. This allowed to test the user-friendliness of the platform and the clarity of the process to start a game on their own smartphone, an essential characteristic for the innovation. The field trial was held on a Saturday afternoon where a large group of test-users was invited to play a La Mosca game on their own smartphones or tablets. They were collectively guided through the process by the instigator and through observation and interviews after the game, feedback was collected. This field trial was also a technical test of the platform in development. As a final research step, a business modeling session was held. The focus of the project and of the research steps being used was largely on the end-user, whereas a lot of questions were also regarding the business model. Therefore, as main outcomes, the gut feeling of the instigator was confirmed, and some technical issues could be solved. However, most of the business model questions could not be solved, also because no other ecosystem actors were part of or even involved in the project.

Methodological overview:

La Mosca	SotA market & user	Survey	Co-design users	Usability labtest	Co-creation users	Field trial with observation & interviews	Interviews test-users	Business model workshop

Outcome innovation process: 3 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Interaction with the target audience	Limited business model session both in scope, depth of the experts and time
Qualitative research showed: 'go for it'-factor vs. quantitative research confirmatory	

Outcome market: At the moment, the online platform is not publicly accessible yet, but some games of La Mosca are available in the Google Play store. They are looking to expand their business abroad, but most of their time and resources still go into their day-to-day operations, which put this project on hold.

Planza – 10/12 – 09/13

Living Lab: Mediatuin

Instigator: Planza (SME)

Goal: **Exploration** of the user needs and feedback on the Planza application

Funding Model: IWT innovation project

Planza is a young start-up that wants to solve the current frustration of endless back and forth mailing when organizing a social activity by developing an intelligent, semantic, all-in one online platform with the same name as the company. The goal was to be a simple, convenient and user-friendly online plaza where you can meet to plan every detail of your upcoming event with the attendees. The project was carried out within the Mediatuin Living Lab. The application was initially seen as B2C and no other ecosystem actors or partners were involved in the project.

By means of an environmental scan and an intake survey, we looked at the current market environment with a competitor analysis and asked for the global opinions of the end users towards this concept. These results were further elaborated upon during a co-design session where the participating users could also draw up their own planning tool. After these research steps, two separate field trials were held. First, a closed field trial where only invited users recruited from the survey were able to test Planza, and later on an open field trial where anyone could potentially participate. During these field trials, the activity was monitored through logfiles and there was the possibility to provide feedback on a tumblr-page. However, this did not generate a lot of spontaneous comments. After the field trial, a short post-survey was held.

The Planza project was the result of a demand of the IWT that forced Planza to perform a market assessment. The people from Planza themselves were not convinced of this approach, as they thought it was too early for Planza to be judged by end-users. They felt as if the user feedback and input consisted of mostly suggestions and issues they already knew themselves, with no real 'eye openers' or novel insights. During the co-design session, this became apparent as the instigator went quickly in 'defense-mode' instead of truly listening to the feedback and comments.

Methodological overview:

Planza	SotA market & user	Survey	Co-design session	Closed field trial	Open field trial with logging & feedback possibility	Post-survey

Outcome innovation process: 3 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Confirmation of an opportunity	Influx of researchers
	Lack of flexibility of the own organisation
	'Too soon' feeling

Outcome market: Currently, the Planza platform is online and can be used by end-users, although it is still in beta. They are currently looking to close partnerships with other companies and are also exploring the possibility of a B2B-model, something which came out of the Living Lab.

Kianos – 11/12 – 04/13

Living Lab: Mediatuin

Instigator: Kianos (Start-up)

Goal: **Exploration** of the market potential of the Kianos application

Funding Model: KMO Portefeuille

The start-up Kianos developed a prototype of a home multimedia system that allows to consult all kinds of media (audio and video) and content (music and films) on any device, anywhere and anytime, with as a special feature that all content is aggregated in one search engine that also contains a recommendation function. Moreover, the interface also serves as a remote to control all home media devices. This project was carried out in the Mediatuin Living Lab. The project itself was rather small in scope, as Kianos wanted an assessment of the adoption potential and a user evaluation of the concept. No actors from the ecosystem were involved, also because Kianos was conceived as a strictly B2C concept.

Therefore, first a SotA was done of the market and of the end-user, making a segmentation based on Digimeter as well as Mediatuin data. This was followed by a user survey and a co-design session which also consisted of a technical discussions regarding interfaces and formats. This was facilitated by selecting users with a high product-related knowledge from the survey respondents. Based on these needs and wants of the end-users, the intention was to adjust the User Interface and some features. No field trial was held as the prototype was not stable enough to enable this at this point. As there was no real-life setting or testing, this project lacked some fundamental elements that are normally present in a Living Lab project. However, because of budget constraints and time constraints (a project carried out under the KMO Portefeuille has to be finished within the year, otherwise the subsidy is no longer available), this was not possible within one project.

Methodological overview:

Kianos	SotA market & user	Survey	Co-design

Outcome innovation process: 2 - 2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Confirmation of ideas	Testers were tech savvy users; no representation of the market.
Feedback of target audience	
Co-creation input	

Outcome market: Initially, the intention was to prepare a follow-up project afterwards, but this has not happened. After a hiatus following this case, because of the instigator being active with other projects, Kianos is now preparing its beta-launch and subsequent market introduction. Their website is up and running (http://www.kianos.tv/), but it is not clear when the products and services will be available for end-consumers.

Hoaxland – 01/13 – 09/13

Living Lab: Mediatuin

Instigator: Hoaxland

Goal: **Exploration** of the potential of the idea of Hoaxland to be transformed into an application against bullying

Funding Model: KMO Portefeuille

Posi & friends is a multimedia project consisting of a collaboration between Prana (a collective partnership of coaches working on self-image and well-being), Vlaams Netwerk 'Kies Kleur Tegen Pesten' (know from the Ketnet 'Move tegen pesten') and Hoaxland (3D animation studio, producers of Aya & Rex) as main instigator. The Living Lab project, with a firm ecosystem approach, was carried out in the Mediatuin Living Lab because of its link with multimedia content formats. The main goal of this project was to work around bullying with children between six and twelve years old. A digital 3D animation series was to be the central element of this project which also aims to develop other formats and media products. This Living Lab project focused on the opportunities of an innovative ICT solution to meet the challenges of bullying behavior within this framework. This platform, that would be able to coach children in their reaction on bullying, would also be usable as an educational tool by parents and teachers. The complex concept has a B2B2C nature as the eventual end-users are children, their parents and their teachers, but also companies, organizations and other actors that sponsor, sell or distribute the different content formats of the Posi and friends characters. The exploratory Living Lab project consisted of a SotA on market and user, containing a competitor analysis, expert interviews, a survey aimed at teachers and parents, a co-design session with teachers and a business model workshop. This project also did not contain a field trial or real life settings, but given the status of the innovation, this was not possible yet.

During the project the instigator got the chance to explore the (complex) ecosystem in which the innovation would have to find its place, and also to collaborate with potential partners (Prana and Kies Kleur Tegen Pesten). This offered him the opportunity to acquire some data regarding interest in the concept and regarding potential partners and stakeholders for market introduction.

Methodological overview:

Hoaxland	SotA market & user	Expert interviews	Survey teachers & parents	Co-design teachers	Business model workshop

Outcome innovation process: 1 - 2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Team's enthusiasm	Duration of the Co-design sessions might have been longer
Confirmation of ideas	
Interaction with multiple stakeholders	

Outcome market: At this moment, a follow-up project is planned for the actual design and development of the application. At the same time the necessary funds are being collected to move forward the project. The instigator of the project uses the project data to convince potential investors.

7.8 iMinds Living Labs

After the experience with the three ICT Living Labs, and based on the success of Mediatuin in terms of attracting (SME) projects, the modus operandi was integrated into iMinds Living Labs and efforts were made to deal with the processes that take place when running this type of projects. The most 'formal' event that marked this shift was the recruiting of the Mediatuin Living Lab manager as business developer of iMinds Living Labs in December 2012, the formal ending date of all three Living Labs. In practice, LeYLab and FLELLAP continued some of their operations, but for the Mediatuin this only consisted of the external projects being completed like they were supposed to before the formal ending, as in the course of events the panel management had also shifted back to iMinds Living Labs. With the Living Lab manager now also as a full-time member of the iMinds Living Labs team, the projects starting from 2013 are regarded as iMinds Living Labs cases. However, the first iMinds Living Labs project was initiated earlier (Spotty/Wadify) as this project was not carried out within one of the existing Living Labs because there was no clear match with any of them. Since its inception (under the name iLab.o), iMinds Living Labs had developed some services and operations that could be put to productive use within these small scale projects. These include the yearly Digimeter-studies with additional panel recruitment (cf. supra), and the development of the LLADA system for panel management (soon te be replaced by an improved version named PanelKit, cf. supra). These activities were intended for the European projects and for the larger scale collaborative projects in which iMinds Living Labs engaged, but could be perfectly integrated in the daily activities of the newly established SME team, that 'de facto' started its operations when the ICT Living Labs ended, but only became a more formalized team in the course of 2013[89]. Therefore, we can look at iMinds Living Labs from the perspective of an Open Innovation network, facilitating this kind of Living Lab projects without the support or governance of an overarching Living Lab infrastructure, but as an embedded division within the iMinds research institute consisting of different collaborating actors, dependending on the type of project.

7.8.1 iMinds Living Labs innovation projects

Wadify – 02/12 – 04/13

Living Lab: iMinds Living Labs

Instigator: PlayOut! (SME)

Goal: **Exploration** of the needs of youngsters and of the potential of the platform

Funding Model: IWT Feasability study

[89] http://www.iminds.be/en/succeed-with-digital-research/living-lab

Within the Wadify project the SME PlayOut! was working on a new and innovative service, first called Spotty, later changed to Wadify. Wadify was an online streaming platform that reimburses young people for watching commercial messages: advertisements, movie trailers, etc. With this product PlayOut! wanted to introduce a new business model in the market: viewers of a commercial would get paid for watching. As a target group, PlayOut! aimed at youngsters and as a check, a question was introduced at the end of the video to see whether the video had been watched. PlayOut! was redirected to iMinds Living Labs by the venturing team of iMinds. Because there was no direct link with one of the three Living Labs, and no added value to be gathered from the three Living Lab constellations and infrastructures, it was decided to carry out this case within an iMinds Living Labs-setting. This project was part of an IWT feasibility study.

For the development of its product, services and business plan, the company needed an insight on the possible technical problems, the influencing parameters and possible barriers for this innovation. Therefore PlayOut! validated this new idea within a test user panel, based on its initial target group (young people between 16 to 25). First step was surveying 200 young people, recruited from the Digimeter-panel. Based on those results more qualitative feedback was gathered from a group of representative Lead Users, acting as 'core panel' (10 persons). These users were gathered in co-creation sessions and interviewed after a field trial with the platform. This field trial involved more test-users that could express their ‘needs & wants’ through a splash page, being shown when they logged in for the first time. Extra data was gathered by analyzing the logfiles of all actions users performed on the platform.

The project resulted in several changes being made to the platform and also in the idea to create closed discussion groups with youngsters regarding brands or products. The youngsters themselves also appeared to be very enthusiastic regarding the platform. However, because the interest of advertisers and other relevant market players was not overwhelming, PlayOut! changed its strategy and came up with another innovation that was closer to their core business: the PlayPass, a festival wristband with access control and other relevant features. This low interest from the advertisers only became apparent after the Living Lab project. The results were used by the instigator to convince advertisers himself, but these advertisers or other actors in the ecosystem were not involved in the project itself. The initial intention of PlayOut! was to do a follow-up project using a Living Lab methodology, but this never happened. It was clear that the instigator considered the Living Lab project as separate from his own ecosystem and business model investigation, something which did not turn out as desired in the end.

Methodological overview:

Wadify	SotA user	Survey	Field trial with logging	Interviews with testers

Outcome innovation process: 2 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Checking the idea with the target audience	Difficulty in creating a real-life context during field trials

Outcome market: The Spotty/Wadify idea is abandoned, but PlayOut is now successful with another innovative application that is closer to its original core business, the so-called PlayPass[90].

Veltion – 01/13 – 10/13

Living Lab: iMinds Living Labs

Instigator: Veltion (Start-up)

Goal: **Exploitation** of its website to support optimization processes in organizations

Funding Model: KMO Portefeuille

Veltion, a start-up and spin-off of Ghent University, focuses on lean manufacturing methods. They improve the production processes of companies. Veltion noted that a lot of companies still use analog methods to capture the problems in their production lines and wanted to introduce digital tools that replace this analog approach. Therefore, Veltion has created an online tool based on the PDCA-cycle. This online tool was the subject of the Living Lab project that was carried out in the Mediatuin Living Lab. By the nature of this project, we also see that it is moving further and further away from the initial focus of Mediatuin. Veltion was also the first purely B2B case that engaged in a Living Lab project attracted by the methodology and the generated knowledge on digital applications, as this had become more of a constant factor in the previous cases (La Mosca, Hoaxland, Jukebox21, Streemr, Kianos, Qwison, Planza). However, as in December 2012 the Mediatuin Living Lab manager became the business developer of iMinds Living Labs, because Mediatuin ended formally, this project is considered an 'iMinds Living Labs-case', although the active business development still happened under the Mediatuin banner.

By means of an environmental scan and a co-creation session with relevant company profiles, the current market environment and the global opinions of the business users towards this concept were assessed. Next, a field trial was held in a selected company to get further in-depth insights in the 'needs & wants' of the end-users. A PTA (proxy technology assessment)

[90] http://www.playpass.be/home/

approach was taken to enable all workers to give feedback on current work processes. Since this is a B2B application, there are a lot of stakeholders involved, and this increases the need of user research. At the end of the project, a survey was sent out to potential users of the online tool and a business model workshop was held.

During the project, and especially during the PTA field trial, Veltion noticed the potential of a digital application for workers. However, some issues also emerged. Regarding their own tool, the goal was to assess whether they could sell this tool separately. During the concluding business model workshop, it became apparent that this strategy was not optimal to pursue at this stage. Rather, they decided to focus on their core competencies, i.e. consultancy in companies aimed at optimizing internal work processes, and using their own tool together with these consultancy assignments, and not as a stand-alone solution yet. The outcome of the Living Lab is that Veltion in the short run will focus on its current core competencies, while a further development of their tool can be something for the long run. These outcomes of the Living Lab project are also the result of the fact that at this stage, business model researchers from iMinds-SMIT (also connected to iMinds Living Labs) were included in the project. This was a direct result of the shifting focus of the new cases and of the experiences in other projects (e.g. La Mosca) where a business workshop at the end of the project with an external expert did not provide satisfactory results.

Methodological overview:

Veltion	SotA market & user	Co-creation with users	Field trial in company	Co-creation with testers	Business model workshop

Outcome innovation process: 3 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Support in setting up a field trial	Lack of feeling with the case at the researcher's part
Interesting contacts due to co-creation sessions	Co-creation approach
Survey yielded some interesting results	
Business modeling session	

Outcome market: The Veltion app is now being used as a tool for their own consultancy activities, and not as a stand-alone solution for their customers.

Webinos 01/13 – 12/13

Living Lab: iMinds Living Labs

Instigator: University research group

Goal: **Exploration** of the potential of the underlying innovative technology to become a potential industry standard

Funding Model: European Project

The Webinos project is also an outlier case because of its scope and approach. Webinos is the name of the EU-funded project aiming to deliver the Webinos platform (Secure WebOS Application Environment), which is a computing platform for the development of software components that are independent of the utilized computer hardware or operating system. The Webinos platform is based on open-source software. More than 30 partners are represented within the consortium, research institutes as well as companies. The objective of Webinos is to enable web applications and services to be used and shared consistently and securely over a broad spectrum of converged and connected devices (cross-platform and cross-domain), including mobile, PC, home media (TV) and in-car units. As most of the work in the project dealt with technical standards, programming and general architecture of the platform, no users whatsoever were involved in the first part of the project, with only some personas being created for potential use cases of the platform. Main goal of the Living Lab project was to have a user test of some of the use-cases and scenarios from the previous research activities. Based on data from the Digimeter-studies, a clustering was executed which more or less confirmed the existing personas. Based on the new data and on the co-creation session with representatives of these personas, they were refined and use cases were given shape. These adjusted personas and their use cases were fed back to the developers in order to program a testable MVP of the swiping application. In a final stage, the developed use cases were put in practice during closed labtests with realistic scenarios. The fact that actual end-users, representing the personas, were involved in these tests forced the developers to deliver a MVP that actually worked, although there were quite some technical issues while testing. In the end, the tests were successful and the Webinos platform was delivered more or less as planned.

In this project with a lot of partners, the Living Lab-aspect forced the developing partners to collaborate more intensively and deliver a working prototype. Moreover, the European Commission plans to have a similar field trial at the end of all European projects in order to enhance the market potential of the innovations in development (Salminen, 2014).

Methodological overview:

Webinos	Persona building	User experience lab testing	Interviews test users

Outcome innovation process: 2 - 3

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Framework for fixed deadlines and fixed quality	Partners' lack of knowlegde with regards to Living Labs
Usability aspect	

Outcome market: A foundation has been established in order to further develop the platform[91].

CEONAV – 01/13 – 12/13

Living Lab: iMinds Living Labs

Instigator: CEONAV (SME)

Goal: **Exploitation** of the CEOPS platform to managers

Funding Model: KMO Portefeuille

CEONAV is a Belgian SME active in the innovation management and strategic foresight business. In order to support their consulting activities, they have developed an online application called CEOPS, which means a GPS for CEOs and labels this as a B2B application. This tool gives managers a visual overview of their strategic path and of potential opportunities and threats. When giving input regarding trends and events that occur in the company context, CEOPS helps determining a long term strategy by challenging the fixed set of assumptions that are based on their previous experiences. This project was also carried out as an 'iMinds Living Labs-case', although the business development stage took place as Mediatuin Living Lab, for reasons similar to the Veltion project (cf. supra).

The initial goals of the Living Lab project were to gather feedback from end-users on the application regarding outlook and functionalities, get a view on use cases and usage in a field trial and assess the market potential and willingness-to-pay. Therefore, the project started with a State-of-the-Art research on other applications and tools for managers that dealt with foresight or strategy. This was followed by around ten interviews with managers, looking at their current habits and practices, followed by a pitch of CEOPS after which the interviewees could provide feedback. A lot of issues surfaced during these interviews, which would be tackled during the field trial. However, for planning the field trial, a total of four steering committees was held discussing the results and working on the pitch of CEOPS, and looking for companies for the field trial. In the end, one business model workshop was held and it was decided to abandon the project. As a final outcome, it became apparent that CEOPS did not answer any current market needs, but mainly because knowledge and practice of strategic foresight and Future-Oriented Technology Analysis (FTA) are lacking amongst managers.

[91] http://webinos.org/

Besides this, the interviews showed that the outlook and visualization of the application itself looked outdated and complicated. Therefore, CEONAV decided to stop the cooperation with its developer and restrained back to consulting activities, coupled with educational workshops to initiate and train managers in the world of strategic foresight and FTA, in a way trying to uncover the need that CEOPS could solve potentially.

Two aspects about this case make it peculiar. First, the innovation reverted from pre-launch stage back to the idea/concept stage at the end of the project. This happened because of the negative user feedback and because of the lack of knowledge and competencies of managers to handle CEOPS, something which was underestimated by the instigator. Therefore the field trial and post assessment were not carried out, as the initial experiences with CEOPS during the interviews provided already enough material to take the innovation multiple steps backwards. “Réculer pour mieux sauter” as the instigator phrased it himself in the interview. Second, during the steercos and other project activities, there were always one or two other people present. These were shareholders in CEONAV and consultants as well, keeping a direct eye on the progress of the project and participating in the lively discussions that occurred during the numerous meetings. Therefore this project is also an example of the ecosystem being involved, although there were certain power relations within this ecosystem that had a latent influence on the Living Lab operations.

Methodological overview:

Ceonav	SotA market & user	CEO interviews	Steercos	Business model workshop

Outcome innovation process: 4 - 3

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Second objective opinion	Lead time
Interviews	B-2-B vs. B-2-C
Good value for money	Missing more depth
Business modeling session	Improving the intake
Credibility (Supplied by iminds)	

Outcome market: redefining the scope and goals of the company.

Twikey – 04/13 – 08/13

Living Lab: iMinds Living Labs

Instigator: Twikey

Goal: **Exploitation** of the Twikey-system for electronic pay mandates to business customers

Funding Model: KMO Portefeuille

Twikey has developed a solution for the easy management and online approvals of direct debits and other contracts, with the end customer retaining complete control of the approved direct debits. The Twikey service provides an easily accessible negotiation and change management framework. It allows companies to streamline the acceptance process of eMandates and eContracts using the existing, trusted ecosystems. On top of that, Twikey allows seamless integration with third-party CRM or ERP packages. The Twikey services and framework are fully complementary to internal mandate management systems or any other SEPA Direct Debit management tool.

Through a Living Lab-approach, carried out within the iMinds Living Labs innovation system and aimed at the end-users, Twikey wanted to gain insights in end-user behavior and predict adoption ratios. It was a conscious choice to only research the end-users and not to involve the ecosystem, despite Twikey being a B2B2C application. The instigator, who had unsuccessfully proposed to develop the application while working for a large company in the financial sector, chose to create his own start-up. In this project, users were surveyed, participated in a co-creation session and conducted a usability test in a lab-setting. There was also an expert usability review conducted. The user-friendliness and trustworthiness were essential for the success of this kind of application. These positive results were used by the instigator in his negotiations with banks and potential clients to strengthen his position and credibility. The user interface and the process were also adapted based on the user feedback.

Methodological overview:

Twikey	SotA market & user	Survey	Co-design session	Expert Usability review	Usability labtest

Outcome innovation process: 2 - 6

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Interaction with different actors	SOTA didn't contribute enough; no added value; not actionable
Combination of quantitative and qualitative information	

Outcome market: At this moment, Twikey is on the market and has its first B2B customers. They are currently expanding their activities and customer base through active business development.

Coxo – 04/13 – 12/13

Living Lab: iMinds Living Labs

Instigator: COXO

Goal: **Exploration** of the potential of an online matching and co-creation platform for users that want to organize cultural activities

Funding Model: KMO Portefeuille

The COXO project wanted to investigate the potential of an online matching and co-creation platform for users that want to organize cultural activities. The project was instigated by the consultancy and project management company i-Ball, but the instigator was commissioned by VTB Kultuur, a public organization in the cultural field. During meetings and steercos, both people from i-Ball and VTB Kultuur were present. This way, there was some resemblance with the CEONAV-project. COXO was intended to become an all-embracing platform for every step before, during and after an event, organized by end-users with a link to culture.

First, similar initiatives were investigated and the interest for the presented tool was assessed through interviews with experts in the innovation domain. This was followed by a survey targeted at people that were willing to organize culturally related events, followed by a stakeholder co-design session, as the platform would offer a lot of extra services that would benefit organizers, thus potentially impacting the providers of these services (e.g. insurance, rental services, locations,…). This impacted the session, as some of the participants regarded the platform as a potential competitor, which did not result in a lot of interesting contributions. In order to compensate this, two additional stakeholder interviews were conducted and analyzed by a business modeling expert. However, the results also did not add a lot to the knowledge of the instigators of the project, as after the project it became clear that the consultant from I-Ball had conducted some interviews by himself without sharing this to the researchers in this project. This had as a result that ‘double work’ was being carried out and stresses the importance of openness between all actors engaged in a Living Lab project.

The project resulted in an overview of the interest in the tool with some concrete recommendations and suggestions for the platform. The stakeholder investigation provided the insight that this tool would be potentially interesting for villages and cities.

Methodological overview:

Coxo	SotA & competitor analysis	Expert interviews	Survey	Stakeholder co-creation	Stakeholder interviews

Outcome innovation process: 1 - 2

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Networking	Reliability of the conclusions with regards to the last phase
Conclusions' usability	Not enough focus
	Small scale Living Lab

Outcome market: At this moment, the platform is being developed under the brand name Planidoo and a follow-up Living Lab-project has started which aims at co-creating the platform with end-users during a Scrum development process. Also, in terms of strategy, cities and villages are now targeted as potential customers.

Smartseats – 12/13 – 03/14

Living Lab: iMinds Living Labs

Instigator: SmartSeats

Goal: **Exploration** of a solution for reselling empty seats for sold-out events

Funding Model: KMO Portefeuille

SmartSeats, the last project that could be included in our analysis, wants to offer a solution for reselling empty seats for sold-out events. In order to achieve this, they created the concept of the 'smart time', a given moment when all non-occupied seats become available again for people queuing in the 'smart seats queue'. Based on algorithms, everyone in the queue receives a chance of getting tickets the day of the event. Entering the system, queuing and receiving notifications runs through an online application, accessible with a smartphone, tablet and computer. The goal of this Living Lab-project was to assess initial user interest in the system, evaluate the different aspects related to it and test the developed MVP (a 'quick and dirty' version before the actual application was to be developed) during three real-life field trials (football matches of RSC Anderlecht). This way, user data could be gathered to attract investors for the SmartSeats company and the development of the actual application could be prepared. During the field trials, observations and interviews were carried out, together with an analysis of the log data of all activity on the platform. A large-scale survey was held to assess the interest in the platform, the different possibilities and the use cases, and an exploratory co-creation session was held for the possible use cases regarding music events.

A major lesson learned was that the communication towards the users of SmartSeats was of utmost importance. This was learned during the three field trials, where the first was a small success, the second a failure and the third a big success in terms of participating test-users.

Methodological overview:

SmartSeats	Field trial 1	SotA market & user	Field trial 2	Survey	Co-creation music events	Field trial 3	Interviews test users

Outcome innovation process: 1 - 4

Outcome Living Lab satisfaction:

Living lab Evaluation	
Positive aspects	***Negative aspects***
Speed	Need for an ergonomy-phase
	Global marketstudy was too light

Outcome market: At this moment, the final application is being developed and the Smart Seats system is already up and running with some organizations (e.g. official reseller of RSC Anderlecht tickets). SmartSeats has also opened an office in the United States and has gathered more than 2 million dollar of seed funding. They are now preparing a worldwide launch and are running an IWT innovation project to get the Smart Seats application completely up and running. In the project, iMinds will also perform further user research and user testing.

7.9 Macro level analysis

After the introduction to the Flemish Living Lab 'history' and of the four Living Lab constellations and 21 Living Lab projects, we now start our analysis on the level of the constellation, the so-called macro level. At this level, we consider Living Labs as an innovation network consisting of different stakeholders that engage in knowledge transfers. This innovation network is mostly structured around an innovative infrastructure which can be material and/or immaterial. The table below summarizes the main domains, aims and infrastructure. The table also gives an overview of the different actors that participated in these Living Labs with their stakeholder role, as was defined by Leminen & Westerlund (2012) and which we discussed in the previous chapter.

Table 32: Summarizing table of the Four Flemish ICT Living Labs and their Living Lab projects

Living Lab	*FLELLAP*	*LeYLab*	*Mediatuin*	*iMinds Living Labs*
Domains	-Smart grids -Smart media -Smart cities	-Multimedia -eHealth -Gaming	-Cross media innovation with specific attention for music and radio	-New media & ICT innovation
Aim	-Energy management and energy reduction -User research on smart media applications and services to evaluate innovative media experience -Increasing the self-sustainability of the elderly	- Experimenting with new applications that request a fast Internet connection. - Digital inclusion, bringing any multimedia service to everyone on any device - Optimising the life of care-demanding citizens through new technologies.	-Co-creating and validating cross media innovations and innovative formats	-To create a lasting and positive impact on society through innovation in ICT
Material Infrastructure	-Telenet cable infrastructure -Project-based tablets & 3D TVs	- Fibre Internet network - 43 Android tablets - 36 mini PCs	-No permanent infrastructure	-No permanent infrastructure
Immaterial Infrastructure	-Data from bi-monthly profiling suveys	- City of Kortrijk ecosystem - Logfiles of user activity on FttH-network	- Thematic dataset - REC media ecosystem	-User panel of >20.000 test-users -Digimeter-datasets -Connection to iMinds knowhow & expertise
Number of users	2.015 profiled panel members	Core panel of 115 connected addresses with +/- 200 profiled panel members	Dataset of 7.000 respondents with 2.057 test users	User panel of >20.000 test-users
Enablers	IWT	IWT City of Kortrijk Case-based enablers	IWT	Agentschap Ondernemen iMinds/Flemish Government
Providers	Telenet iMinds Living Labs panel management	Alcatel-Lucent Belgacom iMinds Living Labs panel management Case-based providers	Netlog REC Radiocentrum	iMinds Living Labs panel management iMinds Living Labs business development
Researchers	iMinds user researchers	iMinds user researchers	iMinds user researchers	iMinds user researchers & business modelling researchers
Utilizers	FifthPlay 3 external utilizers	3 internal utilizers 3 external utilizers	SonicAngel 7 external utilizers	>10 external utilizers

We will now first discuss the stakeholders more in depth and outline their main motivation to participate in the Living Lab, and assess whether this goal was reached or not. We continue the macro level analysis with a review of the three network paradoxes, as proposed by Klerkx and Aarts (2013, cf. also chapter 3).

In terms of **success** of the Living Lab constellations (macro level), we looked for each stakeholder if the initial goal (exploration of new knowledge or exploration of existing own knowledge/technology) was attained at the end of the Living Lab, or in the case of external utilizers, at the end of the innovation project. We gathered the initial goal of the stakeholders out of the project proposals of the Living Lab constellations. We also reviewed these initial motivations of the actors with the Living Lab managers after the interview, where we also assessed the success. For the utilizers from our sample of cases, we gathered the info from the interviews (cf. infra). We only took the main motivation and coded the success for this motivation (+ for success, +/- for a neutral or unclear outcome, - for failure), and did not take into account other motivations or shifting roles during the Living Lab.

7.9.1 FLELLAP analysis of stakeholders

When analyzing the Living Lab constellation according to the stakeholder roles from Leminen and Westerlund (2012), Telenet clearly is in the role of **provider** of the infrastructure, where the initial goal was to *explore* future applications and features for its cable network and look for additional services that could be offered to its customers, with a focus on Smart Media, as can be gathered from the project proposal. It might be argued that in the long run, Telenet wants to further exploit its cable infrastructure, which can be facilitated by delivering new services to existing and new customers, but the official motivation is exploratory. Based on the project proposal, Alcatel-Lucent was also to be a provider within the Living Lab constellation, but due to a changed course from the management of the company during FLELLAP, as was gathered from the interview with the Living Lab manager, Smart Grids were no longer a priority, so the laboratory infrastructure was never used for external utilizers. The goal of Alcatel-Lucent was initially to *exploit* the laboratory to utilizers and to explore the possibilities, but this was not realized. Androme can also be labeled as a provider as they offer their technical knowhow to the Living Lab constellation and were looking to *exploit* their knowledge in other projects. However, in practice, Androme only delivered services to Telenet, especially for the user interface of YeloTV, the second screen application that Telenet announced and launched during the running time of the Living Lab. These exchanges took place in a pecuniary modus, where Androme exploited its knowledge to Telenet, and outside the context of the Living Lab. Thus, Androme succeeded in their initial motivation, albeit outside the Living Lab constellation. Androme also became a utilizer during the project as they did a user test with a user interface for video conferencing that they were developing at that time, which was not successful at all as they experienced a lot of technical problems. The panel management from iMinds Living Labs is the fourth provider in the Living Lab constellation, providing the communication with and handling of the user panel and of the devices that were given to the users, and also providing the Living Lab constellation with the LLADA-tool (Living Lab Data Aggregator for storing all user information). Through the Living Lab operations, iMinds Living Labs's panel managers could further develop their skills and expertise, and additional users were recruited that increased the number of total available end-users for other projects. Because of the lack of internal projects, panel management was able to experiment with 'repetitive' surveys, which proved to be successful. Some of the learnings from FLELLAP are at this moment being implemented in PanelKit, the successor of LLADA, which can be regarded a form of retention.

FifthPlay is situated somewhere between the provider role and the **utilizer** role within the Living Lab constellation. FifthPlay wanted to *exploit* its platform towards other (local) service providers who would be able to deliver their services to the end-users on the platform, although they also engaged in FLELLAP to *explore* the possibilities of the platform. They used the Telenet infrastructure and the user panel recruited by the iMinds researchers and panel managers to roll-out their platform, but they also provided the gateway and the platform itself on dedicated tablets. The main goal, exploiting the platform, was not very successful as local retailers and organizations were not very keen to get on the platform. After FLELLAP, FifthPlay launched a commercial version of the platform on the market called Nuvonet[92], but according to FifthPlay themselves (cf. the instigator interview) this has not been a huge success. One of the services that did run on the platform during the Living Lab, and which appeared to be one of the most valued applications by the test-users, was the energy monitoring application with smart electricity plugs, also a product of FifthPlay. In the course of FLELLAP, FifthPlay was able to exploit this technology to Electrabel[93] in the form of a joint 'smart boxes' offering that was launched as a commercial service to end-users[94]. This service was more successful than Nuvonet (cf. FifthPlay instigator interview).

In the 3DTV and YeloTV projects, Telenet also acted as a utilizer within the Living Lab, but these cases did not seem to have had a high priority. For 3DTV this became apparent during the first steering committee and also due to the fact that the only 3D only channel, High 3DTV[95], was recently removed from the offering[96]. For YeloTV, most of the development was done outside of the Living Lab in alliance with Androme[97], and the user test only took place in the period between the sneak preview in October 2012[98] and the official launch in March 2013[99], which did not leave a lot of space to take into account the user feedback. YeloTV as a service is considered a success by Telenet[100].

It is striking that the consortium did not include any stakeholder that could be labeled as a utilizer *pur sang*, which indicates that FLELLAP was conceived as a Living Lab that would

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92 http://www.nuvonet.be/en
93 www.electrabel.be
94 http://www.fifthplay.com/en/news/press/smart-energy-box
95 http://www.hightv3d.com/
96 http://nl.wikipedia.org/wiki/Telenet_Digital_TV
97 http://www.uhasselt.be/UH/techtransfer/Voor-bedrijven/tevreden-klanten/tevreden-klanten-Androme-stond-mee-aan-de-wieg-van-YELO-TV.html
98 http://corporate.telenet.be/en/news-and-media/press-announcements/yelo-tv-brand-new-television-experience
99 http://corporate.telenet.be/en/news-and-media/press-announcements/telenet-launches-new-tv-experience-yelo-tv-5-march-2013
100 http://snap.telenet.be/tips/artikel/yelo-tv-app-op-windows-phones-8

be able to quickly attract external utilizers. However, this turned out differently as eventually only three external projects were carried out within FLELLAP. This also forced the **researchers** in FLELLAP, who came from iMinds and were connected to iMinds Living Labs, to be creative and initiate research with the panel members in order to activate them. This allowed to conduct some experiments in terms of methodology and in terms of user motivation to participate, which led to some academic publications that are also an example of knowledge retention (Baccarne et al., 2014; Logghe et al., 2014a & b; Lievens et al., 2014; Veeckman et al., 2013).

These **users** consisted of a separate 'Smart City'-panel of testers of InCityS, all inhabitants of the Flemish city Sint-Niklaas, and a panel with 2.015 users that were recruited by iMinds Living Labs panel management and that were sent a survey once every two months regarding the three thematic domains. However, this also allowed to conduct some experiments regarding user motivations to participate and regarding panel retention (exploration of new knowledge), where it appeared that the users seemed to be mainly intrinsically motivated to participate.

As **enabler** of the Living Lab constellation, we can discern IWT (Institute for the Promotion of Innovation by Science and Technology in Flanders), a Flemish government agency, together with iMinds. IWT supports innovation in Flanders in various ways: financial support, services, coordination and policy preparation. First, IWT distributes more than 260 million euro in subsidies yearly. This money mainly goes to the individual and collective projects of small and large companies, universities and other Flemish innovation stakeholders. As was already explained in the historical overview of Flemish Living Labs, iMinds and IWT were in charge of redistributing the subsidy that was awarded to the defunct I-City Living Lab. In terms of involvement, the Living Lab manager and the consortium partners had to report to IWT regarding the progress they made once a year. In between, there were also informal contacts between representatives of IWT and with the Living Lab managers. However, the role of IWT in FLELLAP remained rather passive. In order to stimulate external projects, a one-time call for Living Lab projects was announced within one of the existing funding mechanisms for SMEs of IWT[101], but this resulted in no extra projects for FLELLAP. Interestingly, no other enabler was present in the external cases, as at the time these were conceived, the 'KMO Portefeuille'-option (cf. infra) was not known, or rather it was not seen as a funding option for Living Lab projects. However, in order to generate research activity and to activate the user panel, the external research cases were largely funded by the researchers themselves who 'invested' their research capacity, thus also acting as a temporary enabler for these cases, and by the utilizers themselves who paid for using the Living Lab infrastructure.

[101] http://www.iwt.be/evenementen/proeftuinproject-infosessie-door-iwt-ibbt

Table 33: Core Living Lab actors for FLELLAP

	Actor	Main goal	Success
Utilizers	FifthPlay	Exploitation	-
	OKEEZ	Exploration	+
	Fietsnet	Exploration	-
	MuFoLive	Exploration	+
Enablers	IWT	Exploration	+/-
Providers	Telenet	Exploration	+/-
	Alcatel-Lucent	Exploitation	-
	Androme	Exploitation	+
	iMinds Living Labs	Exploitaiton	+
Users	Smart City user panel	Exploration	+
	General user panel		
Researchers	iMinds	Exploration	+

7.9.2 LeYLab analysis of stakeholders

Because of the complexity of the internal projects within LeYLab in terms of the number of actors involved (12 consortium partners), we will discuss the roles separately for the general roll-out and exploitation of the fibre infrastructure, the eHealth case and the audiovisual (AV) database project.

FttH-roll-out and exploitation

The **providers** of the main Living Lab infrastructure, Alcatel-Lucent and Belgacom, participated in the Living Lab for *exploring* the potential of FttH and for *exploiting* the infrastructure as a testing environment. This exploration was intended to anticipate the potential commercial roll-out of FttH, as more and more countries have a FttH-offering[102] and with organizations such as the FttH-council[103] actively promoting the uptake of FttH. Belgacom regarded LeYLab mostly as an exploration of the possibilities, as according to the proposal they wanted to learn how to facilitate this kind of infrastructure roll-out and look for 'killer applications' for FttH, whereas Alcatel-Lucent looked more to exploit the infrastructure, as it was most active in the business development activities. In terms of a potential infrastructure, Belgacom mentioned to have been able to prepare and align the processes and procedures necessary to facilitate this when a more general roll-out would take place. These procedures and processes are a form of knowledge retention on the side of Belgacom.

[102] http://en.wikipedia.org/wiki/Fiber_to_the_premises_by_country
[103] http://www.ftthcouncil.eu/

Although, the Living Lab did not generate 'the' killer application that would make fibre internet a necessity, research data from surveys showed that the users were nonetheless excited with the sheer speed of the network and technical logging data indicated that they started using more bandwidth when they had 'domesticated' their fibre conection. This logging data enabled an additional exploration of user behavior which could be used for future developments. The logging data was exchanged and confronted with other research data from the researchers, which provided additional value for the providers, who complemented their logging data with self-reporting data, and for the researchers, who could verify the self-reported data with objective logfiles. This even resulted in a joint publicaction between iMinds researchers and Alcatel-Lucent (Schuurman at al., 2013), and also in the construction of a prediction algorithm for network usage by researchers from Alcatel-Lucent (Kawsar & Brush, 2013), both examples of knowledge retention. However, the exploitation motivation was clearly less successful with only three external utilizers carrying out an innovation project in the Living Lab. The panel managers from iMinds Living Labs provided their services such as recruiting the end-users, acting as single-point-of-contact between the panel members and the companies when problems occurred, and supporting research activities.

As **utilizers** within LeYLab we have on the one hand the participating actors from the two thematic use cases and the three external utilizers. For the audiovisual use case, the infrastructure allowed for technical testing of the Mediahaven platform, but the end-user panel was not involved in this case. However, this case can be seen as a successful exploration of the potential and possibilities of the innovation (cf. infra). For the eHealth case, there was no match with the infrastructure nor with the panel, which made this project less successful in terms of exploration (cf. infra). In contrast with the internal projects, the projects with the external utilizers were conceived and carried out as more typical Living Lab projects (cf. infra). In these Living Lab projects, the utilizers were able to *explore* their innovations based on user feedback and user behavior captured by the researchers, who abstracted user needs from the data through co-creation sessions and surveys. In one case (CloudFriends), the results led to the *exploitation* of the innovation to an international company (Inteno) who changed the name of the application to Iopsys[104]. All external utilizers were able to utilize the generated knowledge from the Living Lab case for the innovation development, but in two of the three instances extra test users had to be recruited outside of the Living Lab, and none of the innovations explicitly benefitted from the technical infrastructure. Contrary to the internal AV-case, where the technical infrastructure served best for exploration purposes, the exploration in the external cases was mainly generated through the user panel and the research methodology.

[104] http://www.intenogroup.com/iopsys.aspx

These research activities were carried out by the **researchers** from iMinds. They functioned as intermediaries between utilizers and users, but had to define other research activities because of the lack of internal and external cases in order to activate the panel members. However, the researchers also acted as an intermediary between the providers and the utilizers, as they were also active in attracting external projects. The aggregation of research activities provided enough data and material for academic valorization, a form of retention.

Table 34: Core Living Lab stakeholders for LeYLab

	Actor	Main goal & success
Utilizers	Zeticon	Exploitation +
	Videohouse	Exploitation +
	Televic	Exploitation -
	OnCloud	Exploration +
	Poppidups	Exploration +
	CloudFriends	Exploitation +
Enablers	IWT	Exploration +
	City of Kortrijk	Exploration +
Providers	Alcatel-Lucent	Exploitation –
	Belgacom	Exploration +
	iMinds Living Labs	Exploitation +
Users	LeYLab panel members	Exploration +
Researchers	iMinds	Exploration +

Regarding the **users**, these were the people living in the area where the FttH network was rolled out and that agreed to be connected to the network. In the profiling surveys that were conducted during the running time of LeYLab, users indicated that they participated mainly because of the infrastructure (extrinsic motivation) and out of curiosity (intrinsic motivation), so the infrastructure itself was considered an incentive. An unforeseen effect of the Living Lab activities was a strong sense of community among the test users. The geographic proximity and the shared infrastructure seemed to function as a social cohesive, which became apparent during offline gatherings where the participation of panel members was very high and by spontaneous actions such as helping each other in case of technical problems. However, for the external projects, additional test-users had to be recruited. This was taken care of by the panel managers.

As **enablers** of the Living Lab constellation, we can discern the city of Kortrijk and IWT (cf. supra). Remarkably, from the meeting minutes of a meeting with the private actors in the consortium before the start of LeYLab, IWT stated that funding was only provided for establishing and exploiting the Living Lab infrastructure, and that usage of the infrastructure could not be funded, although the partners in the thematic use cases also received funding. It is clear that IWT saw the Living Lab infrastructure as something to be exploited. However, it is remarkable that in the project proposal no attention is dedicated to who should be in charge of attracting external projects, the business development of the Living Lab. Only on the steerco of 12/08/2011 a dedicated ‘working group’ was created in order to coordinate the efforts of all consortium partners in attracting external projects. This group consisted of two researchers and the Living Lab manager from provider Alcatel-Lucent. However, this did not result in a huge success as the exploitation of the Living Lab infrastructure did not have a direct impact on the exploration goals the actors in the thematic use cases pursued. As already mentioned when discussing FLELLAP, in order to stimulate external projects, a one-time call for Living Lab projects was announced within one of the existing funding mechanisms for SMEs of IWT[105], which resulted in the CloudFriends project. Both the Poppidups and WeePeeTV projects were (partly) funded through the ‘KMO Portefeuille’, provided as a support grant for SMEs by Agentschap Ondernemen[106], but this enabler for the external projects did not have a direct influence on the projects. The city of Kortrijk also acted as an enabler in the Living Lab by granting permits for the network roll-out and facilitating and initiating contacts with the citizens and local stakeholders. By its participation in the Living Lab, Kortrijk was able to establish itself as an innovative city towards its citizens as well towards other cities and stakeholders.

AV (audio visual) internal project

For the AV internal project, Zeticon en Videohouse acted as the **utilizers** of the FttH-infrastructure as they tested and *explored* their content archiving and distribution system (which was later called ‘Mediahaven’) . The city of Kortrijk acted as a specific **enabler** in this project as they played the role of promoter and distributor of local content through the Mediahaven platform. However, in a later stage, Zeticon was able to exploit the Mediahaven platform to Kortrijk, so Zeticon and Videohouse were able to *exploit* their technology. Focus WTV acted as a specific **provider** by adding content to the system that could be consulted by the end-users. This way, they hoped to potentially *exploit* their content through this new distribution channel. The LeYLab panel members were able to test and *explore* the system, and in a later stage other citizens could also make use of the database. However, no research was carried out by an external research partner in this project.

[105] http://www.iwt.be/evenementen/proeftuinproject-infosessie-door-iwt-ibbt
[106] http://www.agentschapondernemen.be/maatregel/kmo-portefeuille-technologieverkenning

Table 35: Living Lab stakeholders for the audiovisual pillar of LeYLab

	Actor	Main goal & success
Utilizers	Zeticon	Exploitation +
	Videohouse	Exploitation +
Enablers	City of Kortrijk	Exploration +
Providers	Focus WTV	Exploitation +/-
Users	LeYLab panel members	Exploration +
	Other citizens	
Researchers	None	/

e-Health internal project

Televic healthcare was the main **utilizer** in the e-health internal project as it wanted to *explore* its video calling system Xtramira. OCMW[107] was the **enabler** in this project as it was intended that they would facilitate by enabling the roll-out of the application amongst the target population. At the same time, they also wanted to *explore* the potential of their solution as a possible service to be included in their portfolio. Androme and InHam **provided** technical support (integrating the solution with the FttH network) and social support (interaction with the target population) respectively. This way, they both looked to exploit their knowledge. The social support of InHam consisted of assistance with the iMinds panel manager when visiting potential test-users. The elderly and disabled LeYLab panel members were seen as potentiual **users** for the application, but in reality, only few of the panel members were interested in testing the application, and within this small interested group there was no match with the envisioned target population, or the users dropped out after an initial visit by the panel managers and the people from InHam. USentric was intended to research the usability of the solution, but as there were no users found to test the application, this only resulted in an expert review of the application. Therefore, their initial goal of exploiting their research capacity was not successful.

Table 36: Living Lab stakeholders for the eHealth pillar of LeYLab

	Actor	Main goal & success
Utilizers	Televic Healthcare	Exploitation -
Enablers	OCMW Kortrijk	Exploration -
Providers	Androme	Exploitation -

[107] OCMW is a public service organization that delivers caring services to elderly and disabled citizens.

	In-Ham	Exploitation -
Users	Elderly & disabled LeYLab panel members	Exploration -
Researchers	USentric	Exploitation -

7.9.3 Mediatuin analysis of stakeholders

Within the Mediatuin Living Lab, REC can be seen as a **provider** because they took care of the recruitment, communication and community-building activities surrounding the Mediatuin panel, as they were already experienced in performing these type of activities. They also provided access to relevant partners and potential utilizers through their well-developed network of media organizations. In their role as provider, REC was very active in terms of attracting external utilizers for the Living Lab. This can also be explained by the fact that in terms of budget, this was by far the smallest Living Lab. From the interview with the Living Lab manager we gathered that the budget that was awarded to REC did not suffice to keep him on the payroll for the total duration of the Living Lab, which increased the need for extra funding through external projects. Therefore, the main goal of REC was to exploit the Living Lab. Telenet and Netlog also joined the Living Lab constellation as providers of their infrastructure (digital radio channel and community-page on their social networking site), initially to explore the opportunities, but in the end they did not fulfill their role due to shifting priorities internally.

SonicAngel was an internal **utilizer** of the Living Lab constellation as they could benefit from all the data gathered from the intake survey and from the research activities in the Living Lab project by the students. Their goal was to explore future opportunities for the SonicAngel platform. This resulted in recommendations to completely redesign their platform.

IWT was also the **enabler** of this Living Lab constellation, whereas iMinds took the role of **researcher**. The researchers wanted to exploit their research capacity and explore the Living Lab methodology. As was the case in the two other Living Labs, the researchers also played an important role in attracting external projects. The **users** participated in the survey in order to be able to test new services in innovation projects, but only a subset of the users willing to participate effectively contributed in the external projects. In total, more than 7.000 respondents filled out a profiling survey regarding music, mobile technologies and interactive media, and in total 2.057 respondents agreed to become (potential) test-users. The survey was rather extensive, but this yielded a large dataset that was intended to be reused within the internal and external projects. This attempt at knowledge retention and re-use was somewhat successful in the first external cases, but the dataset quickly became outdated.

Table 37: Core Living Lab stakeholders for Mediatuin

	Actor	Main goal & success
Utilizers	SonicAngel	Exploration +
	Hoaxland	Exploration +
	Future Legends	Exploration +
	Streemr	Exploration +
	Jukebox21	Exploration +
	Qwison	Exploitation -
	La Mosca	Exploration +
	Planza	Exploration +/-
	Kianos	Exploration +
Enablers	IWT	Exploration +
Providers	Telenet	Exploration +/-
	Netlog	Exploration –
	REC	Exploitation +
Users	Mediatuin panel members	Exploration +/-
Researchers	iMinds	Exploitation +

7.9.4 iMinds Living Labs analysis of stakeholders

Within the iMinds Living Lab constellation, the **users** are the panel members recruited through the Digimeter surveys and through other research projects. In total, more than 20.000 potential users can be contacted for activation in a Living Lab project. Through the LLADA-tool (which will soon be replaced by an advanced version named PanelKit, cf. supra), users can be selected based on the data that is available from them.

The panel management team of iMinds Living Labs acts as a **provider** of panel management activities (including user selection and communication), whereas the prototyping team also provides more technical services in the projects when needed, and is also in charge of the developments of technical tools to be used in the Living Lab projects such as LLADA/PanelKit. Each of these teams regularly discusses the projects to abstract lessons learned in order to optimize the tools and processes. This can be regarded as a form of retention.

As iMinds Living Labs is closely connected to the iMinds-MICT and iMinds-SMIT university **research** groups, the required research skills and capacity is readily available. Based on the requirements of the project, the right expertise can be selected. Most of the research is carried out by dedicated research teams with specific user research and business modeling expertise. However, the senior researchers, in charge of the methodological approach of the projects, are part of the iMinds Living Labs team and are directly funded by iMinds, whereas the other researchers are paid by project funds. These core researchers are responsible for developing the Living Labs methodology in terms of the lessons learned of the other projects, which is a clear form of knowledge retention. Besides Living Lab methodology, they are also responsible for the research agenda in terms of other topics and theoretical contributions, which should eventually lead to academic publications of the Living Labs research teams at the research groups. Through iMinds, the involvement of researchers is not limited to these research groups, as other iMinds research groups can also be involved in a project when needed. The researchers are able to exploit their research capacities in the projects.

As iMinds itself facilitates the Living Lab operations through its financial support for some of the iMinds Living Labs staff, it can be considered as an **enabler**. Other enablers depend on the project type, e.g. IWT for innovation projects or feasibility studies, the European Commission for EU-projects or Agentschap Ondernemen for SME-projects. IWT (Institute for the Promotion of Innovation by Science and Technology in Flanders) is a Flemish government agency. It supports innovation in Flanders in various ways: financial support, services, coordination and policy preparation. First, IWT distributes more than 260 million euro in subsidies yearly. This money mainly goes to the individual and collective projects of small and large companies, universities and other Flemish innovation actors. Note that the financial support of these enablers is necessary for the continuation of the Living Lab ativities.

The **utilizers** are the actors that come to the Living Lab to instigate a project. A lot of the utilizers are start-ups and SMEs, but also larger companies, public organizations, etc. have taken the utilizer role. Most of the utilizers initiate a Living Lab project in order to explore their innovation in development.

Table 38: Core Living Lab stakeholders for iMinds Living Labs

	Actor	Main goal & success
Utilizers	Wadify	Exploration +
	Veltion	Exploitation -
	Webinos	Exploration +
	CEONAV	Exploitation -
	Twikey	Exploitation +
	Coxo	Exploration +
	SmartSeats	Exploration +
Enablers	iMinds central	Exploitation +
	Specific funding models	Exploitation +
Providers	iMinds	Exploitation +
	Panel management	Exploitation +
	Prototyping support	Exploitation +

Users	iMinds Living Labs panel members	Exploration +
Researchers	iMinds	Exploitation +

7.9.5 Analysis of the three innovation network paradoxes

After describing the network stakeholders and their respective roles, their main motives for participation in the Living Lab and the success, we will now look at the interrelationships of the network stakeholders in terms of the three network paradoxes for the four Living Lab constellations, as proposed by Klerkx & Aarts (2013, cf. chapter 3): the 'dynamic stability' of the constellation (balancing new relationships and existing relationships), the way of interaction for goal alignment, and the balance between informal and formal relationships in order to avoid one or more stakeholders gaining total control of the network.

• ***'dynamic stability'***

FLELLAP: As the name suggests, this Living Lab network was initially conceived as a platform connecting the separate Living Labs with each their own set of partners, panel and scope. It was intended to attract external projects within these three 'sub-Living Labs' as there were no clearly described internal projects in the project proposal. To this end, the relationships between the actors in the thematic projects needed to be strong. Telenet and Androme did build a strong tie within the development of YeloTV, but this remained almost exclusively an exchange of knowledge and (monetary) assets between the two actors that took place largely outside of the Living Lab[108], so Telenet did not act very committed towards the network, as we also gathered from the interview with the Living Lab manager. He also literally stated that he was 'tolerated' by Telenet in his role as Living Lab manager, but that he did not have real power to move things inside the company. For the Smart Cities Living Lab, more actors were involved (FifthPlay, Telenet, the researchers and the panel managers), and the roll-out of the infrastructure and of the platform among a dedicated set of end-users was successful, but attracting external utilizers on the FifthPlay platform (new relationships) appeared to be much more difficult. The most interesting and valued use-case on the platform was a smart energy application, which sparked some distrust from FifthPlay towards Alcatel-Lucent, as they were potential competitors in this domain, which was not foreseen in the proposal. However, as Alcatel-Lucent had made a strategic change in priorities, the exploitation of their laboratory infrastructure with the other Living Lab actors did not take place.

Because of these issues, attracting external projects that would lead to new relationships was difficult. This task was mainly executed by the Living Lab manager and by the iMinds

[108] http://www.androme.com/index.php/news/35/70/Telenet-lanceert-digitale-tv-over-wifi

researchers who looked for ways to develop and showcase the research capacity and opportunities, and to activate the panel members. In order to foster a stronger tie with these end-users, the researchers and panel managers conducted multiple survey waves with fixed time intervals, covering different subjects. This was also carried out in order to gather relevant data to attract external utilizers, but the most important side effect was that the response rates of the panel members remained fairly high, which suggests a sense of community among the end-users. Eventually, three external utilizers engaged in an innovation project (OKEEZ, Fietsnet and MuFoLive), but these projects were executed without any assistance or involvement of the other actors. Out of the interview with the Living Lab manager we gathered that a lot of potential external utilizers were either scared of sharing their innovations with Telenet as a large actor (cf. the Open Innovation paradox), or interested because of the presence of Telenet which they regarded as a potential partner. However, this interest declined as it became apparent that Telent did not show a lot of interest in the Living Lab. This also relates to the suggestion of Dutilleul et al. (2010) of chosing a public, more neutral actor as project lead (cf. infra).

LEYLAB: The developed strong ties between actors of the Living Lab were especially developed amongst the partners within the internal projects. Especially Alcatel-Lucent and Belgacom had to collaborate intensively to roll-out the network and to keep it in the air whilst monitoring all activity taking place on the network. The roll-out of the network also fostered intensive collaboration with the city of Kortrijk (in order to obtain all necessary permits), with the iMinds Living Labs panel managers (for the communication with the end-users) and with the researchers (who had to profile the panel members). The internal collaboration was also very obvious during some of the external events that were organized in order to attract panel members and in order to introduce the users to new services or hand out devices (e.g. the tablets), as these events were set-up with the shared effort of most of the consortium partners. In the two internal use cases, the collaboration was also rather intensive, but the degree of cross-collaboration between the use-cases remained low.

As the number of external projects remained low, the Living Lab manager launched a call for participation during the last steerco in 2011 to all consortium partners to generate leads that could foster new projects. This resulted in a long list of potential utilizers and eventually led to three projects, although the majority of the leads was generated by the 'core' partners Alcatel-Lucent and iMinds. With only three external projects, the number remained below the expectations. As noted in the steerco reports, the external actor Barco took part in one of the successful technical tests within the AV project, which is a different example of dynamic stability. In the eHealth case, a couple of meetings were held with a local hospital and elderly care facility in order to establish a form of collaboration, but these efforts were not successful. A similar reason as with FLELLAP can be mentioned here to explain the low amount of external projects, as the project lead was also in the hands of a large company, and with the presence of the other large telco in the consortium, this was perceived as intimidating by potential utilizers. The CloudFriends project was an exception, as they wanted to exploit their innovation to a telco like Belgacom, although in the end they sold their innovation to Inteno, a Swedish company. In terms of the users, the geographic proximity and the shared infrastructure fostered a spontaneous sense of community, which could be witnessed by the enthusiasm of the panel members for participating in research and other activities related to LeYLAb.

MEDIATUIN: In terms of dynamic stability, Mediatuin achieved a form of openness in the innovation network as it succeeded in attracting quite some external utilizers. The strong ties among the network actors were especially achieved between the researchers and the provider, REC, which also had the project lead. From the meeting minutes, it appears that in total more than 25 meetings with potential utilizers were set-up where the Living Lab manager from REC teamed up with a researcher from iMinds. Initially, attempts were made by REC to establish a strong tie with the users (the Mediatuin panel members) by means of various online (blog, newsletter,…) and offline (network events,…) activities, as can be deducted from the project proposal and from the interview with the Living Lab manager, but lack of internal resources within REC constrained these efforts. This became apparent within the innovation projects (cf. infra), where it appeared to be difficult to motivate enough users to participate in the different research steps. The ties with the other providers, Telenet and Netlog, cannot be considered as very strong, as they did not display a lot of activity in the Living Lab. A possible explanation might be the lack of formal meeting moments with all the partners, as only one official steerco took place.

IMINDS LIVING LABS: In terms of dynamic stability, clearly the iMinds Living Labs constellation is the most successful, as it succeeds in attracting a lot of external utilizers, thus achieving a form of openness in the innovation network, whilst also fostering strong ties among the other network actors. The existing relationships consist of the collaboration and interaction between the iMinds researchers, the iMinds panel managers and the iMinds management (who decides on the budget allocation for iMinds Living Labs). With the exception of the users and utilizers, all of the actors are aiming at exploiting their knowledge within external projects, which fosters a state of dynamic stability.

• Interaction for goal alignment

FLELLAP: Because of its intended structure, with three separate Living Lab networks, interaction between the different actors needed to be facilitated in order to reap potential benefits of the ‘platform’ structure. This was intended by introducing a strict meeting schedule with regular steering committees and customer groups for the three different ‘Living Labs’ and with general steering committees to report the progress of the different internal projects, with one Living Lab manager as the central spokesperson. There were also separate meetings regarding the infrastructure management and regarding the panel management. This complex 'meeting schedule' was summarized by the following graphic.

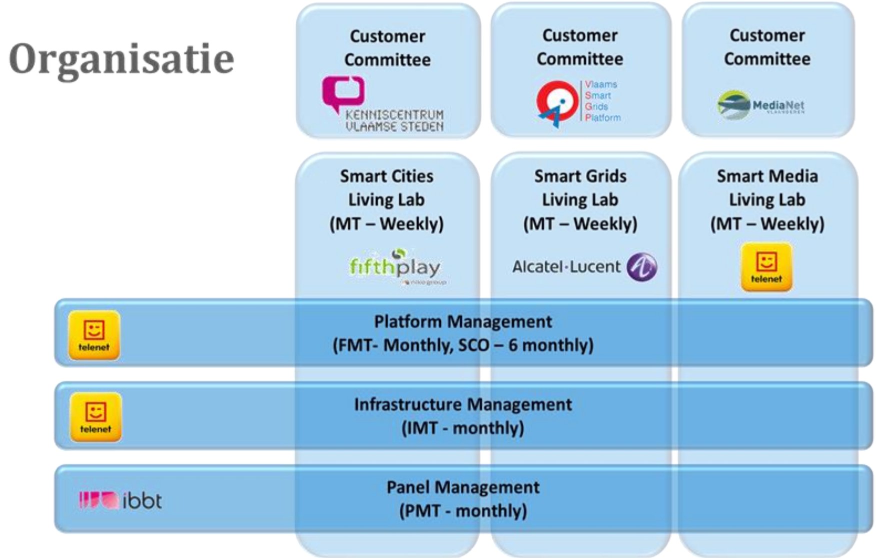

Figure 16: FLELLAP formal meeting structure

However, in practice this created a structure that was too formalized to be able to act and respond quickly. Moreover, as we could witness from the meeting minutes, not all of these intended meetings effectively took place.

Both the panel manager and Fifthplay mentioned distrust between the partners, partly caused because of the asymmetrical power relationships between the participating actors (SMEs versus large companies) and potential conflicts of interest (Smart Grids & energy), and also because of the rather closed attitude of Telenet and Androme. This resulted in most of the internal as well as external projects being carried out with only a limited set of actors. Only the researchers, panel managers and Living Lab manager had the shared goal to attract external utilizers, carry out innovation projects and activate the user panel, while the companies rather pursued their own goals and agendas. The Living Lab manager also pointed towards the proposal, which was rather vague in terms of the shared goals.

LEYLAB: In LeYLab, a large number of steering committees (24 in total, almost monthly) were held in order to foster interaction and decision-making amongst the consortium partners. The Living Lab manager, who was employed at Alcatel-Lucent, was the main responsible for these steering committees. When going through the meeting minutes of these steercos, it becomes apparent that the structure becomes more and more formalized and the list of action points grows, in an attempt to get the internal projects on track. However, most of the time there was little collaboration between the actors active in the different thematic work packages, only between the actors from the same working package, despite the efforts of the Living Lab manager (e.g. the plea to generate new leads). In fact, the thematic projects operated rather by themselves, and the steering committees remained more of a status update regarding the progress that had been made. However, within the use cases, the goals of the actors were more or less aligned with each other.

MEDIATUIN: As was mentioned in the previous section, only one official steering committee was held. This offered the opportunity to the active partners, REC and iMinds, to dedicate all effort towards attracting external utilizers, but it also resulted in the internal projects running astray. This resulted in a light weight decision structure, but also in the other partners not providing any help in the search for external projects.

IMINDS LIVING LABS: In iMinds Living Labs, a lot of attention was dedicated to the interaction processes because of the lessons learned from the previous Living Labs. After a period of trial and error, this has led to a strict meeting schedule with the different people from the different actors involved in the different Living Lab projects. There are bi-weekly meetings with all iMinds people involved in the Living Lab projects (panel management, researchers and business development), and separate panel management and researcher meetings in order to facilitate cross-project learning. For the researchers, this also includes research goal setting. As most of the actors belong to iMinds, they share the same overarching organizational goal: to foster and develop ICT innovation and talent in Flanders.

Balancing informal and formal relationships

FLELLAP: From the different data, we gather that the balance between formal and informal relationships between the different actors within FLELLAP seemed to be a hurdle. Especially the dual role of Telenet, as utilizer in the smart media thematic domain as well as (potential) provider of its infrastructure in the other cases, as well as overall project lead. This function was taken by the Living Lab manager who was a consultant employed by Telenet at that time. However, because of his position as external consultant working for Telenet, he lacked the negotiation power to mobilize other people and divisions within Telenet for the Living Lab. This was confirmed by the observation that Telenet was not very supportive towards testing its own technologies in FLELLAP, as became apparent when discussing the actor roles in the Living Lab (cf. supra). Therefore, none of the other companies involved took the initiative to attract external utilizers, but instead they focused on their own projects. As stated earlier, the Living Lab manager, the researchers and the panel managers became an informal alliance in search for external projects, which resulted in three external projects.

Moreover, Telenet also largely neglected its role as provider for external utilizers. This became apparent in the interviews with MuFoLive and Fietsnet who had expected more cooperation and involvement from Telenet, something which was also one of the reasons to engage in a Living Lab project. However, in the end there was hardly any involvement at all.

In terms of panel members, the FLELLAP panel was rather successful as the response rates of the surveys remained rather high, but the lack of external cases and offline testing activities did not foster a strong sense of community among the panel members.

LEYLAB: In terms of informal relations, the organization of offline events together with panel members and potential utilizers did foster a sense of community among the panel members, but also among the participating actors. Some informal knowledge exchanges between the researchers and the provider Alcatel-Lucent eventually led to a shared publication (Schuurman et al., 2013). The contacts and collaboration in LeYLab also led to two new European projects: Specifi[109], where Alcatel-Lucent, Belgacom, the city of Kortrijk and iMinds also participate, and Care4Balance[110] with iMinds, Alcatel-Lucent and Televic Healthcare.

In terms of network position, Alcatel-Lucent and Belgacom were central in the network because of their role in setting-up and maintaining the FttH-network. However, they did not intervene in the thematic internal projects when this was not necessary. The Living Lab manager followed up on the progress and tried to coordinate most operations, but did not impose decisions upon them. This is also apparent in the steerco minutes, as for important decisions, a voting procedure was used where all actors had an equal amount of votes. As a downside, this 'democratic' decision process was a delaying factor, especially because of the large amount of actors.

MEDIATUIN: The formal relationships between the actors in the Mediatuin Living Lab were postulated in the project proposal, but in reality the relationships turned out differently. Besides some help during the recruitment of the panel members, SonicAngel acted as an external utilizer, showing only interest in its own internal Living Lab project. Telenet showed interest in some of the results of the intake survey regarding its digital radio channels, but this did not lead to anything else than an internal presentation at the Telenet premises. With Netlog, three meetings were held in order to prepare the internal project regarding social radio, but no concrete actions were undertaken because of lack of interest on their behalf. This can be explained by the situation of Netlog at the time of the establishment of the Living Lab. Because of declining user interest, caused by the increasing popularity of Facebook, Netlog decided to look for extra applications and functionalities that would retain the users of the platform[111]. Netlog joined the consortium of Mediatuin in order to test and develop potential new cross media applications. However, one of these ideas was a dating application, which was turned into its own networksite (Twoo) at the time Mediatuin started. As this

[109] http://www.specifi.eu/about
[110] http://www.care4balance.eu/
[111] http://www.skynetadvertising.be/download/netlog_072011.pdf

appeared to be very successful[112], Netlog decided to focus on Twoo and the interest in Mediatuin declined.

IMINDS LIVING LABS: As every actor in the iMinds Living Labs innovation network has its specific tasks and goals, there is not a single 'dominant' actor, as all actors are rather dependent on each other. Only the enablers of the projects can be considered as rather 'dominant' actors as without their (financial) resources, it would be much more difficult to attract utilizers. However, they do not have a lot of impact on the definition of Living Lab projects. In terms of project definition, the researchers are in charge of the methodological choices, whereas the utilizers provide the research questions.

7.9.6 Actor roles, knowledge transfers and Living Lab success

In order to conclude our analysis on the macro level, we will now look into the success ratio of the Living Lab actors (58 in total). We do this for the actors in general, related to their main goal, their role in the network and in terms of the Living Lab constellations.

Referring back to the three main knowledge processes, none of the involved actors had retention as main goal to participate in the Living Lab, so all actors had exploration or exploitation as a main goal. This is also in line with the findings from the Living Labs literature in the previous chapter, where only a minority of the papers mentioned retention as a process in Living Labs. Only for researchers, retention occurred in all four Living Labs. Clearly, the iMinds Living Labs constellations is most focused at knowledge retention, but due to the lack of thematic focus, this retention has to take place on a higher level of abstraction (e.g. in terms of methodology).

Regarding the other two Open Innovation processes, we witness the following. If we look at the grand total of all 58 actors that participated in the four Living Lab constellations as consortium partner or as instigator of a Living Lab project in one of these constellations, the numbers are quite in balance with 30 actors having exploration as main goal against 28 who mention exploitation. This contradicts our expectation, as from the Open Innovation literature we would assume that the majority of knowledge exchanges would be targeted at exploitation, as Living Labs are regarded as a means to overcome the European Paradox. However, in the previous chapter we discovered that only a minority of the Living Labs papers takes the exploitation process explicitly into account when conceptualizing Living Labs, whereas all of the papers from our sample regarded exploration as inherent in Living Labs activities.

If we make a breakdown of the initial motivation in relation to the role in the Living Lab, we come to the following table that indicates that for none of the five categories, this balance between exploration and exploitation is attained.

[112] http://www.nieuwsblad.be/article/detail.aspx?articleid=DMF20130212_00467010

Table 39: Motives per stakeholder role

	Exploration	Exploitation	Total
Utilizers	17 – 65%	9 – 35%	26
Enablers	5 – 71%	2 – 29%	7
Providers	4 – 24%	12 – 76%	16
Users	4 – 100%	0 – 0%	4
Researchers	0 – 0%	5 – 100%	5
Total	**30 – 52%**	**28 – 48%**	**58**

For users, the dominant motivation is exploration of new knowledge by testing and participating in research activities, something which is supported by the current research available into user motivations for participation in Open Innovation (Ståhlbröst & Bergvall-Kåreborn, 2011). For researchers, exploiting their research capacity is the dominant reason, although they are also able to explore new knowledge by conducting experiments in the different projects and research activities, in terms of methodology or in terms of other specific topics. For providers, the initial interest is clearly more situated towards exploitation. More than 3 out of 4 providers in the studied Living Labs want to exploit the infrastructure or services they contribute to the Living Lab, either directly in the Living Lab (e.g. as a testing infrastructure for external utilizers), to partners from the Living Lab or externally by demonstrating the added value of the infrastructure or of the offered services. The enablers tend to have exploration as the dominant motive to participate in the Living Lab. The funding enablers of the three ICT Living Labs wanted to explore the viability and sustainability of a Living Lab approach for innovation in Flanders, but the enablers within the iMinds Living Labs constellation see their investments as a means to exploit the value of the Living Lab to stimulate innovation. For utilizers of the Living Lab, the ratio is the most balanced, with 17 mainly coming to the Living Lab to explore new knowledge versus 9 looking to actually exploit their innovation.

In other words, generally speaking, the providers and researchers tend to exploit their services, knowledge and technology in the Living Lab towards utilizers who mainly have exploratory motives, although a substantial proportion also regards the Living Lab as a means for exploitation.

Table 40: Motives per Living Lab constellation

	Exploration	Exploitation
FLELLAP	6 – 55%	5 – 45%
LeYLab	7 – 39%	11 – 61%
Mediatuin	12 – 80%	3 – 20%
iMinds Living Labs	5 – 36%	9 – 64%

When looking at the Living Lab constellations, they also differ quite drastically in terms of the goals of their actors. For FLELLAP, a relative balance is attained with 6 actors focusing on exploration against 5 on exploitation. For LeYLab, with clearly the largest amount of actors, only 7 focus on exploration whereas 11 had the initial intention to exploit their knowledge. For the Mediatuin, the balance is largely towards exploration, with especially a large amount of external utilizers pursuing this strategy, whereas only 3 actors, two internal actors and one external ulitilizer, focus explicitly on exploitation. For the iMinds Living Labs constellation (iMinds Living Labs), the balance shifted again towards exploitation: 9 actors are looking to exploit their knowledge, of which 5 internal, whereas 5 actors aim at exploration, of which 4 external utilizers.

In total, of all 58 actors participating in the studied Living Labs, 39 succeeded in their initial motive to participate, which accounts for 67% or a success rate of 2 out of 3. When we look at these statistics for the Living Labs separately and according to the initial motive, we can construct the following table.

Table 41: Success rate per Living Lab

	Success	**%**
FLELLAP	6 out of 11	55%
LeYLab	11 out of 18	61%
Mediatuin	10 out of 15	67%
iMinds Living Labs	12 out of 14	86%
Total	**39 out of 58**	**67%**

In terms of success, iMinds Living Labs had the most actors being able to fulfill their initial goal, with the three ICT Living Labs lagging behind. However, in every Living Lab constellation, more than half of the actors reached their initial exploration or exploitation goal, which is an indication of their relative success and of the value they were able to generate.

In terms of the goal, it seems that actors looking for exploration were not only in the majority, but were also more likely to be successful. In total, 73% of the actors that came to the Living Lab for exploration purposes was successful, whereas for actors looking at exploitation the success rate drops to 61%. If we further split up the ratio of success with regards to exploitation versus exploration according to the five actor roles, this leads to the following table.

Table 42: Success rate per actor

	Total success	**%**	**Exploration success**	**%**	**Exploitaiton success**	**%**
Enablers	5 out of 7	71%	3 out of 5	60%	2 out of 2	100%
Providers	8 out of 16	50%	1 out of 4	25%	7 out of 12	58%
Researchers	4 out of 5	80%	/	/	4 out of 5	80%
Users	4 out of 4	100%	4 out of 4	100%	/	/
Utilizers	18 out of 26	72%	14 out of 17	82%	4 out of 9	44%
Total	**39 out of 58**	**67%**	**22 out of 30**	**73%**	**17 out of 28**	**61%**

We gather that the user and researcher roles were most likely to successfully explore new knowledge or exploit their own knowledge. Enablers and utilizers also show rather high success rates, but for providers this drops to 1 out of 2. This can for the most part be explained by the large amount of providers for the internal projects in the LeYLab consortium. As these projects are unsuccessful, it is difficult for these actors to become successful themselves within the Living Lab. Especially for providers looking to explore new knowledge, this appears to be difficult, whereas providers with an exploitation strategy, aimed at valorizing their own knowledge or other assets, are more likely to be successful. Finally, utilizers that come to the Living Lab to explore new knowledge regarding their innovation are likely to generate this kind of knowledge, whereas exploitation motives are less common for this type of actor and are also less successful.

Referring to the European Paradox, out of our studied Living Lab constellations, we can conclude that knowledge exploration and exploitation are almost in balance with each other in terms of main goal, but that stakeholders aiming at exploration are more likely to be successful than stakeholders aiming at exploitation (73% versus 61%). Most remarkable is that for the utilizer role, which is the actor that instigates the Living Lab project, these ratios shift completely. Utilizers are almost twice as likely to look for exploration in Living Lab projects, and the ulilizers that aimed for exploitation were not successful in more than half of the studied cases. It would be interesting to investigate whether the utilizers that successfully explored new knowledge are better able to exploit their knowledge afterwards. Within our meso level analysis, we will shed some more light on this. Second, this still indicates that the

Living Labs we studied are more tailored towards exploration than towards direct exploitation.

7.9.7 SMEs in Living Lab networks

As in Open Innovation literature there was a gap in research looking into SMEs, and as within the studied Living Lab constellations a lot of SMEs were active, we redid the analysis only taking into account the SMEs. Out of all 58 actors, 23 are SMEs, which accounts for 40% of all actors. In terms of the Living Lab constellations, FLELLAP had 4 SMEs, LeYLab 6, Mediatuin 8 and iMinds Living Labs 5. Regarding the roles of these SMEs in the Living Labs, the majority (16) acted as an external utilizer of these Living Labs, 3 as internal utilizer, 3 as provider, and 1 as researcher. In terms of the main motive to participate and the success of the participation for the SMEs, we can construct the following table.

Table 43: Success rate for SMEs

	Total success	**%**	**Exploration success**	**%**	**Exploitaiton success**	**%**
Providers	8 out of 16	<u>50%</u>	/	**/**	1 out of 3	33%
Researchers	4 out of 5	80%	/	/	0 out of 1	0%
Utilizers	18 out of 26	72%	11 out of 12	92%	3 out of 7	<u>43%</u>
Total	**15 out of 23**	**65%**	**11 out of 12**	**92%**	**4 out of 11**	**36%**

In total, 65% of the SMEs were successful in realizing their initial goal, which is more or less in line with the general success ratio of 67%. However, when taking into account the main motivation, we can discern a huge difference. The division between exploration and exploitation is rather balanced, but the success ratio for SMEs looking for exploration is 92%, whereas for exploitation this drops to 36%. Moreover, when looking at the four successful instances of SMEs exploiting their innovation or knowledge, in two instances this occurred outside of the Living Lab. For Androme in FLELLAP, they were able to exploit their knowledge in the development of YeloTV, but Telenet took the actual development for the most part outside of the Living Lab, with only a small scale user test in the Living Lab. CloudFriends wanted to exploit their innovation to a telco (Belgacom) in LeYLab. However, they sold their technology to Inteno, a Swedish telco, so the actual exploitation also took place outside of the Living Lab. In the Twikey-project, they used the results of the user research to convince banks and companies to adopt their technology, which was successful. However, the actual exploitation also did not take place inside the Living Lab, the Living Lab project was merely used as a means within the exploitation strategy of Twikey. Only in the case of Zeticon, they were able to exploit their Mediahaven platform to Kortrijk. Based on the cases we studied, SMEs have the most chance of success when going for an exploration strategy in Living Labs within the role of (external) utilizer. An exploitation strategy seemed to be far less successful, as is the strategy to take a different role in the Living Lab constellation.

7.10 Meso level analysis

After our analysis of the Living Lab constellations and the different stakeholders operating in these constellations, we now turn towards the meso level, which stands for the innovation projects that are carried out within the Living Lab constellations. For the analyses on this level, we take the perspective of the instigator of the project, which we referred to as the utilizer role in the Living Lab constellation. Therefore, we look into the 21 Living Lab projects we described in the case descriptions at the beginning of this chapter, and base ourselves mainly on the interviews that were held with all of the project instigators (cf. annex). The following table gives an overview of the 21 cases, the Living Lab in which they took place, the company or organization type of the instigator, together with the name if this differs from the project name, and the title of the interviewee within the company or organization. A more detailed list can be found in the annexes, containing the name of the interviewees and the date of the interviews.

Table 44: Overview interviewees per project

Case	Living Lab	Instigator	Interviewee
Wadify	**iMinds Living Labs**	SME PlayOut!	CEO
Smart Seats		Start-up	Co-founder
Webinos		EU-project University research group	Senior researcher
Coxo		Organization VTBKultuur	Project manager
Twikey		Start-up	Founder
Ceonav		SME	Founder
Veltion		Start-up	Founder
Planza	**Mediatuin**	Start-up	Founder
Qwison		SME – Aconos	Founder
SonicAngel		SME	Co-founder
Hoaxland		SME	CEO
La Mosca		SME	CEO
Future Legends		Organization - REC	Director
JukeBox21		Start-up	Co-founder
Streemr		Start-up	Founder
Kianos		Start-up	Founder
OnCloud	**LeYLab**	Large firm - Belgacom	Senior strategic consultant
Poppidups		SME Prophets	Project manager
Fietsnet	**FLELLAP**	Organization	Co-founder
Fifth Play		SME/Large firm	Business Unit Director
MuFoLive		Start-up SampleSumo	Co-founder

In the remainder of this chapter, we will refer to the instigator by the name of the project, for the sake of clarity. It should be clear that when we refer to the organizational capabilities of e.g. Poppidups, we refer to the organizational capabilities of the company Prophets as they are perceived by the interviewee from Prophets, in this case a project manager.

The interviews included statements from both the Open Innovation literature (Open Innovation company capabilities, previous experience with Open Innovation) as well as the User Innovation literature (Lead User statements, perceived user contribution). The interviewees were asked to elaborate upon their scores and some open questions were also included to assess how they had experienced the Living Lab project and what they perceived as positive and negative elements. Some of these elements were already presented when introducing the cases (cf. supra). In the following paragraphs we will look at some of the variables from the Open as well as the User Innovation paradigm in relation to the success of the projects. This will allow to gain insights into the characteristics and nature of these instigators engaging in a Living Lab innovation project.

In order to assess the success of the innovation projects on the meso level, we have chosen three criteria: perceived value of the project, progress made during the project in the innovation development process, and market introduction. These success criteria will enable to explore the relation of the instigator characteristics with potential success. We will elaborate upon these success criteria in the next section.

7.10.1 Living Lab project success

As it is difficult to assess the success of an innovation project by means of a single criterion, we chose to discern three different indicators of the success of a Living Lab project: the market introduction of the innovation, the progress that has been made during the project in terms of the innovation development, and the attitude of the instigator towards the Living Lab project.

The first definition of success takes into account the attitude of the instigator towards the Living Lab-project, which we label as *perceived success*. During the interviews, the instigators were asked to sum up the positive and negative aspects of the Living Lab project. These answers were coded by two independent coders one a five-point scale from very positive (5) to very negative (1). Both coders were researchers involved in the Living Lab team. The results were compared and the four cases where the codings differed were discussed and resolved. A summary of the arguments is included in the 21 case descriptions (cf. supra).

Eventually, all scores were recoded to the three following values:

Positive: there are more positive remarks regarding the Living Lab-project than negative ones.

Neutral: the positive and negative remarks are balanced.

Negative: the negative remarks are more frequent than the positive remarks.

As a result, the majority of the instigators showed a positive attitude towards the Living Lab-project (11 out of 21 – 52%), 7 out of 21 had a neutral attitude towards the Living Lab-project, while the remaining three instigators were predominantly negative or critical towards the Living Lab-project.

The second definition of success looks at the progress that has been made in terms of the innovation development process during the Living Lab project. Therefore we took into account the two variables that were assessed during the interviews as '*outcome innovation process'*. We distinguished between the following stages in the innovation development process: *1 - idea phase, 2 - concept phase, 3 - prototype phase, 4 - pre-launch phase, 5 - launch phase, 6 - post-launch phase*. All instigators indicated the progress that had been made in terms of the innovation development process during the Living Lab project. The first phase indicates the state of the innovation at the start of the project, whereas the second phase indicates the state at the end of the project.

We discern three values:

Leap: in terms of the innovation development process, two or more steps have been taken.

Step: this indicates that during the Living Lab-project, the progress consisted of one step.

Stop: stands for no advancement or a regression in the innovation development process.

For 4 out of 21 (19%) Living Lab-projects, more than one step of progress was made (Twikey, Future Legends, SonicAngel and FifthPlay). The majority of the projects progressed one stage in the innovation development process: 13 out of 21. The remaining four projects did not make any progress, with 1 out of these 4 taking back some steps in order to, as the instigator phrased it himself "reculer pour mieux sauter" (Ceonav).

The third definition of success is the current status of the innovation in terms of market success as it was assessed in October 2014. We took the interviews as main source of information, but we also conducted a final online investigation of the websites of the instigators to see whether there was any evidence of the innovation being on the market. We discern the following values:

On the market: the innovation is available on the market for the target customers.

Pipeline: the innovation is still in development and planned to be launched somewhere in the future, or is ready to be launched, but not launched yet.

Reoriented: the innovation that was the subject of the Living Lab project will not be further developed or launched by the instigator. This can be because the instigator as an organization ceased to exist or decided to stop the innovation development in its current form.

In total, 6 out of the 21 (29%) innovation projects have resulted in the innovation being currently available in the target market. This is the case for two (out of seven) iMinds Living Labs-projects (Twikey and Smart Seats), two (out of nine) Mediatuin-projects (Future Legends and Planza), one (out of two) LeYLab-projects (Belgacom OnCloud), and one out of three FLELLAP-projects (FifthPlay). 11 out of the 21 projects are still in the pipeline to be launched on the market, while the remaining four projects have resulted in a reorientation, which includes companies that have stopped their activities (Jukebox21 and Aconos of the Qwison-project), and the other companies having stopped the innovation project in the form it was brought into the Living Lab.

In terms of the three success criteria, the perceived success of the Living Lab projects was clearly the highest, while innovation development progress and market introduction are a lot less common. When we combine all three success factors by considering the three variables on scores from 3 to 1 and adding them up, two projects have a 'perfect score' (Twikey and Future Legends), while three other projects have a total of 8 points (FifthPlay, Belgacom OnCloud and SonicAngel). 5 projects have a total score of 7, 6 projects have a score of 6, 3 a score of 5 and 2 had a score of 4 (Fietsnet and Ceonav). Therefore, we can conclude that the Living Lab projects clearly led to successes on the different criteria for the instigators, but that this was definitely not a complete success story. We will now turn to variables and characteristics of the innovation projects related to the key concepts and frameworks we gathered out of the Open and User Innovation literature (cf. supra), and related these to the project outcomes.

Below a summarizing table can be found containing the outcomes for all three variables, for which we discern three potential outcomes: value '3' coinciding with the most positive outcome, value '2' indicating an outcome between positive and negative, and value '1' indicating a negative outcome. We have ranked the cases based on a composed variable that adds the score for all three variables, which means that projects can score a maximum of 9 (positive outcome on all three the variables) and a minimum of 3 (negative outcome on all three the variables).

Table 45: Outcome related to strategy

Case	Sum	Perceived success	Progress	Market status	Goal
Twikey	9	Pos	Leap	On the market	Exploitation
Future Legends	9	Pos	Leap	On the market	Exploration
Fifth Play	8	Neut	Leap	On the market	Exploitation
OnCloud	8	Pos	Step	On the market	Exploration
SonicAngel	8	Pos	Leap	Pipeline	Exploration
Streemr	7	Pos	Step	Pipeline	Exploration
La Mosca	7	Pos	Step	Pipeline	Exploration
Webinos	7	Pos	Step	Pipeline	Exploration
Hoaxland	7	Pos	Step	Pipeline	Exploration
MuFoLive	7	Pos	Step	Pipeline	Exploration
Qwison	6	Pos	Step	Reoriented	Exploitation
Planza	6	Neg	Step	On the market	Exploration
Coxo	6	Neut	Step	Pipeline	Exploration
Smart Seats	6	Neg	Step	On the market	Exploration
Wadify	6	Pos	Step	Reoriented	Exploration
Veltion	6	Neut	Step	Pipeline	Exploitation
Kianos	5	Neut	Stop	Pipeline	Exploration
JukeBox21	5	Neut	Step	Reoriented	Exploration
Poppidups	5	Neg	Stop	Pipeline	Exploration
Fietsnet	4	Neut	Stop	Pipeline	Exploration
Ceonav	4	Neut	Stop	Reoriented	Exploitation

In the final column, we also added the main motivation for the instigator to carry out a Living Lab project (exploration versus exploitation). We will now relate these success factors to the degree of experience in Open Innovation with other actors.

7.10.2 Experience in Open Innovation & collaboration

As Bogers (2011) suggested that experience and relation to other actors in Open Innovation play a role in the outcome of Open Innovation processes, we also included some items assessing the experience of the instigators with innovation activities with different other actors. The following actors were included: other companies, academic researchers, research institutes, iMinds, market research company, consultants, a Living Lab, a public actor and a non-governmental actor. We let the instigator assess the experience with these actors on a five point scale and recoded this variable into dummies, considering 4 or 5 out of 5 as having experience with this actor, and everything below as not having experience with innovating with this actor. The table below gives an overview of the experience for all 21 instigators with innovation activities with the 9 actors.

Table 46: Experience in Open Innovation

	Com-pany	Aca-demia	Research institute	iMinds	Market research	Consul-tant	Living Lab	Public actor	NGO	Tot
Future Legends	-	X	X	X	-	-	-	X	X	**5**
SonicAngel	-	-	-	-	-	-	-	X	-	**1**
FifthPlay	X	-	X	-	X	X	-	X	-	**5**
Fietsnet	-	-	-	-	-	-	-	-	-	**0**
Streemr	X	-	-	-	-	X	-	X	-	**3**
Jukebox21	X	-	-	-	X	X	-	X	X	**5**
Wadify	X	-	-	-	-	X	-	X	-	**3**
OnCloud	X	X	X	X	X	X	X	X	X	**9**
Qwison	X	-	-	-	-	-	-	-	-	**1**
La Mosca	-	X	X	X	-	X	-	X	X	**6**
Poppidups	-	-	-	-	X	-	-	-	-	**1**
Planza	-	-	-	-	-	-	-	X	X	**2**
Kianos	-	-	-	-	-	-	-	-	-	**0**
MuFoLive	X	X	-	-	-	-	-	-	-	**2**
Hoaxland	-	-	-	-	-	X	-	X	X	**3**
Veltion	-	X	-	-	-	-	-	-	-	**1**
Webinos	X	X	X	X	-	-	-	X	X	**6**
Ceonav	-	-	-	-	-	X	-	-	-	**1**
Twikey	-	-	-	-	X	X	-	-	-	**2**
Coxo	X	-	-	-	-	X	-	X	-	**3**
SmartSeats	X	X	-	-	X	X	-	X	X	**6**
Total	**10**	**7**	**5**	**4**	**6**	**11**	**1**	**13**	**8**	**65**

Public actors (13), consultants (11) and other companies (10) are the most solicited actors for collaboration on innovation among the 21 instigators. In terms of the Triple Helix of business, government and academia, the instigators are the least experienced in collaborating with academia for innovation. This can partly be ascribed to the overrepresentation of SMEs among the instigators (16 out of 21), as in the literature it was suggested that industry-academia relationships are mostly tailored towards large companies (Meyer et al., 2003).

Fietsnet and Kianos are the only two instigators with no Open Innovation experience whatsoever. For five instigators, this experience is only related to one category of stakeholders: SonicAngel, Qwison, Poppidups, Veltion and Ceonav. Planza, MuFoLive and

Twikey have experience with actors from two categories, and Streemr, Wadify, Hoaxland and Coxo with three categories. In other words, 14 of the 21 instigators (2 out of 3) have only limited experience in Open Innovation activities in terms of the diversity of Open Innovation partners. This can also be related to the type of organization, as Kianos, Veltion, CEOPS (CEONAV), Streemr, Planza, SampleSumo (MuFoLive), and Twikey are start-ups, whereas PlayOut (Wadify), SonicAngel, Aconos (Qwison), Hoaxland, and Prophets (Poppidups) are small SMEs. Fietsnet and VTBKultuur (Coxo) are not-for-profit organizations.

Future Legends, FifthPlay and Jukebox21 have experience with 5 different actors, La Mosca, Webinos and SmartSeats with 6, and OnCloud (Belgacom) with all of the 9 categories. For Future Legends, REC was the instigator, an organization connected to the university, supported by public organizations and connected to a lot of media players, whereas FifthPlay (subsidiary of the Niko-group) and La Mosca are more established SMEs. Jukebox21 and SmartSeats are start-ups, but both consisted of partners that had already a long track record in other companies and organizations. For Webinos, the instigator was an academic research group and Belgacom (OnCloud) is a large Flemish telco (cf. supra).

These results indicate that **the majority of the instigators of a Living Lab project in our sample are inexperienced in terms of Open Innovation** and that their involvement in a Living Lab can be regarded as their introduction to Open Innovation. Of all instigators, only one (Belgacom) had already a previous experience with a Living Lab. It seems that the Living Lab projects as offered in the studied cases attract companies and organizations that are relatively to totally inexperienced in terms of Open Innovation and of Living Labs.

In order to further explore the potential influence of Open Innovation experience on project success, we made a distinction between instigators that have experience with at least 5 different types of actors (7 in total), which we consider high, and the rest of the instigators that have experience with 3 or less different types of actors, which we consider low. In the table below, we recoded the different variables regarding project success into dummy variables. For the total success score, values of 9, 8 and 7 were regarded as successful (marked with 'X'), all projects with a score lower than 7 were considered unsuccessful (marked with '-'). For the three separate success variables (value as perceived by the instigator, progress made in terms of the NPD process, and market readiness) only the highest value was coded as 'X'. We also included the goal of the instigator (exploration versus exploitation).

Table 47: Open Innovation experience related to success criteria

	OI exp	Tot	Value	Prog	Market
OnCloud	9	X	X	-	X
La Mosca	6	X	X	-	-
Webinos	6	X	X	-	-
SmartSeats	6	-	-	-	X
Future Legends	5	X	X	X	X
FifthPlay	5	X	-	X	X
Jukebox21	5	-	-	-	-
		5/7 71%	**4/7 57%**	**2/7 29%**	**4/7 57%**
Hoaxland	3	X	X	-	-
Streemr	3	X	X	-	-
Wadify	3	-	X	-	-
Coxo	3	-	-	-	-
Planza	2	-	-	-	X
MuFoLive	2	X	X	-	-
Twikey	2	X	X	X	X
Veltion	1	-	-	-	-
SonicAngel	1	X	X	X	-
Ceonav	1	-	-	-	-
Poppidups	1	-	-	-	-
Qwison	1	-	X	-	-
Fietsnet	0	-	-	-	-
Kianos	0	-	-	-	-
		5/14 36%	**7/14 50%**	**2/14 14%**	**2/14 14%**

In terms of the total success score, the organizations with a broader experience in Open Innovation with different types of actors are more likely to be successful, as 5 out of 7 scored 7 or higher. For the instigators with less experience, this was only 5 out of 17, or less than 1 out of 3. Logically, this is also reflected in the three separate success factors. The difference is the least distinct in terms of perceived value, and the most distinct in terms of market readiness. From the 'inexperienced' organizations, only two succeeded in bringing their innovation to the market, whereas from the 'experienced' instigators four succeeded. The success criterion regading progress in the NPD process during the Living Lab project has the lowest score, with only two instigators from both categories that achieve in progressing more than one phase. It is also remarkable that only one of the experienced instigators had exploitation as a main motive, whereas four of the inexperienced had this motivation. From the inexperienced, only one was successful (Twikey), for the experienced, the single company with this motive, FifthPlay, was also successful. However, as we already discussed in the macro analysis, the success occurred with a smart plug solution that was only a part of the InCitys platform. This solution was exploited to Electrabel after the Living Lab project and is currently on the market, whereas exploiting the InCitys platform to local stakeholders was much less successful. Only Twikey was successful in its exploitation motive, as this instigator used the user insights to sell the service to other companies and organizations (cf. supra). This indicates that for utilizers it appears to be difficult to directly exploit their innovation by means of the Living Lab, and that more experienced organizations seem to have a higher chance of innovation project success, and especially market introduction, than less experienced organizations.

7.10.3 Open Innovation company capabilities

Out of the Open Innovation literature we gathered that Open Innovation processes are related to organizational capabilities. For all 21 Living Lab case instigators, we assessed how they rated their own company capabilities according to the framework of Lichtentahler (2011).

Table 48: Open Innovation processes and capabilities

Open Innovation process **(Licthenthaler & Lichtenthaler, 2009; van de Vrande et al., 2009)**	**Exploration** ***= innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments***	**Exploitation** ***= innovation activities to leverage existing knowledge or technological capabilities outside the boundaries of the organization***	**Retention** ***= maintaining, storing and reusing knowledge over time outside of an organization's boundaries***
Internal organizational capabilities **(Lichtenthaler, 2011)**	Inventive capacity *= the ability to generate knowledge internally*	Innovative capacity *= the ability to generate innovation internally*	Transformative capacity *= the ability to re-use internal knowledge*
External organizational capabilities **(Lichtenthaler, 2011)**	Absorptive capacity *= the ability to explore knowledge from external actors*	Desorptive capacity *= the ability to exploit internal knowledge to external actors*	Connective capacity *= the ability to connect with external actors to store or re-use knowledge*

The table below includes the statements that were used to assess these capabilities, on a scale from 1 (disagree) to 5 (agree), with the mean score for the 21 project instigators. The items are ranked from high to low. It is clear that the companies and organizations from our studied sample rank their capabilities related to ideation as highest, with the external capability ranking even higher than the internal capability. Although the instigators regard themselves as capable of exploration, the internal storage of the gathered knowledge is more problematic with a mean score of 3.62. The actual development of innovations based on this gathered knowledge seems to be again a bit more difficult with a mean score just over 3.5. The capabilities related to the actual exploitation of this knowledge rank remarkably lower. The external storage or retention of gathered knowledge (e.g. through a relationship with a knowledge institute) is clearly the least common capability, as it is the only one with a mean score beneath 3.

Table 49: Open Innovation capabilities

Statements	Mean (/5)
As a company, we excell in detecting external innovative ideas/knowledge (absorptive capacity)	4.19
As a company, we excell in coming up with our own innovative ideas (inventive capacity)	4.10
As a company, we excell in the internal storage of gathered knowledge (transformative capacity)	3.62
As a company, we excell in developing innovations (innovative capacity)	3.52
As a company, we excell in externally exploiting internal knowledge (desorptive capacity)	3.24
As a company, we excell in the external storage of gathered knowledge (connective capacity)	2.24

We distinguish a funnel-like structure of the organizational capabilities with the statements related to knowledge exploration clearly regarded as highest by the companies and organizations from our sample. Capabilities related to knowledge exploitation are rated the lowest, while knowledge retention scores somewhere in between. However, there is a large gap between internal knowledge retention capacity, which is rated rather high, and external knowledge retention capacity, which has the lowest overall score.

These results are in line with the European Paradox we encountered in chapter 5, as exploration is clearly superior to exploitation. If we look at the internal versus external firm capabilities, it is clear that the firms rate their internal capabilities much higher than their external capabilities. This is an indication that firms regard themselves as better at internal, more closed innovation processes than at more external, Open Innovation processes. Out of the interviews we gathered that the instigators regard their Living Lab cases as a means to engage in these Open Innovation processes. As we gathered from the analysis on the macro level, most of the processes occurring in Living Labs are exploratory in nature, followed by exploitation, with a small minority of retention processes. As the organizational capabilities of the instigators are especially lacking in the area of exploitation and retention, we would argue to put more emphasis on these processes in Living Lab projects.

The following table gives an overview of the organizational capabilities in relation to the main motive by which the instigator started a Living Lab project. We recoded the capabilities to dummy variables, with values 4 or 5 out of 5 being regarded as having the capability (marked X), and 3, 2 or 1 as not having the capability.

Table 50: Open Innovation capabilities related to motive

	Inv cap	*Abs cap*	*Innov cap*	*Des cap*	*Trans cap*	*Conn cap*
EXPLORATION						
Planza	X	-	X	-	X	-
Future Legends	X	X	X	-	-	-
OnCloud	X	X	X	X	-	-
SonicAngel	X	X	X	X	X	X
Fietsnet	-	X	-	-	-	-
Streemr	-	X	-	-	-	-
JukeBox21	X	-	X	-	X	-
Wadify	X	X	X	X	X	-
La Mosca	X	X	X	X	X	-
Poppidups	-	X	-	-	X	-
Kianos	-	X	X	-	-	-
MuFoLive	X	X	-	X	X	-
Hoaxland	X	X	X	X	-	-
Webinos	-	X	X	X	X	X
Coxo	X	X	-	X	X	-
Smart Seats	X	X	X	X	X	-
	11/16 69%	***14/16 88%***	***11/16 69%***	***9/16 56%***	***10/16 63%***	***2/16 13%***
EXPLOITATION						
Twikey	X	-	-	-	-	-
Fifth Play	X	X	X	X	X	-
Qwison	X	X	-	X	X	-
Veltion	X	X	X	-	X	X
Ceonav	X	X	X	-	X	-
	5/5 100%	***4/5 80%***	***3/5 60%***	***2/5 40%***	***4/5 80%***	***1/5 20%***

If we look at the organizational capabilities for exploration (inventive capacity and absorptive capacity), we notice that the instigators that aim at exploiting their innovation score very high on both the intra (5 out of 5) and inter (4 out of 5) organizational capabilities. For the instigators looking at exploration of their innovation, these numbers are somewhat lower, especially for the internal capability inventive capacity (11 out of 16). Regarding absorptive capacity, 14 out of 16 instigators indicate they have this capability.

Regarding the capabilities related to exploitation, innovative capacity and desorptive capacity, the organizations looking to exploit their innovation score lower than the exploring instigators, especially in terms of innovative capacity and desorptive capacity of knowledge.

None of the instigators of a Living Lab project had retention as a goal for the Living Lab project, something which already appeared during the analysis on the macro level. The capabilities related to retention are also the lowest amongst the instigators, especially with connective capacity scoring very low.

Summarizing, we find some indications that instigators engage in a Living Lab project in order to complement their lack of organizational capabilities, which was suggested by Rese and Baier (2011) and Van de Vrande et al. (2009), as the instigators looking for exploitation are less likely to rate themselves high on innovative and desorptive capacity, whereas instigators looking for exploration are less likely to rate themselves high on inventive and absorptive capacity. If we only take the SMEs from our cases, this does not change the general tendencies, although this is also largely due to the fact that 16 out of the 21 instigators are SMEs.

When we only take into account the SMEs, we see that all five instigators engaging in a Living Lab project for exploitation are SMEs, so for this group the results are the same as for the total sample. For the 11 SMEs looking for exploration, we also do not find notable differences with the total sample.

A good example of using the outcomes of a Living Lab-project in order to complement the lack of desorptive capacity is the Twikey case. In order to be able to convince companies and banks to adapt and buy his digital mandate solution, the instigator engaged in a Living Lab project in order to explore the user needs and wants with regards to his solution. With these results, he was able to convince the other actors, and was able to outlicense the technology to multiple external parties. Both the Ceonav and Veltion projects are also an illustration of this. Both rated themselves low in terms of exploitation capabilities and regarded the Living Lab project as an opportunity to discover a go-to-market stragtegy and identify the target market to exploit their innovation. However, in the course of both projects it appeared that the innovations were not suited for a market launch (yet). For Veltion, the take-away was that their application could be used to support their current service delivery, but was not suited to be launched as a stand-alone application. For Ceonav, the application in its current form appeared to be too complex for the target population, and did not fit their needs, which put them back to the drawing board (this was the only project where the instigator took some steps backwards in the innovation development process). These projects did not results in an exploitation of the innovation, but instead prevented the instigators of blindly launching the innovation with the chances of success being slim.

7.10.4 User Innovation and user contribution

From the previous chapter, we gathered that within the current Living Labs literature, an explicit connection to the User Innovation paradigm is still rare. This was rather surprising, as Living Labs regard the user as an equal partner in the innovation process. An interesting suggestion that did refer to User Innovation, albeit in a slightly different way, came from Almirall and Wareham (2008), and was repeated by Pallot et al. (2011). Both regard Living

Labs as ideal infrastructures to facilitate support to entrepreneurial users or user-entrepreneurs, as Shah and Tripsas (2007) called them. This type of user bridges the gap between User Innovation and Open Innovation, as these users are Lead Users that envision future market needs, expect high benefits when these needs would be solved, and decide to become an entrepreneur themselves. As we already learned that a lot of the instigators of the Living Lab projects were start-ups, we decided to assess the Lead Userness of every instigator with regards to their innovation domain. Therefore, based on the literature from the User Innovation chapter and the different scales for measuring Lead Userness, we constructed our own scale for measuring the Lead Userness of the instigator. We chose the following criteria and characteristics, based on Lüthje (2003), Franke et al. (2006), Schreier and Prügl (2008) and Bilgram et al. (2008): experiencing needs, benefit expectation, innovation related knowledge, usage experience, dissatisfaction and early adoption. The table below shows the items that were used. It appears that the instigators for the most part experience the needs they want to satisfy with their own innovation themselves and expect equally high benefits by using their own innovation. They also have a high degree of innovation related knowledge and have a lot of experience with the current solutions that exist. The only two items that score slightly lower are knowledge about the needs and wants of the end-users in their target market and being an early adopter of innovations in the innovation domain.

Table 51: Lead User statements

Dimensions *Items*	**Mean** **/5**
Experiencing needs	
We ourselves experience the needs our innovation wishes to satisfy	4.33
Benefit expectation	
We ourselves would experience high benefits by using our innovation	4.33
Innovation related knowledge	
We know the ecosystem around our target market well	4.24
We have knowledge regarding the current technical solutions in the target market	4.33
We have extensive knowledge regarding the innovation domain	4.19
Usage experience	
We have a lot of experience with the existing solutions for the needs our innovation wants to solve	4.10
We know about the needs and wants of the users in our target market	3.76
Dissatisfaction	
We ourselves are dissatisfied with the current solutions on the market	4.38
Early adoption	
We are amongst the first to try out new products or services in the innovation domain	3.81

Despite the small sample, we conducted a reliability analysis to assess the validity of this Lead Userness scale. For all items, we found a Cronbach's Alpha value of 0.725, which is satisfactory and indicates that the aforementioned items together compose of a reliable Lead User-scale. When we calculate the mean Lead Userness of the 21 instigators of our sample by adding up all scores on the 9 Lead User-statements, dividing the total by 9, we end up with a mean Lead User score of 4.16 out of 5, which indicates that, on average, all instigators at least 'agree' with all the statements. In order to divide our sample, we take 4.0 as cut-off point for being labeled as a Lead User. This results in 7 out of 21 scoring lower than the treshold, while 14 instigators or 2 out of 3 can be labeled a Lead User.

These results suggest that the majority of the instigators regard themselves as Lead Users in the innovation domain in which they are operating. The Living Lab project can be seen as a means to assess whether the needs they are experiencing are actually 'needs that will become general in the market place', or whether these needs are tied to a niche. This is also apparent in their relatively low knowledge of the needs and wants of the users in their innovation domain. This way, Living Labs are capable of attracting Lead Users and supporting entrepreneurial users, but in a slightly different way than sometimes proposed in the Living Labs literature, where the participation of end-users in Living Labs would induce them to innovate eventually (Pascu & van Lieshout, 2009; Leminen et al., 2014). This would lead us to suspect that in terms of user contribution, the instigators are looking for evaluative (*innovation for users*) or incremental input (*innovation with users*), rather than for radically new ideas or input (*innovation by users*).

This becomes even more apparent when looking at the influence the instigators perceived the participating users to have on their idea or innovation. All instigators rate 'evaluating' as 4 or 5 out of 5, which confirms the importance of user evaluations in a Living Lab project. The possibility of suggesting incremental innovation scores a lot lower. Just over half of the instigators (11 out of 21) agree that the users were able to suggest incremental innovations or modifications, while only three scored this item 2 or 1. This means that 7 instigators were rather indecisive regarding this matter. The possibility to suggest or come up with radical innovation or input that (re)defines the direction and outcome of the innovation scores the lowest. Only 4 instigators were open to this type of input, and 2 remained undecided, meaning that the remaining 15 instigators (more than 70%) were not open to this kind of user input. These results are also in line with our literature research in the previous chapter where we discovered that the majority of the Living Labs papers deal with 'innovation with users' (= incremental innovation), followed by 'innovation for users' (evaluation), and even none of the papers explicitly considering 'innovation by users', which occurred four times in our projects.

Table 52: User contribution according to the instigator

How many influence did the user have on the idea/innovation?	Mean
Evaluating our idea/innovation	4.52
Finetune our idea/innovation (incremental innovation)	3.38
User input will define the direction & outcome of the idea/innovation (radical innovation)	1.95

The four instigators that were open to this radical innovation input were Twikey, FifthPlay, SonicAngel and Veltion. For Twikey, the most radical innovation input from the end-users regarded the user interface and how users perceived the transaction process.

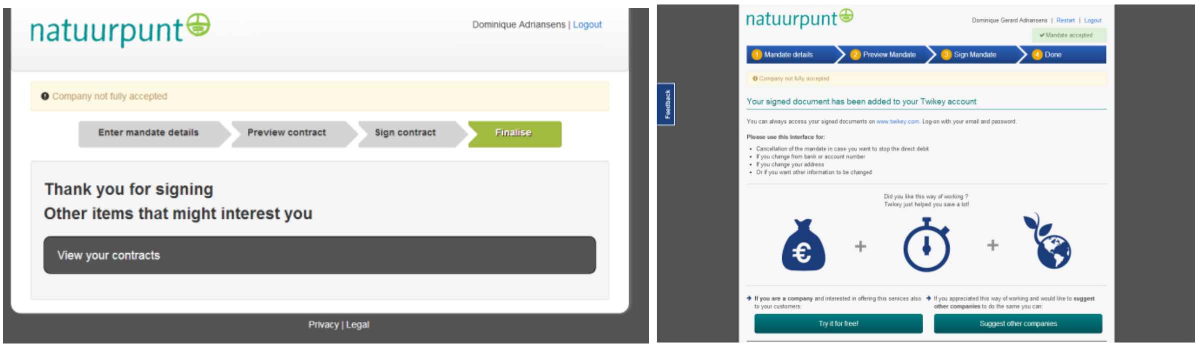

Figure 17: Twikey screen 'before' and 'after' the Living Lab project

The eventual interface was much more visual, contained more information regarding the transaction process and was calmer in terms of lay-out. These changes increased the trustworthiness of the application which put Twikey in a stronger position to negotiate deals with other companies and banks.

As we already mentioned, the outcomes of the FifthPlay project were the exploitation of a smart plug solution, initially a side project on the InCitys platform. The platform itself did not function that well and did not attract a lot of external utilizers, and was put on hold eventually.

For SonicAngel, they carried out the project to get some ideas for a mobile application of their crowdfunding website. The Living Lab resulted in a mobile solution that extened the ways of crowdfunding, based on the live experience and direct interaction between the band and their fans.

In the case of Veltion, the Living Lab resulted in a mobile extension of their supporting platform for change management processes. By means of a proxy technology assessment, this was put to the test during a field trial in a company. This mobile extension was considered a radical innovation, although the final outcome of the project was that the platform should be used to support the consultancy activities of Veltion and not (yet) as a stand-alone solution, which was the initial idea of the project.

Although these instigators were open to radical user input, the projects did not result in actual User Innovation. This also becomes apparent when we look at the perceived user contribution, or the types of information they extracted from the Living Lab project.

Table 53: Perceived contribution by the instigator

What kind of information did you gather from the research?	Mean
Evaluative information	4.05
Need information	3.71
Solution information	2.1
User Innovation	1.62

When looking at the types of information that were gathered from the Living Lab project, the instigators clearly rank evaluation of their innovation highest, followed by insights into the needs of the end-users. Although all instigators were open to evaluation, four did not gather evaluative input: Future Legends, Coxo, Ceonav and Jukebox21. For Future Legends, Coxo and Jukebox21, this can be explained by the fact that no field trial was held (cf. also infra) due to the immaturity of the innovation. In the Future Legends project, the idea for the innovation (a crowdsourced radio for urban youngsters) only surfaced after the formal ending of the project, so the idea itself was never evaluated during the project. Instead, the needs and wants of the urban youngsters were uncovered, which served as input for the eventual innovation. In the case of Ceonav, as was mentioned earlier, the innovation was only very briefly assessed within a couple of in-depth interviews with managers, which resulted in retreating back two steps in the innovation process. However, in the interview, the instigator mentioned that the managers were 'not ready' for the innovation as they lacked the right mindset to look at the problem. Therefore, he did not consider the innovation to have been evaluated properly. For Jukebox21, just before the field trial was going to take place, their content provider went into liquidation, and the new management after a take-over was not willing to participate in the project, which led to the whole idea being put to rest. For the Coxo-project, field trials and user feedback on the application are at this moment being facilitated in a follow-up project[113]. Just like Future Legends, the project mainly focused on uncovering the needs and wants of the target population and describing the value chain in which the innovation would operate.

A total of eight instigators mentioned not to have gathered user needs from the project. An interesting illustration is the Planza project where the instigator was in fact forced to carry out a Living Lab project by enabler IWT, a rare occasion where the enabler had a direct impact on a utilizer. During the interview, the instigator mentioned that the innovation was

[113] The application is now called 'Planidoo'.

evaluated by end-users, but that he did not encounter any 'new' aspects or needs that he had not thought of himself, as he regarded it as too early to engage in a Living Lab project. The other two types of information score low, with User Innovation barely over 1.5 as a mean. Remarkable, none of the instigators mentioned to have gathered solution information from the Living Lab project. The two instigators that encountered User Innovation, again Planza and Coxo, both mentioned that they were not open to radical user input. Therefore, the User Innovations, which consisted of an ingeneous planning system a user developed in the case of Planza, and a specific information and reservation system in a muncipality, where detected but not actively used in the eventual innovation. In the following sections, we related the perceived contribution and the openness to user input to the three success criteria.

Table 54: Success criterium 'market' related to user contributions

	need	*sol*	*eval*	*User Innovation*	*eval*	*incr*	*Subst*
On the market							
Twikey	X	-	X	-	X	X	X
Future Legends	X	-	-	-	X	-	-
Fifth Play	X	-	X	-	X	X	X
Belgacom OnCloud	X	-	X	-	X	X	-
Planza	-	-	X	X	X	-	-
Smart Seats	X	-	X	-	X	-	-
	5/6 83%	*0/6 0%*	*5/6 83%*	*1/6 17%*	*6/6 100%*	*3/6 50%*	*2/6 33%*
Pipeline							
La Mosca	X	-	X	-	X	X	-
Webinos	-	-	X	-	X	-	-
Hoaxland	-	-	X	-	X	X	-
MuFoLive	X	-	X	-	X	-	-
SonicAngel	X	-	X	-	X	X	X
Coxo	X	-	-	X	X	X	-
Veltion	X	-	X	-	X	X	X
Streemr	X	-	X	-	X	X	-
Kianos	-	-	X	-	X	-	-
Poppidups	X	-	X	-	X	-	-
Fietsnet	X	-	X	-	X	X	-
	8/11 73%	*0/11 0%*	*10/11 91%*	*1/11 9%*	*11/11 100%*	*7/11 64%*	*2/11 18%*
Reoriented							
Wadify	-	-	X	-	X	X	-
Ceonav	-	-	-	-	X	-	-
JukeBox21	-	-	-	-	X	-	-
Qwison	-	-	X	-	X	-	-
	0/4 0%	*0/4 0%*	*2/4 50%*	*0/4 0%*	*4/4 100%*	*1/4 25%*	*0/4 0%*

For the innovations that are already on the market, only one project did not provide need information, whereas for the innovations that are still in the pipeline, this was the case for 8 out of 11 cases. Strikingly, none of the reoriented or stopped innovations provided need information.

In terms of the degree of user involvement, none of the reoriented projects contained substantial user input, whereas only 1 out of 4 provided incremental input. For innovations on the market, half of the projects included incremental user input and one out of three substantial input. Relatively speaking, for the innovations in the pipeline there was more incremental input versus less substantial input.

Table 55: Success criterium ‘leap’ related to user contributions

	need	*sol*	*eval*	*User Innovation*	*eval*	*incr*	*Subst*
Leap							
InCitys	X	-	X	-	X	X	X
Twikey	X	-	X	-	X	X	X
SonicAngel	X	-	X	-	X	X	X
FutureLegends	X	-	-	-	X	-	-
Wadify	-	-	X	-	X	X	-
	4/5 80%	*0/5 0%*	*4/5 80%*	*0/5 0%*	*5/5 100%*	*4/5 80%*	*3/5 60%*
Step							
BgcOnCloud	X	-	X	-	X	X	-
Webinos	-	-	X	-	X	-	-
Coxo	X	-	-	X	X	X	-
Hoaxland	-	-	X	-	X	X	-
Streemr	X	-	X	-	X	X	-
LaMosca	X	-	X	-	X	X	-
Planza	-	-	X	X	X	-	-
SmartSeats	X	-	X	-	X	-	-
MuFoLive	X	-	X	-	X	-	-
Veltion	X	-	X	-	X	X	X
Jukebox21	-	-	-	-	X	-	-
Qwison	-	-	X	-	X	-	-
	7/12 58%	*0/12 0%*	*10/12 83%*	*2/12 17%*	*12/12 100%*	*6/12 50%*	*1/12 8%*
Stop							
Kianos	-	-	X	-	X	-	-
Fietsnet	X	-	X	-	X	X	-
Poppidups	X	-	X	-	X	-	-
CEONAV	-	-	-	-	X	-	-
	2/4 25%	*0/4 0%*	*3/4 75%*	*0/4 0%*	*4/4 100%*	*1/4 25%*	*0/4 0%*

When looking at the table, some striking facts appear. In terms of user information, almost al projects where a 'leap' was made resulted in need information regarding the users, whereas these numbers seem to drop for the other two categories. Interestingly, the only two projects where User Innovation was detected only advanced one step in the innovation development process. There were also notable differences in the extent of the user contribution. In the projects were a leap occurred in the innovation process, the instigators were much more open to profound forms of user input, as in four out of five instances the user had an incremental influence on the eventual innovation and in three out of five even a substantial influence, whereas these numbers are much lower when only one step of progression was made. From the four projects where no progress was made, only one instigator indicated that users had an incremental contribution to the innovation.

Table 56: Success criterium 'perceived project outcome' related to user contributions

	need	*sol*	*eval*	*User Innovation*	*eval*	*incr*	*Subst*
Positive							
Twikey	X	-	X	-	X	X	X
Future Legends	X	-	-	-	X	-	-
Belgacom OnCloud	X	-	X	-	X	X	-
SonicAngel	X	-	X	-	X	X	X
Streemr	X	-	X	-	X	X	-
La Mosca	X	-	X	-	X	X	-
Webinos	-	-	X	-	X	-	-
Hoaxland	-	-	X	-	X	X	-
MuFoLive	X	-	X	-	X	-	-
Qwison	-	-	X	-	X	-	-
Wadify	-	-	X	-	X	X	-
	7/11 64%	*0/11 0%*	*10/11 91%*	*0/11 0%*	*11/11 100%*	*7/11 64%*	*2/11 18%*
Neutral							
Coxo	X	-	-	X	X	X	-
Fifth Play	X	-	X	-	X	X	X
Veltion	X	-	X	-	X	X	X
Kianos	-	-	X	-	X	-	-
JukeBox21	-	-	-	-	X	-	-
Poppidups	X	-	X	-	X	-	-
Ceonav	-	-	-	-	X	-	-
	4/7 57%	*0/7 0%*	*4/7 57%*	*1/7 14%*	*7/7 100%*	*3/7 43%*	*2/7 29%*
Negative							
Fietsnet	X	-	X	-	X	X	-
Smart Seats	X	-	X	-	X	-	-
Planza	-	-	X	X	X	-	-
	2/3 67%	*0/3 0%*	*3/3 100%*	*1/3 33%*	*3/3 100%*	*1/3 33%*	*0/3 0%*

Compared to the neutrally evaluated projects, the positive projects are more likely to have provided need information (7/11) and evaluative information (10/11). However, for the negatively evaluated projects, 2 out of 3 resulted in need information and even all three contained evaluative information. However, when looking at the degree of user involvement, only 1 out of 3 was open to incremental input and none towards substantial feedback, whereas for the neutral projects the numbers are also rather low (3/7 and 2/7). However, for the positively evaluated projects, the openness for incremental user input is high (7/11).

Summarizing, our data suggest for all three the success criteria that the openness of the instigator towards incremental user input, the middle stance from our User Innovation framework, increases the chances of success.

7.11 Micro level analysis: Living Lab methodology in 21 projects

In the third and final part of our empirical analysis, we will turn to the micro level, which consists of the Living Lab methodological steps. We will look at the 107 different research steps for all of the 21 Living Lab projects and compare them to the methodological Living Lab approach we gathered from the literature review. Subsequently, we will assess the impact of the Living Lab characteristics ‘real-life experience’ and ‘multi-method’ on the perceived user contribution by the instigators and on the outcome of the innovation project.

7.11.1 Living Lab methodology in the 21 cases

Within our literature review of Living Labs theory, Pierson and Lievens (2005) suggested five methodological steps to carry out a Living Lab project. We suggested that this methodology was very similar to a quasi-experimental design, as was used in the original American Living Labs (cf. chapter 5). The biggest difference was that the intervention stage in European Living Labs took place in a real-world context instead of in a laboratory context. We summarized the different steps in the following table:

Table 57: Methodological design Living Lab research

Pre-test	*Intervention*	*Post-test*
- Contextualization - Selection - Concretization	- Implementation	- Feedback

In the case descriptions, we already gave an overview of the different research steps that were taken in the 21 Living Lab projects. The table below gives a summary of all the projects, with the projects ordered chronologically. We provide a quick reminder of the different color codes that are used in the table. The research steps in grey indicate that no users were involved in this research step. If secondary user data was used (e.g. reusing research data from previous projects), the research step was also marked in grey. Other examples are business modeling workshops from the business model researchers or prototyping sessions from the prototyping experts, providers in the iMinds Living Labs constellation. Research steps in blue indicate user involvement without contextual innovation knowledge being gathered, so-called ‘voice-of-the-customer’ techniques, associated with the ‘innovation for users’-stance (Kaulio, 1998; cf. infra) without direct exposure to the innovation itself or to the (envisioned) usage context. In some of the co-creation sessions the innovation is pitched by the instigator, after which potential use cases and features are discussed. However, we do not regard this as a prolonged or in-depth exposure, required to get a deeper insight into the innovation. In terms of methodology, we regard these research steps as pre assessments. The boxes in yellow indicate a research step where the user is exposed to the innovation or to a representation of the innovation in real-life or in a laboratory setting resembling a real-life context. These research steps mostly consist of field trials, proxy technology assessments or related research steps, and can include data gathering techniques such as logging, observation or contextual interviews. In terms of methodology, this can be regarded as the intervention. Finally, the green boxes indicate gathering user information and knowledge after, but not during, the exposure to the innovation. In terms of methodology, this can be regarded as a post assessment. In terms of user characteristics, users have an increased usage experience and product related knowledge with regards to the innovation.

Table 58: Methodological steps Living Lab projects

Case	Research steps								Duration
Future Legends	SotA ecosystem & user	Expert interviews	Survey	Workshops with observation	Media diary study	Cultural probe research	Closing event with observation		09/11 - 06/12
SonicAngel	SotA market & user	Segmentation users	Co-creation users	Interviews users	Stakeholder interviews				10/11 – 12/11
FifthPlay	Survey end-users	Long term field trial	Surveys	Focus group	Post-survey				10/11 - 12/12
Fietsnet	Survey end-users	Co-creation with end-users	Persona segmentation						12/11 - 04/12
Streemr	SotA market & user	Survey	Field trial with logging	Co-creation with testers					01/12 - 04/12
Jukebox21	SotA market & user	Survey	Co-creation users	Business model analysis					02/12 - 06/12
Wadify	SotA user	Survey	Field trial with logging	Interviews with testers					02/12 - 04/13
OnCloud	Survey	Field trial	Online feedback forum	Co-creation with testers	Post survey				03/12 – 07/12
Qwison	SotA market & user	Survey users	Survey stakeholders	Expert interviews	Stakeholder co-creation	Co-design session	Business model workshop		09/12 - 12/12
La Mosca	SotA market & user	Survey	Co-design users	Usability labtest	Co-creation users	Field trial with observation	Interviews with testers	Business model workshop	09/12 - 02/13
Poppidups	Survey user	Usability expert review	Co-creation session	Field trial users	Co-creation testers	Post assessment testers	Field trial school	Co-creation school	10/12 - 02/13
Planza	SotA market & user	Survey	Co-design session	Closed field trial	Open field trial with logging & feedback	Post-survey			10/12 - 09/13
Kianos	SotA market & user	Survey	Co-design						11/12 - 04/13
MuFoLive	Survey	One time field trial with observation	Focus group	Closing event with stakeholders					12/12 - 04/13
Hoaxland	SotA market & user	Expert interviews	Survey teachers & parents	Co-design teachers	Business model workshop				12/12 - 09/13
Veltion	SotA market & user	Co-creation with users	Field trial in company	Co-creation with testers	Business model workshop				01/13 - 10/13
Webinos	Persona building	User experience lab testing	Interviews with testers						01/13 - 12/13
Ceonav	SotA market & user	CEO interviews	Steercos	Business model workshop					01/13 - 12/13
Twikey	SotA market & user	Survey	Co-design session	Expert Usability review	Usability labtest				04/13 - 08/13
Coxo	SotA & competitor analysis	Expert interviews	Survey	Stakeholder co-creation	Stakeholder interviews				04/13 - 12/13
SmartSeats	Field trial 1 sport	SotA market & user	Field trial 2 Sport	Survey sport & music	Co-creation music events	Field trial 3 sport	Interviews with testers		12/13 - 03/14

A first general remark that can be made is the large variety in the number of research steps, ranging from only three in the Fietsnet, Kianos and Webinos projects, to eight in the Poppidups and La Mosca projects. These differences are due to differences in resources, time constraints and the nature of the research questions. For Webinos, a more realistic field trial was also planned, because of the maturity and stability of the innovation, only a lab test based on realistic scenarios was possible. For Poppidups, initially less research steps were planned, but because the results of the user field trial were less favorable than hoped for, an extra field trial in a school was planned to have an initial assessment of the potential in a different setting. Moreover, when comparing the original project proposals with the actual research steps that took place, almost none of the projects follows the same trajectory as initially planned. The Fietsnet case was an exception because the instigator was not involved during the different research steps, but from the interview with the instigator we gathered that this is not a good solution as none of the research results have been implemented to this date. This can also be related to the 'interaction for goal allignment' paradox we discussed during the macro level analysis. As both the instigator and the researcher pursue different goals within the Living Lab project, we gathered that it was important to include enough interaction moments in order to align the goals of the actors. In the Fietsnet case, there were no interaction moments in between, which resulted in the results being not actionable enough for the instigator. In most of the other projects this was solved by having meetings with the researchers and the instigators after every finished research step. In these meetings the results are presented and the next steps are discussed and altered if necessary.

In terms of the methodological approach, we notice that a lot of the projects do not follow the pre-test/intervention/post-test design as was proposed in the previous chapter. Only 12 out of 21 projects contain an intervention, whereas only 10 out of 21 also include a post assessment. Both methodological elements can be regarded as forms of user contextualization, which is proposed as a means to overcome barriers related to user involvement, or the so-called 'real-life experience' of Living Labs. Another suggested method to overcome these barriers was to include triangulization of different methods, which equals the 'multi-method' characteristic of Living Labs. To assess if there was triangulization in the Living Lab projects, we looked whether there were multiple blue research steps with different data collection techniques (e.g. a survey and a co-creation session). The majority of the projects adhere to this criterion, with 17 out of 21 projects containing triangulation of user involvement.

Only three projects contained none of the methodological criteria: Coxo, Ceonav and Hoaxland. For Coxo and Hoaxland, the reason was twofold. First, the maturity of the innovation did not allow a proper field trial, as both innovations were still in the idea/concept stage. The Living Lab project was regarded as a first exploration of the potential of the innovation and of the ecosystem surrounding the innovation. Second, this ecosystem was for both innovations rather complex. This led to different research steps aimed at different actors in the innovation ecosystem, without triangulization of different research methods for the eventual end-user. For Hoaxland, it was difficult to involve the end-user as this group consisted of young children. Therefore, attention was dedicated towards parents and teachers. For Coxo, the user group was threefold: users that wanted to organize cultural events, organizations that wanted to offer the service to their own end-users, and service providers that wanted to offer services to organizing users. However, both the Coxo and Hoaxland instigators are currently planning a follow-up project which would include an actual field trial, which shows that these instigators see the short term Living Lab projects as the start of a longer collaboration that continues over multiple projects[114].

For the Ceonav project, the lack of triangulation, an intervention and a post assessment stage can be attributed to the fact that the very first user assessment turned out to be quite dramatic. Remember that the Ceonav-project was the only instance where the innovation took a couple of steps back in terms of the innovation process, as it did not have a fit with current market needs.

We will now investigate the occurrence of these methodological elements, that are regarded as beneficial to user involvement and user contribution in the User Innovation literature, in relation to the generation of evaluative input, incremental innovation input and radical innovation input of the end-users during the project. For this information, we took the perspective of the researchers, as they were in the best position to assess the type of user contribution within the different research steps.

We also included the variables 'input for innovation development', 'innovation development during the Living Lab project', and 'increasing the internal knowledge' as three success criteria of user contribution during the user research phases. The variable 'input for innovation development' referred to whether the instigator used the result of the Living Lab project for changes and/or adjustments in the innovation. The variable 'innovation development during the Living Lab project' was used to indicate whether the innovation was changed in the course of the Living Lab project based on the user contributions, and 'increasing internal knowledge' referred to the fact if the instigator felt the user contribution led to an increase of the internal knowledge without necessarily having an impact on the innovation itself.

[114] At the moment of writing, the follow-up project of Coxo has already started, with the name Coxo being replaced by Planidoo. See http://www.driebit.nl/projecten/planidoo and http://www.planidoo.be/

Table 59: Methogological design related to researcher perceived user contribution and instigator application of contribution

	Interv	Post	Triang	Eval	incr	subst	Inn dev	LL dev	Know
FifthPlay	X	X	X	X	X	-	X	X	X
Streemr	X	X	X	-	X	-	X	X	X
Wadify	X	X	X	X	X	-	X	X	-
OnCloud	X	X	X	X	X	-	-	-	X
Poppidups	X	X	X	X	-	-	-	-	-
Planza	X	X	X	X	-	-	X	-	-
MuFoLive	X	X	X	X	-	-	X	X	X
Veltion	X	X	X	-	X	X	X	X	X
La Mosca	X	X	X	X	-	-	X	X	-
Webinos	X	X	-	X	-	-	X	-	X
Twikey	X	-	X	X	X	-	X	X	X
SmartSeats	X	-	X	X	X	-	-	-	-
				10/12 *83%*	*7/12* *58%*	*1/12* *8%*	*9/12* *75%*	*7/12* *58%*	*7/12* *58%*
Future Legends	-	-	X	-	X	-	X	-	X
Jukebox21	-	-	X	X	-	-	X	X	-
Fietsnet	-	-	X	-	X	X	-	-	-
SonicAngel	-	-	X	-	-	X	X	-	-
Qwison	-	-	X	X	-	-	-	-	-
Kianos	-	-	X	X	-	-	-	-	-
Hoaxland	-	-	-	X	-	-	-	-	-
Ceonav	-	-	-	X	-	-	X	-	-
Coxo	-	-	-	-	X	-	X	-	X
				5/9 *56%*	*3/9* *33%*	*2/9* *22%*	*5/9* *56%*	*1/9* *11%*	*2/9* *22%*

In terms of the three success factors, 14 out of 21 projects resulted in the user contribution leading to input for the innovation development process. For the second success criterion, changes being made to the innovation during the Living Lab project based on the user contribution, this dropped to 8 out of 21. In total 9 out of 21 instigators mentioned that the user contributions led to an increase of their internal knowledge.

These results indicate that in the majority of the projects, the user contribution had an impact on the innovation development (2 out of 3 projects), but that iteration of innovation development (the so-called 'pivots' out of the lean start-up literature) is far less common (just over 1 out of 3 projects). However, if we look at these success criteria in terms of the three methodological elements, we gather that the projects that included more methodological elements were also more likely to result in input for innovation development (9 out of 12) than the other projects (5 out of 9). The results are even more apparent when taking into account if changes were made *during* the Living Lab project. Only in one of the 'methodologically-poor' projects this was the case, whereas in 7 out of 12 projects instigators made changes to the innovation during the project. The degree of methodological characteristics also seemed to have a positive impact on the generation of new knowledge for the instigator, as this was the case for 7 out of 12 projects, whereas for the other projects this was only the case for 2 out of 9.

When looking at the type of contribution the users had within the innovation project in relation to the presence of the methodological elements intervention, post assessment and triangulation, we notice that the more of these elements are present in the project, the more likely that the user contributions 'evaluation' and 'incremental innovation' are present. For evaluation, when two or all three elements are present, this leads to 10 out of 12, against 5 out of 9 when only one or none were present. For incremental user contribution or 'innovation with users', this is also the case as this type of contribution was present in 7 out of 12 projects. This drops to 3 out of 9 when only one or none of the methodological elements was present.

According to the researchers of the Living Lab project, radical user input was only generated in three projects: Veltion, SonicAngel and Fietsnet. However, none of these innovations is on the market. For Veltion the idea of a mobile extension to their platform was generated during the co-creation session. This idea was subsequently tested during a field trial within a company. However, during the business model workshop, it appeared that for Veltion as a company, it was better to use their platform as a support for their consulting services, and not as a stand alone solution. In the other two projects, the involvement of the instigator was low (SonicAngel) to absent (Fietsnet) during the various research steps, and the innovation itself was only at the idea stage (both wanted a mobile extension for their current offering). Therefore, the researchers from both projects co-created an innovative solution with users during different research steps, but without actual innovation development during the project. This resulted in innovative solutions[115] that were not easily implementable for the instigators. Fietsnet has not undertaken any action since, despite some failed efforts to get support from Telenet during the running time of FLELLAP, and the new SonicAngel site is still to be launched. In the Veltion case, through the involvement of the instigator and by conducting a field trial, the innovative idea was turned into a working prototype, which might still be launched in the future when the timing would be right business wise. **These three projects**

[115] For the SonicAngel project, a concept video was made which can be viewed here: http://vimeo.com/66262582.

illustrate the importance of the involvement of the instigator and of conducting field trials.

Finally, we had three projects where none of the three methodological elements were present. According to the Living Lab methodology we proposed, these projects did not contain any of the specific characteristics. For Ceonav, the instigator that rated himself to be in the most advanced stage of all projects at the start of the Living Lab, this was due to the negative results the first interviews with users yielded. It appeared that the innovation did not answer an actual user need and that the market was difficult to enter. Therefore, the remainder of the project focused on working on the pitch of the innovation and on the business model. Therefore, no other user research was carried out. The two other cases, Hoaxland and Coxo, were both very exploratory projects in nature. The instigators indicated that at the beginning of the project they were still at the start of the innovation development process, and the innovations were both conceived in a complex ecosystem. Therefore, the projects themselves focused on mapping and assessing the different stakeholders in this ecosystem, with a less exclusive focus on the eventual end-user of the innovation. Moreover, in both projects the end-user consisted of different groups that would come in contact with the innovation, as Coxo concerned a platform where creative organizers would visit to co-create an event, service providers would offer services to the organizers, and end-users would search for events, and Hoaxland wanted to develop an application against bullying that would be used by children, parents and teachers. Instead of triangulating multiple research steps with the same target group of end-users, all groups were explored. For both projects, at this moment a follow-up project is scheduled in order to further elaborate on the results of this first project and to advance the innovation development process. As the idea was still more ‘open’, this explains why the instigator regarded the user input to be ‘incremental’ in nature.

7.12 Discussion & conclusion

In this chapter we have put all the key concepts and frameworks we gathered into practice by means of an exploratory case study analysis of four Flemish ICT Living Labs, 21 Living Lab projects and 107 research steps within these projects. Moreover, we did this according to the three-layered Living Labs model we proposed in the previous chapter. A first finding is that **we succeeded in applying our theoretical Living Labs model to guide our case study analysis and to describe the different Living Lab processes, characteristics and elements**. We could also distinguish the abstracted key concepts and frameworks of both Open and User Innovation on the different levels of our model.

Second, this chapter also provided us with the most in-depth insight into Living Labs practice, as the abundance of data sources (interviews with key informants, access to key documents and deliverables, and personal experience) allowed to paint a detailed picture of Living Lab activities. This enabled to get **an indication of the potential value a Living Lab**

can generate for the three identified problems and gaps in the literature. We will illustrate this for each of the three issues.

1. whether they can play a positive role in solving the 'European Paradox'

Regarding the role of Living Labs in the context of the European Paradox, or the imbalance between knowledge exploration and exploitation, we got a different picture from our studied constellations compared to the Living Labs literature, where we discovered an imbalance in terms of attention for both processes (all papers refered to exploration, whereas only 1 out of 3 mentioned exploitation). From the 58 stakeholders involved in the four Living Lab constellations, 30 had exploration as main goal versus 28 for exploitation of knowledge. In terms of success, stakeholders seeking exploration were more successful (73%) than those seeking exploitation (61%). However, this is a clear indication that, despite a focus on knowledge exploration in the literature, Living Labs in practice are able to facilitate knowledge exploitation. When taking into account the stakeholder roles, there is a more outspoken difference between organizations seeking exploration versus exploitation. The 'utilizers', which are the instigators of Living Lab innovation projects, also the bridge to the meso level, are less likely to have exploitation as main goal when instigating a Living Lab innovation project (1 out of 3), and are less likely to be successful when they do so (less than 1 out of 2). In the studied cases, Living Labs appear to be especially successful in facilitating knowledge exploitation of researchers and providers of services to the Living Lab. The instigators of innovation projects are mostly successful in exploring new knowledge, but future research should aim at investigating whereas this more short-term knowledge exploration during a Living Lab innovation project potentially leads to exploitation in the longer run. Therefore, with regards to the European Paradox, Living Labs are capable of facilitating exploitation, but not necessarily for the instigators of Living Lab projects. In terms of the success of the constellation, we noted that there were substantial differences between the four Living Labs in terms of success of the stakeholders in achieving their initial goals. This could be related to the way the constellations dealt with the identified innovation network paradoxes. Future research should also take into account these network paradoxes and investigate the relation with network orchestration.

These findings illustrate that on the macro level Living Labs can be considered an emanation of Open Innovation: Open Innovation processes take place between the participating stakeholders that form an organized innovation network. Moreover, attention to network paradoxes in terms of adequate orchestration seems to have a positive impact on the success ratio of these Open Innovation exchanges.

2. whether they are able to govern and structure user involvement and user contribution for innovation

In order to assess the value of user contribution for the innovation in development, we analyzed the 107 different research steps for all of the 21 Living Lab projects. In terms of the three success factors, 14 out of 21 projects resulted in the user contribution leading to input for the innovation development process. For the second success criterion, changes being made to the innovation during the Living Lab project based on the user contribution, this dropped to 8 out of 21. In total 9 out of 21 instigators mentioned that the user contributions led to an increase of their internal knowledge. This suggests that user involvement in Living Lab projects leads to valuable contributions in the majority of the projects, but that this is not always the case. Subsequently, we specifically looked at the Living Lab characteristics 'real-life experience' and 'multi-method' as these are considered as inherent to the Living Lab approach. We translated these characteristics into the methodological elements intervention, post assessment (both account for 'real-life experience') and triangulation (which accounts for 'multi-method'). We discovered that the more of these elements were present in the project, the more likely that the user contributions would impact the innovation development, result in pivots and increase the internal knowledge of the instigator. Moreover, the 'real-life experience' and 'multi-method' characteristics also seemed to have a positive influence on the degree of user involvement, a framework from the User Innovation literature, as in more than half of the cases the user contribution could be labeled as 'innovation with users' when the Living Lab characteristics were present, whereas this was only the case for 1 out of 3 when the charateristics were not present.

These results indicate that the Living Lab characteristics 'real-life experimentation' and 'multi-method' are able to foster valuable user contributions, which leads us to propose that Living Lab projects including these characteristics provide structure and governance to user contribution. On a methodological level, we propose a quasi-experimental approach as ideal.

3. whether they might help closing the gap between Open and User Innovation

In the previous chapter, we proposed a three-layered analytical and conceptual model to describe Living Labs. We were able to intergrate the key concepts and frameworks of both Open and User Innovation within this model. Within this chapter we assessed the applicability of this model and the ability to distinguish and study Open and User Innovation concepts and frameworks. In the previous two points we have illustrated that Open and User Innovation phenomena occur within Living Labs and have an impact on the outcomes of the Living Lab. The characteristics inherent to Living Labs, which include a multi-stakeholder approach, real-life experimentation, multi-method and active user involvement, can also be attributed to the different levels.

Table 60 Living Labs theoretical model

Level	Studied cases	Analyzed concepts	Impact assessment
Macro	4 Living Lab constellations	Open Innovation processes Open Innovation network paradoxes	Open Innovation success
Meso	21 Living Lab projects	Open Innovation capabilities Degree of user involvement	NPD progress Market-readiness Perceived value
Micro	107 research steps	Real-life context Multi-method	Contribution to NPD Knowledge increase Pivot

This way Living Labs offer an organized approach towards interactice coupled Open Innovation, as proposed by Piller and West (2014). They propose 'interactive coupled innovation' between organizations and users as a model illustrating the convergence between Open and User Innovation (cf. Epilogue part I).

The contribution to the gap between Open and User Innovation is that Living Labs offer an integrated approach by means of their specific characteristics which consist of Open and User Innovation activities and processes. The three-layered model also enables to measure the outcomes of these activities. **Living Labs provide a structured way of facilitating co-creation by connecting the Open Innovation capabilities of stakeholders with the innovative capacities of end-users mediated and facilitated by researchers and specific Living Lab characteristics.** Moreover, our three-way model offers a structured way to analyze these different phenomena and to investigate possible relations and dependencies between concepts and phenomena from both paradigms, including impact assessment.

We see the meso level as the 'arena' where Open and User Innovation concepts 'clash' and are put to practice in innovation processes from the project instigators involving end-users and other stakeholders. The macro level provides the overarching constellation and infrastructure which allows to facilitate these projects and gather all relevant stakeholders, whereas the micro levels provides the tools and methods to foster user contribution for these projects. Therefore, the process of co-creation becomes tangible on this meso level and can be subjected to analysis, relating the outcomes to the antecedents from both the macro and micro level, which would lead to a better understanding of co-creation as a process, a process that links the Open and User Innovation perspectives inherently.

Summarizing, within this chapter we have been able to demonstrate the applicability of our theoretical lens. Moreover, through the three levels we haven been able to demonstrate that Living Labs are an embodiment of both Open and User Innovation. On the macro level, Living Labs are an innovation network where partners exchange knowledge and where Open Innovation characteristics have an impact on the outcomes of the constellation. On the micro level, Living Labs involve end-users in different research steps to abstract user contribution. We gathered that concepts from User Innovation such as contextual and usage experience, and the degree of user involvement have an impact on the user contribution. On the meso level, both Open and User Innovation come together as the Open Innovation capabilities of the instigator as well as the openness towards user contribution and the perceived user contribution seem to impact the project success criteria.

By no means we propose the used success criteria and the outcomes as conclusive for the Living Labs movement as a whole, but with the threeway theoretical lens we have provided a way to analyze Living Labs more consistently, and by distinguishing and chosing success criteria on the different levels this also enables to demonstrate (added) value more clearly. Moreover, this *modus operandi* also allows to better isolate factors and variables that have an impact on the outcomes on the three levels and to link these to the Open and User Innovation literature, depending on the level of analysis. This would also enable Living Lab researchers to tap into more established research domains more easily, and as a consequence would make it easier to increase the research output in highly ranked journals. Moreover, this would also offer the opportunity for researchers from other innovation disciplines to see Living Labs as a study domain.

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III. CONCLUSION

8.1 Conclusions related to the research goals

Within this PhD we encountered two main issues related to Living Labs. First, the **conceptualization of Living Labs remained problematic**, as within theory as well as practice, a too broad amalgam of initiatives and definitions has been put forward under the same 'Living Labs' umbrella. Second, within the theory as well as the Living Labs practice, **no clear assessment of the added value of a Living Labs approach has emerged**, something which is regarded as even more problematic as quite a lot of European funding is spent on projects and initiatives related to Living Labs (Katzy et al., 2013). These issues have manifested themselves in two current problems with Living Labs. First, we witnessed a declining growth of new Living Labs in the European Network of Living Labs (ENoLL) and an inactivity rate of at least 40% among the current members. Second, the body of Living Labs academic literature has witnessed a large increase since 2006, the inception of ENoLL, but has failed to generate a lot of academic impact, as illustrates the low amount of papers in the Web of Science-database and the low number of papers with a citation count higher than 10. This gave the impression of **Living Labs as a field in development** that is in need for a better and clearer conceptualization and delineation that would help to shape and improve Living Labs practice as well as its academic relevance. Thus, our main intention with this PhD was to add to the understanding of Living Labs by exploring the phenomenon bottom-up, based on our in-depth knowledge and experience with Living Labs, but also top-down, looking at related, more established innovation theories in order to facilitate an inductive process of sense making and theory building regarding the Living Labs phenomenon. We did this pursuing four main research goals.

First, from a theoretical perspective, we investigated whether Living Labs relate to more established innovation theories. Therefore, we reviewed the literature on Open and User Innovation, as we regarded both as emanations of the larger phenomenon of distributed innovation. From both paradigms we were able to abstract key concepts and frameworks that could be used to make sense of and apply to Living Labs. From the Open Innovation literature we gathered that innovation processes essentially deal with **exchanging relevant knowledge** between actors. These exchanges can be characterized as exploration, exploitation or retention of knowledge (Lichtenthaler & Lichtenthaler, 2009; van de Vrande et al., 2009). From the perspective of an Open Innovation Network three different challenges and paradoxes occur that require network orchestration of the participating actors (Klerkx & Aarts, 2013): dynamic stability (balancing new relationships and existing relationships), determining the most appropriate way of interaction for perspective and goal alignment, and balancing informal and formal relationships in order to avoid one or more actors dominating the network.

Table 61: Open Innovation processes and capabilities

Open Innovation process	**Exploration**	**Exploitation**	**Retention**
Internal organizational capabilities	Inventive capacity	Innovative capacity	Transformative capacity
External organizational capabilities	Absorptive capacity	Desorptive capacity	Connective capacity

However, in the current Living Labs literature Open Innovation is only rarely used as a defining paradigm (less than 1 out of 4). Nevertheless all studied Living Labs papers do mention exploration as a central process in Living Labs, and 1 out of 3 refers to exploitation. As a main research gap, Open Innovation authors mention that there are still a lot of blind spots that prevent an easy-to-use and one-size-fits-all innovation management approach for Open Innovation. However, we consider these concepts and frameworks as matching with Living Labs for they are characterized by a multi-stakeholder organization that can be described as a Public-Private-People partnership.

Regarding User Innovation, the main idea is that given certain circumstances, users start innovating themselves or make valuable contributions to innovation processes. The literature learned that there are three modes of user involvement: traditional 'voice-of-the-customer' methods, associated with the Manufacturer Active Paradigm, Lead User methods, associated with the Customer Active Paradigm (von Hippel, 1976; Hansson, 2006), and user co-creation which entails a shared locus of innovation between users and producers (Piller & Ihl, 2009). Kaulio (1998) referred to these three stances as design for users, design with users and design by users.

Table 62: Stances on user involvement

Voice-of-the-Customer	**User co-creation**	**Lead User methods**
MAP	Shared locus of innovation	CAP
Design for users	Design with users	Design by users

When looking at the occurrence of User Innovation as an anchoring framework for the Living Labs papers, this was only explicitly refered to in just over a third of the Living Labs papers, although all papers refer to Living Labs as a means to involve end-users. The dominant mode is clearly *design with users* or co-creation with users (34 out of 45), whereas 1 out of 4 papers (11 out of 45) see *design for users* as the dominant user involvement mode, which refers to evaluation by means of traditional voice-of-the-customer techniques.

As research gap for User Innovation we can mention adequate insight into barriers to user conctribution, and how to lower these barriers. This has shifted the focus of User Innovation literature from Lead User research towards **interaction methods** and **user characteristics** that enhance the value of **user contributions**. To this end, triangulation and contextualizing of end-users are suggested to overcome barriers related to user involvement and to optimize user contribution (Frissen, 2000). Summarizing, these User Innovation concepts and frameworks can be linked to the other general Living Labs characteristics: active user involvement (= co-creation or design with users), as well as real-life experimentation and a multi-method approach as ways to overcome barriers to user contribution.

For the key concepts and frameworks of both Open and User Innovation, we succeeded in detecting and studying them within our sample of Living Lab constellations and projects. Moreover, these concepts could also be used to clarify and explain certain Living Lab processes.

This leads us to two main conclusions. First, with regards to our observation that the current Living Labs literature is not very developed in terms of academic impact, this provides opportunities to link up with both Open and User Innovation in a more consistent way in order to establish Living Labs as a research field. Second, as Living Labs include both elements of Open and User Innovation, and as the Living Lab characteristics seem to match with certain barriers and problems with both Open and User Innovation, this might extend the role of Living Labs as a structuring framework that fosters knowledge exchanges and user contributions.

This leads us to our s**econd** research goal, where we from a practice perspective, wanted to explore the emergence and current state-of-the-art within the Living Labs field, and draw up a more clear picture regarding the apparent diversity of approaches and practices, and regarding the current activity level of the ENoLL Living Lab initiatives. We discovered that at least 40% of the ENoLL Living Labs is currently inactive, the number of new Living Labs entering the network is declining year by year, and for the ICT Living Labs, we discovered four divergent types of Living Labs: three dealing predominantly with user involvement, albeit to different degrees and in different sizes, and one ‘new’ type that is all about knowledge sharing and collaboration, with less emphasis on the end-user. Moreover, the other types were still firmly rooted within previous European practices and initiatives, which reinforced the image of Living Labs as a field in development with an urgent need for better conceptualization.

This was tackled by our **third** research goal, as based on the apparent diversity of Living Lab approaches and the conceptual unclarity regarding the different elements that constitute a Living Lab, we wanted to compose a general Living Lab framework that allows to clearly define Living Labs and that is consistent with the previous two research goals. Based on various observations in the Living Labs literature, we proposed an analytical lens that distinguishes three levels of analysis within Living Labs: 1) an overarching Living Lab constellation that can be described as an innovation network to which the related concepts of the Open Innovation literature can be applied, 2) the Living Lab project taking place within this constellation, where certain actors and assets of the constellation are put to productive use in order to advance the innovation process of the instigator of the project, including end-user involvement, this way merging both the Open and User Innovation perspective, and 3) the methodological steps used within these Living Lab projects, or the way the user involvement is structured and how valuable knowledge and contributions are generated in function of the innovation, which makes that the concepts and models from the User Innovation literature are applicable to this level.

Table 63: Living Lab three-way model

Level	Definition	Research paradigm
Macro	Living Lab constellation consisting of organized stakeholders (PPP-partnership)	Open Innovation: knowledge transfers between organizations
Meso	Living Lab innovation project	Open & User Innovation: real-life experimentation, active user involvement, multi-method and multi-stakeholder
Micro	Living Lab methodology consisting of different research steps	User Innovation: user involvement & contribution for innovation

This leads us to propose an update of our Living Lab definition from the introduction, taking into account the three levels. We defined Living Labs as an organized approach (as opposed to an ad hoc approach) to innovation consisting of real-life experimentation and active user involvement by means of different methods involving multiple stakeholders, as is implied in the Public-Private-People character of Living Labs. With our three-layered model, we propose the following definition: **Living Labs are an approach to innovation consisting of three separate, but interrelated levels of analysis. On the macro level, Living Labs are a Public-Private-People partnership organized to exchange knowledge and conduct innovation projects. We regard these Living Lab innovation projects, that are characterized by active user involvement, co-creation, multi-method and multi-**

stakeholder, as the meso level. These projects consist of different research steps that are aimed at generating user input and contribution to the innovation process, which we consider to be the micro level. Open Innovation can be used to study the knowledge tranfers on the constellation level, whereas User Innovation can provide insights into user contribution and user involvement methods.

As a final and **fourth** research goal, we wanted to assess the (potential) value a Living Lab can generate for the three identified problems and gaps in the literature:

1. whether they can play a positive role in solving the 'European Paradox';
2. whether they are able to govern and structure user involvement and user contribution for innovation;
3. whether they might help closing the gap between Open and User Innovation.

We will elaborate on this for each of the three issues.

1. whether they can play a positive role in solving the 'European Paradox'

Within our studied sample, we discovered that almost half of the stakeholders pursued exploitation and that 61% was successful. However, instigators of Living Lab projects (utilizers) are are less likely to be successful (44%), so it seems that in their present form, the studied Living Lab projects are not aimed at exploitation. This is also in line with the Living Labs literature that tends to focus on exploration. Therefore, with regards to the European Paradox, Living Labs are capable of facilitating exploitation, but not necessarily for the instigators of Living Lab projects. In terms of the success of the constellation, we noticed differences between the constellations that could be related to the way the constellations dealt with the identified innovation network paradoxes.

2. whether they are able to govern and structure user involvement and user contribution for innovation

Based on our study of Living Labs projects and the research steps within these projects, we found that in 2 out of 3 the user contribution lead to input for the innovation development process, almost half of the instigators mentioned an increase of internal knowledge based on user contributions and just over 1 out of 3 made changes (pivots) to the innovation during the Living Lab project based on the user contributions. Moreover, 2 out of 3 instigators made progress in the NPD process during the project and almost 1 out of 3 innovations was introduced on the markt. This illustrates that user contribution is able to generate innovation success. Moreover, it appeared that the specific Living Lab characteristics 'real-life experience' and 'multi-method' (or triangulation) increased the chances of generating successful user contributions. These results indicate that these specific Living Lab characteristics are able to foster valuable user contributions, which leads us to propose that

Living Lab projects including these characteristics provide structure and governance to user contribution, which is fostered, on a methodological level, through a quasi-experimental approach.

3. whether they might help closing the gap between Open and User Innovation

In the previous chapter, we proposed a three-layered analytical and conceptual model to describe Living Labs. We were able to intergrate the key concepts and frameworks of both Open and User Innovation within this model. In the previous chapter we assessed the applicability of this model and the ability to distinguish and study Open and User Innovation concepts and frameworks. In the previous two points we have illustrated that Open and User Innovation phenomena occur within Living Labs and have an impact on the outcomes of the Living Lab. The characteristics inherent to Living Labs, which include a 'multi-stakeholder approach', 'real-life experimentation', 'multi-method' and 'active user involvement', could also be related to the Open and User Innovation concepts.

Table 64 Living Labs theoretical model put in practice

Level	Studied cases	Analyzed concepts	Impact assessment
Macro	4 Living Lab constellations	Open Innovation processes Open Innovation network paradoxes	Open Innovation success
Meso	21 Living Lab projects	Open Innovation capabilities Degree of user involvement	NPD progress Market-readiness Perceived value
Micro	107 research steps	Real-life context Multi-method	Contribution to NPD Knowledge increase Pivot

This way Living Labs offer an organized approach towards interactive coupled Open Innovation, as proposed by Piller and West (2014). They propose 'interactive coupled innovation' between organizations and users as a model illustrating the convergence between Open and User Innovation.

The contribution to the gap between Open and User Innovation is that Living Labs offer an integrated approach by means of their specific characteristics. This enables Open and User Innovation activities and processes to take place, and by using our lens we can measure the outcomes of these activities. Living Labs provide a structured way of facilitating co-creation by connecting the Open Innovation capabilities of stakeholder with the innovative capacities of end-users mediated and facilitated by researchers and specific methodological Living Lab characteristics. Moreover, our three-way model offers a structured way to analyze these different phenomena and to investigate possible relations and dependencies between concepts and phenomena from both paradigms. The levels of analysis also enable to assess the impact of variables or contributions.

We see the meso level as the 'arena' where Open and User Innovation concepts 'clash' and are put to practice in innovation processes from the project instigators, involving end-users and other stakeholders. The macro level provides the overarching constellation and infrastructure which allows to facilitate these projects and gather all relevant stakeholders, whereas the meso levels provides the tools and methods to foster user contribution for these projects. Therefore, the process of co-creation becomes tangible on this meso level and can be subjected to analysis, relating the outcomes to the antecedents from both the macro and micro level, which would lead to a better understanding of co-creation as a process, a process that links the Open and User Innovation perspectives inherently. We will elaborate more on this in the next section.

8.2 Implications: Living Labs as structured approach

Initially, at the start of this PhD, we looked at Open and User Innovation as two different research streams that deal with distributed innovation, albeit in a different way. However, when progressing through the chapters, we have gathered more and more evidence of both paradigms being in a process of convergence, to be regarded as two sides of the same larger innovation phenomena, being the distributed nature of knowledge required for innovation. Open and User Innovation present two different approaches to the same reality. Within this PhD we considered the value of both research streams for Living Labs. From both, we were able to abstract some relevant concepts and frameworks to describe and denominate Living Labs processes. However, we also discovered that these concepts and frameworks operate largely on different levels within Living Labs phenomena. We proposed a lens to look at Living Labs consisting of three layers: a macro level consisting of the Living Lab organization, being a Public-Private-People partnership, aimed at knowledge exchange and collaboration. All the ENoLL Living Labs are situated at this macro level, as are the four studied Flemish Living Lab constellations. Open Innovation provides adequate concepts to study the knowledge transfers between these stakeholders and link these to the organizational characteristics. Moreover, the constellation can be labeled as an innovation network, whereas concepts and frameworks regarding networks and interrelationships can be used to study these constellations. On the meso level, we distinguish Living Lab innovation projects that are characterized by active user involvement and real-life experience aimed at innovation development. These user-related characteristics are facilitated by the micro level, being the methodological steps that are used within a Living Lab project. These user involvement methods and tools can be studied and are provided by User Innovation research. In other words, Living Lab projects are situated at the intersection of Open and User Innovation and provide a general structure and governance to the Open and User Innovation aspects. Therefore, we propose to represent our Living Lab methodological framework as follows:

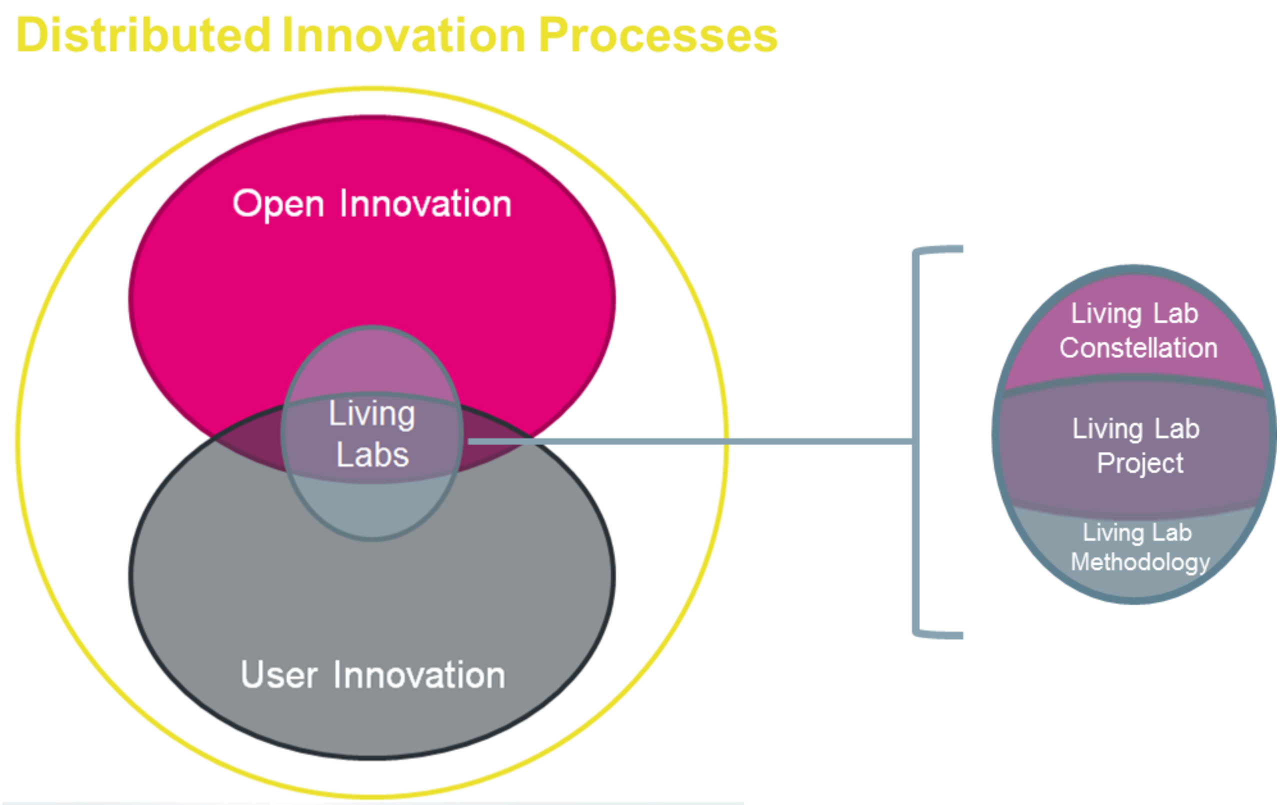

Figure 18 Living Labs theoretical model

Instead of positioning co-creation in Living Labs as potential bridge between these different areas of research within the larger domain of distributed innovation processes, we position our three-layered Living Labs model as a structural approach towards distributed innovation processes with the upper part exclusively in the realm of Open Innovation and the lower part exclusively in the realm of User Innovation. These areas correspond with the macro level (constellation) and the micro level (methodological steps) respectively. The intersection coincides with the meso level (project). Notice that Open and User Innovation also show more intersection space beyond Living Labs, as user-company co-creation and other merging perspectives such as user entrepreneurs are phenomena that are not per se related to Living Labs.

According to the above model, we consider Living Labs as an example of the interactive model of Open Innovation by Piller and West (2014), who take a process perspective, including the stages *defining*, *finding participants*, *collaborating* and *leveraging*. The difference between Living Labs and this model is the presence of an overarching structure, the macro level, which is a PPP organization of stakeholders, that facilitates the Living Lab project. Some of the stages can be carried out or facilitated by designated stakeholders, such as selecting and finding participants. Through the organizational character of the constellations, different stakeholders are able to specialize in certain tasks related to the interactive Open Innovation processes, which also facilitates retention processes and specialization. By having an organization that carries out multiple projects, knowledge can be accumulated and skills refined. This also lowers the tresholds for organizations to engage in Open Innovation, something which we could confirm in our studied Living Lab projects, as the majority of the instigators could be labeled as a start-up or SME without much experience in Open Innovation.

Moreover, the ‘real life experience’ and ‘multi-method’ characteristics of Living Labs impose extra criteria with regards to the nature of the collaboration, which in our analyzed cases seemed to have a positive impact on the user contribution.

Therefore, given this model on coupled Open Innovation, where Open and User Innovation come together, Living Labs are less a bridge between these two paradigms, but rather provide structure and organization to user participation in Open Innovation activities. Based on our case study analysis, we can conclude that given certain criteria are met, Living Labs have the potential to deliver value to the involved actors by facilitating user contribution that is useful and actionable for innovation development.

8.3 General conclusions

Within this PhD, we looked into a specific approach that tries to facilitate and govern distributed innovation processes through a Public-Private-People partnership with a central role for the end-user: Living Labs. As in terms of both theory (no Living Labs papers in highly ranked SSCI-journals and not much influence in terms of citations), and practice (declining growth of ENoLL network and an inactivity rate of at least 40% of the existing ENoLL Living Labs) we gathered that this concept is past its initial hype, we wanted to explore the ways in which we could help Living Labs ‘cross the chasm’. Therefore, we proposed to look into other, more established theories and literature streams on innovation in search of concepts and anchor points that would lead to a better conceptualization and added value assessment of Living Labs.

We started by taking a broader societal perspective on innovation. We argued that the dominant mode of innovation has shifted from a closed single-inventor perspective towards a more open multi-actor process that deals with the search and combination of distributed sources of knowledge, a phenomenon referred to as **distributed innovation**. In terms of theory and research, this shift has for the most part already taken place, but in practice a lot of organizations and innovation practitioners are still struggling with the implementation and management of this distributed innovation process which requires tapping into various sources of knowledge. We considered both Open and User Innovation as academic frameworks that analyze and make sense of distributed innovation processes and practices.

Open Innovation allows to analyze knowledge and technology transfers, and emphasizes the value that is being generated for an actor engaging in these type of inbound and/or outbound knowledge and technology transfers, which mostly results in a company-centric perspective (Chesbrough, 2003; West & Bogers, 2013). The **User Innovation** literature specifically looks at the contribution of end-users to the innovation process and to the circumstances and specific user characteristics that influence the innovative capacity of end-users, or their ability to innovate themselves, resulting mostly in a user-centric perspective (von Hippel, 1976, 2009). Although both can be regarded as making sense of the same distributed innovation phenomena, albeit from a different perspective, both literature streams rarely come together in research (Bogers & West, 2012).

Within this distributed innovation context we also situate Living Labs, a form of Public-Private Partnerships (the Triple Helix-model, cf. Leydesdorff & Etzkowitz, 1996; Etzkowitz & Leydesdorff, 2000) aiming at innovation while taking into account the real-life usage context and treating the end-user as a partner on equal footing in the innovation process (Almirall & Wareham, 2008). This addition of the end-user or 'citizen' (referred to as public), has recently fostered the emergence of Quadruple Helix models, or Public-Private-People Partnerships (Arnkil et al., 2010). Living Labs have been put forward by the European Commission as a **potential solution for the European Paradox**, or the imbalance between Europe's ability to generate new knowledge (exploration), and the lacking valorization of this knowledge (exploitation). In order to explore the actual and potential value of Living Labs as a solution for this paradox, **we looked into the Living Labs phenomenon from both a theoretical as well as a practical point of view**.

From a practice-based perspective, when studying the origins of the label and concept 'Living Lab', this was used loosely and mostly as a word play to describe various practices. The American Living Labs used the term quite literally to describe a research infrastructure, whereas the real take-off occurred in the 2000s when 'Living Labs' as a concept was used to identify a broad amalgam of European initiatives and practices. These originated from earlier predecessors in the 1970s, 1980s and 1990s, with the 'social experiments' as the most related forefather. This concept also suffered from an unclear conceptualization and a wild growth of initiatives using the label (Qvortrup, 1987). Despite some efforts to underpin and elaborate the concept, 'social experiments' have disappeared from the literature and practice after an initial hype. As we gathered from the decreasing number of Living Labs entering the ENoLL and the fact that the European Paradox, for which Living Labs were seen as a way to overcome this imbalance, is still a reality, Living Labs run a similar risk of being just another hype concept bearing a fancy name, but without a solid foundation. Therefore, within this PhD we have investigated Living Labs both from a theoretical and from a practice perspective to assess why they have not been able to solve this European Paradox to this date and where the potential lies for solving this paradox in the future.

For investigating the Living Labs practice, we performed a high-level investigation of the more than 350 Living Labs affiliated to the European Network of Living Labs (ENoLL), a network organization supported by the European Commission. From our analysis we gathered that the network is experiencing a declining growth, with less new members entering the network every year, and that from the affiliated members, at least 40% is currently inactive because of lack of funding and/or interest of the participating actors. This can be regarded as a **first answer to our assessment** of Living Labs as a possible solution of the European Paradox, as a lot of the **Living Lab initiatives** appear to be **unsustainable** and simply disappear, stop their activities or reorient towards another purpose.

We extended this high-level analysis with a more in-depth study of the 64 active ICT Living Labs in order to complement the pioneering work of Følstad (2008) on Living Lab characteristics and to validate the fourfold typology we gathered out of the early Living Labs literature. It appeared that three Living Lab types build further on the European predecessors such as participatory design, digital cities and social experiments, emphasizing user involvement which points towards User Innovation practices, whereas one 'new' type has emerged, focusing more on collaboration and knowledge sharing, linking up with Open Innovation, but with only a limited degree of user involvement. On the one hand, this is an indication of the **diversity of the Living Labs practice**, on the other hand, this also points to a **vague conceptualization** and an arbitrary awarding of the Living Labs label, issues that also emerged with the social experiments in Europe during the 1980s and that resulted in the concept disappearing completely off the radar since the 2000s. In other words, because of their apparent diversity in appearances, it seems that the current **Living Labs** do not have a shared theoretical basis and **are still too much rooted in previous practice**, which holds the risk that the term 'Living Lab' stands for nothing and everything at the same time.

However, this enthusiastic adoption and diversification of Living Labs practice was not followed by a similar development of Living Labs as a research domain. Purely quantitative, there have been published quite a lot of papers on the topic of Living Labs since 2006, but in terms of influence and academic acclaim outside the Living Labs community, **Living Labs as a research domain have not been able to manifest itself in top ranked journals** or to make a strong connection to other fields and disciplines. In total, 45 papers had more than 10 citations, and only 5 more than 100 citations. Even more striking is the fact that more than 1 out of 3 papers makes no reference to any innovation framework, being merely descriptive papers without any rigid theoretical foundation. The most mentioned theoretical anchor point is User Centered Design, which emerged out of the Cooperative Design movement, one of the Living Labs predecessors, another indication of the firm connection with past European practices. User Innovation is mentioned in just over 1 out of 3 papers, whereas Open Innovation is referred to in less than a quarter of the papers. Clearly, **no firm connection has been established to this date with neither Open nor User Innovation**. This is even more surprising taking into account the user-centered nature of the early Living Lab conceptualizations out of practice, such as Følstad's characteristics, and the dominance of the user-centric Living Labs in our four-way segmentation. This illustrates our assumption that the initially blossoming, but soon stagnating adoption of Living Labs practice was not backed up by a firm theoretical basis, which fostered the development of Living Labs practice in different directions.

This induced us to look into both the **Open and User Innovation** literature for relevant **concepts and models to be applied to Living Labs**, and to assess whether these concepts and models are already described in the Living Labs literature.

Summarizing, the results from our investigation of the Living Labs practice within the ENoLL and of the top-cited Living Labs papers, embodying the Living Labs theory, suggest that the Living Labs-movement has passed its *peak of inflated expectations*, now entering the *through of disillusionment* (Fenn & Linden, 2000). Crossing this 'chasm' towards the so-called *slope of enlightenment* and *plateau of productivity* is currently a major challenge for Living Labs, a challenge that can only be met if Living Labs theory is able to better anchor itself to and align itself with more developed innovation paradigms such as Open and User Innovation, and translating the concepts and insights from these research streams into Living Labs practice that is better tailored towards effectively solving the European Paradox.

However, in order to facilitate the embedding of Open and User Innovation concepts and frameworks into Living Labs theory and practice, one important piece of the puzzle is still missing: **a clear conceptual model of the different levels of analysis within Living Labs and their activities**. Within the current literature, there is no consensus regarding these levels and they tend to be used almost randomly, something which is also concluded in Dutilleul et al. (2010), who discern five different meanings out of an overview of Living Labs literature. Almirall & Wareham (2008, 2011) make a distinction between Living Lab constellations, that can be linked to the innovation networks from the Open Innovation literature, and Living Lab innovation projects being carried out with real-life end user involvement. Therefore, we propose **three distinct, but interrelated levels of analysis for studying and denominating Living Labs**, which can be applied both in theory as well as in practice.

On the **macro level**, a Living Lab is an innovation network consisting of different actors with different roles, a constellation that can be labeled as a public-private-people partnership. Living Lab research on this level by Leminen and Westerlund proposed four different actor roles, which we suggest to extend towards five: **providers** (of infrastructure and/or services), **utilizers** (of the Living Lab infrastructure), **researchers**, **users** and **enablers** (of the Living Lab operations). Usually, there is also a material and/or immaterial infrastructure present in the innovation network.

On the **meso level**, we distinguish the different innovation projects that are carried out within these Living Lab networks. Within these projects the Living Lab actors and infrastructure are put to productive use with as eventual goal to advance the innovation process of the instigator of the project. The 'Living Lab as a project' (Ståhlbröst, 2012), which we encountered when analyzing the ENoLL Living Labs, is an extreme example where a Living Lab constellation is established for a single innovation project. However, this type of Living Lab is per definition not sustainable, does not facilitate retention processes and does not allow exploitation of the Living Lab constellation and infrastructure. Therefore, we regard Living Labs where the macro and meso level are identical as sub-optimal.

On the **micro level**, we consider the methodological steps that are used within these innovation projects, and also the way these steps are arranged and carried out, attempting to be beneficial for the innovation process of the instigator of the project, but also for the other participating actors in the innovation project, and for the Living Lab constellation as a whole.

Table 65: Living Labs conceptual three-layered model

Level	Definition	Research paradigm
Macro	Living Lab constellation consisting of actors (PPP-partnership) and infrastructure	Open Innovation
Meso	Living Lab innovation project	Open & User Innovation
Micro	Living Lab methodology consisting of different research steps	User Innovation

We propose this analytical lense to be applied in Living Labs theory as well as in Living Labs practice, as we believe this will facilitate the connection with the Open and User Innovation frameworks. For the macro level, Open Innovation offers concepts and insights to study and denominate the knowledge transfers that take place between different actors in an innovation network, and to govern and manage the relationships between these actors in order to optimize the network operations and the overall functioning of the network. On the micro level, User Innovation provides insights and knowledge regarding user characteristics and user contribution for innovation. Moreover, it also offers methods and tools to facilitate user contribution, and contains insights on the motives and motivations of users to participate in Open Innovation. On the meso level, both viewpoints merge as a Living Lab project consists of different research steps, involving users according to a certain methodology, and involving different actors and assets of the Living Lab infrastructure. Moreover, **the disctinction between these three levels allows to assess the success of Living Labs on these three levels separately and link this to certain aspects and characteristics related to Open and/or User Innovation, depending on the level that is studied**.

In order to test the added value and the applicability of this framework, we applied this to a subset of four Flemish ICT Living Lab constellations and 21 innovation projects taking place within these Living Labs constellations of which we all had a first-hand experience as researcher and access to a variety of data sources.

First, on the **macro level**, we looked at the occurrence of the five proposed stakeholder roles and could confirm that all five roles were present in the studied Living Lab constellations. In terms of success, 2 out of 3 participating actors were able to pursue their initial goal (exploration or exploitation), with actors looking for exploration being slightly in the majority and also slightly more successful. In terms of the different stakeholders, users and researchers were the most successful, followed by utilizers and enablers, with the provider role having the lowest success ratio (only 1 out of 2). This seemed to be related to the necessity of the infrastructure and/or services that are provided to the Living Lab needing to be perfectly aligned with the goals of the other stakeholders. In terms of the network paradoxes, it appeared that the management of the Living Lab constellation is better left to public actors, as they are regarded more neutral which allows to attract external utilizers more easily, thus enhancing the chances to attain a level of dynamic stability and of mutual goal alignment, also avoiding one or more stakeholders to dominate the network.

On the **meso level**, we took the perspective of the instigator of the Living Lab project, also referred to as utilizer according to the Living Lab stakeholder model. As at this level Open and User Innovation come together, as Shah and Tripsas (2007) put the concept of so-called 'user entrepreneurs' forward as a link between these two perspectives, and as Almirall and Wareham (2008) and Pallot et al. (2011) refer to Living Labs as an ideal tool for these entrepreneurial Lead Users, we assessed the Lead Userness of all 21 instigators. It appeared that the majority of the instigators scored high in terms of Lead Userness in the target domain of their innovation, which suggests that utilizers in Living Labs tend to be innovating Lead Users. Regarding success criteria on the meso level, we distinguished three: being on the market with the innovation, having advanced more than one step in terms of the innovation development process and the perceived value of the project for the instigator. The perceived value criterion was the most successful, with just over half of the instigators being predominantly positive regarding the project. The other success criteria, that are both linked more to exploitation, were clearly less successful, as 6 out of 21 innovations resulted in a market introduction and only 4 instigators advanced more than one step in terms of the innovation development process during the project. This again confirms the 'European Paradox', and can be related to the capabilities of the instigators, as the majority of the instigators rated themselves as high scoring in terms of exploration related capabilities, but much less for exploitation related capabilities. Two factors appeared to have a positive impact on the success criteria: the openness of the instigator towards incremental user input and the generation of need information during the project. Interestingly, most of the instigators of Living Lab projects can be regarded as Lead Users in their respective innovation domains, which confirms the idea that Living Labs can play a rol in supporting entrepreneurial users. This would also explain why instigators were rather looking for incremental user contribution than for radical user contribution.

On the **micro level**, or the level of Living Lab methodology, we looked at the value of the user contributions from the different research steps in terms of the innovation development process. We distinguished three criteria to assess the success on this level of analysis: user contribution that led to input for the innovation development, modifications being made to the innovation during the Living Lab project, and an instigator reporting to have experienced an increase of internal knowledge based on the research results. In 2 out of 3 projects, the results served as inputs for the innovation development. For the other two criteria, this drops to respectively 8 and 9 out of 21. For five intigators, all three criteria were successful, whereas for 5 other instigators, none of the criteria was fulfilled. With regards to the methodological characteristics, triangulation, an intervention and a post-assessment all three seem to positively influence the success criteria. These findings confirm the methodological approach that was suggested in the Living Labs literature (Pierson & Lievens, 2005) and which we referred to as a quasi-experimental approach, consisting of a pre-assessment, an intervention, and a post-assessment. This approach induces users to gather contextual usage experience during the intervention, which takes place in a real-life context, and fosters the triangulation of research results.

We can conclude that on all three levels successes were generated as well as less positive outcomes in terms of the success indicators. Moreover, we have also demonstrated that the concepts and frameworks we gathered from the Open and User Innovation literature seem to have impacted the outcomes of these success criteria. Considering the size of our sample and the potential bias in the success criteria, these results should not be generalized towards all Living Labs constellations and projects. Careful consideration should aslo be given towards defining success criteria on the three levels for future research. However, by means of this empirical investigation we have been able to demonstrate the applicability and added value of our (three-)layered analytical lense, as well as to show that Open and User Innovation phenomena occur on the different Living Lab levels, and that manipulating these characteristics seems to have an impact on the outcomes.

In terms of policy recommendations, we would suggest to keep on investing in Living Labs as we believe they have the potential to solve the European Paradox, but some aspects need to be taken into account. First, the support should focus on sustainable Living Lab constellations, as only this long(er) term frame allows to reap the full benefits of Living Labs (e.g. facilitating retention processes with the accumulated knowledge over a longer period of time). We also suggest to apply our theoretical lens regarding the three Living Lab levels to set targets for all three levels and to enable measuring the impact on these three levels. Here we see an important role for the enabler of the Living Lab activities on the different levels. The enabler(s) of the macro level should govern and facilitate a more long term knowledge sharing between the participating actors, and also deal with the knowledge exchange between the macro level and the project level. For the meso level, we suggest that the existing funding and subsidy models become (more) tailored towards Living Lab innovation projects. The enablers behind these funding models need not be necessarily the same as the enablers of the Living Lab constellation. However, we do plead for more involvement of these enablers, as their eventual goal is also to stimulate innovation and foster innovation exploitation. In terms of defining the success criteria and setting the goals and targets for the Living Lab projects, a dialogue should be held with researchers, the (potential) utilizers and the enablers. Second, we also see a role for the ENoLL, as they should re-avaluate their criteria taking into account these three levels, and also think about re-evaluating the existing Living Labs. We do not plead to remove Living Labs not adhering to the criteria, but instead provide coaching and other activities in order to make Living Labs adhere to the criteria. This way, ENoLL could be more self-regulating and by chosing success criteria related to exploitation motives and adequate measurement systems, best practice Living Labs could emerge and serve as an example to stimulate other Living Labs. Moreover, ENoLL could develop more initiatives to stimulate the research community in order to develop Living Labs theory in parallel with Living Labs practice.

As we have demonstrated within our small set of Living Lab constellations and Living Lab projects, it is possible for a Living Lab to generate value for all public and private actors involved and to generate successes on all three levels, we believe that investing in Living Lab constellations, in Living Lab projects and in the providers of services and knowledge during Living Lab research yields extra value compared to funding isolated and ad hoc funding projects. The more sustainable Living Labs become, the more knowledge they are capable of storing and potentially reusing. For this retention role, we look at the researchers to facilitate this.

However, based on our preliminary findings within the studied constellations and projects, and based on our research into the current Living Labs practice and literature, we wish to propose a set of recommendations related to the three levels, which can also be the basis for future research. We will describe these recommendations in section 8.5, but first we will summarize our main contributions.

8.4 Contributions

Within this PhD, our main contribution can be situated in the development of a theoretical lens that distinguished between three separate but interrelated levels of analysis within Living Labs. Enriched with the key concepts from Open and User Innovation, we developed this lens into a theoretical model to analyze and make sense of Living Labs. This theoretical model helps to look at Living Labs more consistently and to denominate the different aspects. It also allows to assess (added) value for the three different levels separately, thus enabling impact assessment of the different Living Lab activities and elements. As both Open and User Innovation phenomena take place in Living Labs, this opens the possibility for Living Lab researchers to bridge the gap between theory and practice, as this enables anchoring and connecting Living Labs to more established innovation paradigms.

However, besides this contribution to Living Labs theory and practice, our theoretical model is also able to contribute to the apparent gap between these paradigms themselves. The specific Living Lab characteristics of multi-stakeholder, multi-method, real-life experimentation and active user involvement within a Public-Private-People partnership organization provides structure and governance to innovation processes taking place on the meso level. Moreover, as these characteristics are linked to Open Innovation at the macro level (organized PPP-partnership and multi-stakeholder) and User Innovation at the micro level (active user involvement, multi-method, real-life experience), both paradigms and perspectives on distributed innovation processes merge on the meso level in innovation projects. This way, Living Labs are also a perfect example of the interactive model of coupled Open Innovation as proposed by Piller and West (2014). Therefore, our theoretical model also contributes to bridging the gap or fostering the convergence between Open and User Innovation. Key to this is the process of co-creation which is underresearched, but can be regarded as the central tenet on the Living Lab meso level.

Finally, our findings also have a large managerial relevance for Living Lab practitioners and stakeholders. We will summarize these managerial contributions in the following ‘recommendations’ paragraph.

8.5 Recommendations

Based on the findings within the case studies, our practical experience in Living Labs for the past four years and of the innovation theories we discussed in this PhD, we propose a set of recommendations aimed at Living Lab practitioners and researchers. In the spirit of the rest of our work, we will present the recommendations according to the three levels of analysis.

MACRO LEVEL:

- As the management and allignment of the Living Lab actors is crucial for the overall performance of the network, careful consideration should be dedicated towards the choice of the Living Lab manager.

From our research and from our practical experience, we suggest that the Living Lab manager should best be someone from a 'neutral' organization. Someone from a research institute, a city representative, a government official…

- In order to attract external utilizers to the Living Lab, an active form of business development is necessary.

The infrastructure or constellation itself will not attract utilizers by itself, a pro-active form of business development is necessary to catch the interest of potential instigators. Out of our experience and based on our case study results, start-ups and SMEs are most likely to engage in Living Lab projects.

- Clearly consider and define the overall goal of the Living Lab: in what domain will it be operating, on what kind of topics will knowledge be shared, and what kind of projects are needed to increase the knowledge and the value of the Living Lab.

Out of the ICT Living Labs we learned that a too broad thematic approach yields confusion for external utilizers (Where does the Living Lab stand for? What's in it for me?) and fosters sub-networks in the Living Labs of actors that are working on shared topics. Moreover, a concise thematic direction also enables generating knowledge with more value for the participating actors in the network, and will also increase the value for external utilizers.

- In terms of the 'Open Innovation paradox', clearly define what kind of information and what kind of assets will be shared in the Living Lab, and what not.

A completely open innovation process is a myth, so clear guidelines and processes should be thought of in advance in terms of knowledge protection and knowledge sharing. What kind of information is 'shared' by who and to whom within the Living Lab? This is necessary for the external utilizers to gain trust in the Living Lab, but a too protective stance in terms of knowledge sharing does not yield added value for the Living Lab constellation.

MESO LEVEL:

- As end-user contribution constitutes an essential element of Living Labs, make sure to have a strategy on how to involve them in the course of the total duration of the project. This means an active and open communication regarding the process, taking into account the intrinsic user motivations.

Although the literature on end-user motivation for participation in Open Innovation is not conclusive yet, we have experienced that end-users find it more important to gain insights regarding what happens with their contribution than to obtain material incentives for participation. An active communication towards end-users regarding the innovation development process also yields two extra benefits. Users get the chance to provide additional feedback on the progress and they feel more committed to the project and the innovation in development, which might lead to them becoming early ambassadors of the innovation once it hits the market.

- Assess the instigator attitudes towards user involvement and towards implementing the user contributions in the innovation. If the instigator is not open towards user input, the project is likely to be unsuccessful in terms of mutual value creation.

A Living Lab project is all about user contribution to innovation. If an instigator is not open to this kind of input, the project is not likely to be successful. If the instigator is only looking for market research, than a Living Lab project is not advised, as this will not yield any value for researchers nor for the end-users themselves. Market research is about getting representative insights, while a Living Lab project is about generating valuable contributions to the innovation in development.

- Take into account the process of retention. What kind of knowledge is already available in the Living Lab and can be used within the innovation project, and what kind of knowledge will the project generate that is of value for the Living Lab constellation and for future projects.

This is also related to the macro level of the Living Lab. It is important to have a strategy on what information will be gathered and what variables will be measured that are beneficial for the innovation project, but also for the Living Lab constellation in the longer run. This means for example measuring the instigator characteristics, using fixed measurement scales to assess user characteristics,… This will enable to generate extra value and results across the different projects, and also enables the comparability between different projects.

MICRO LEVEL:

- Implement a quasi-experimental methodology that takes into account a real-life context and that allows users to gain contextual usage experience, which enhances their user contribution.

The quasi-experimental approach we suggested and implemented in most Living Lab projects seems to yield positive results. By having a real-life exposure, this influences the user characteristics and enhances the value of the user contribution by adding a contextual element, but this real-life intervention also sometimes forces the instigator to think of concrete solutions in order to deliver a working proof-of-concept or prototype to be tested. The real-life intervention is also able to surface technical and practical issues that would otherwise remain unnoticed.

- Make sure that the instigator of the project is involved during all research steps, but the lead in terms of methodology and execution of the research is in the hands of the researcher.

As we learned from our experience with Living Lab projects a project without involvement of the instigator is likely to deliver outputs that are not actionable for the instigator. The real-life contact and interaction is regarded as very insightful by the instigators, so they should be involved and in contact with end-users as much as possible. However, the researcher should remain 'in charge' to guard the methodology and the scientific rigor, in order to be able to also abstract data that is valuable outside of the Living Lab project. Researchers should also be able to 'silence' instigators that go too much into 'defense'-mode when interacting with the end-users, otherwise the results are likely to be biased.

- Take into account the user characteristics of the participants of the different research steps and aim at purposeful sampling in terms of the research questions.

The User Innovation literature offers a lot of insights and suggestions to enable purposeful sampling of users with 'interesting' characterstics such as defectors, expert users, innovators,… According to the stage in the innovation development process, the most suited users can be selected for the different research steps in order to obtain a heterogeneous group of users that should not necessarily be too large.

- Think about additional services and methods that can provide value to the instigator and that can be embedded within the Living Lab projects.

Out of our experience we gathered that business modeling and prototyping expertise are highly valued by some instigators and can be a perfect complement for the user research activities. It would be ideal to assess the needs of the instigator with regards to the innovation in advance so the research steps can be tailored accordingly, mixing user research with other relevant insights and expertise.

8.6 Limitations and future research

We are well aware regarding some of the limitations of our study. Regarding our investigation into Living Labs theory, the choice for papers with more than 10 citations and with 'Living Lab' in the title yielded a bias in terms of 'older' articles as they have a higher chance of being cited. Therefore, the most recent theoretical developments have not been included in our sample, but we tried to overcome this by including more recent articles in our literature review sections. In terms of future research, we propose to repeat this type of systematic literature review in order to keep track of the further developments in the field.

Regarding our study of Living Labs practice, we used a funnel-like approach where we started with a high level analysis of all the affiliated ENoLL Living Labs, while gradually decreasing our sample size as the degree of detail in our analysis increased. In terms of the activity analysis, future research could take into account more strict criteria than apparent website activity. We believe that this should be facilitated by the European Network of Living Labs as a means to improve the value of the EnoLL-affiliation label. We propose to have different labels according to strict quality criteria, as we believe that Living Labs not adhering to the criteria yet or anymore should also have the chance to be part of the network in order to learn from other Living Labs. However, a better segmentation of Living Labs seems necessary, as our analysis revealed very diverging types with different goals. For this type of segmentation, we also propose to extend the coding criteria accordingly to our three-layered model, taking into account characteristics and variables from both the Open and User Innovation paradigms.

In terms of our case study analysis of the four Living Lab constellations, 21 Living Lab projects and 107 research steps, we limited ourselves to Flemish Living Labs and also Living Labs conceived by the iMinds research institute. As a founding member of ENoLL iMinds has credibility and regard in the Living Labs community, but to advance Living Labs to the next level in terms of theory and practice, towards the slope of enlightenment and the plateau of productivity, the success criteria on the three levels should be evaluated for a larger sample of Living Lab constellations and projects, together with an assessment of Open and User Innovation characteristics. This would enable to measure the efficiency of Living Lab processes and structures for potential modifications of the concept for the separate levels, but also enable to assess whether Living Labs are actually capable of solving the European Paradox, which is currently a large gap in Living Labs literature (Katzy et al., 2013).

However, based on the outlook of our model and its relation to the Open and User Innovation literature, we propose an extended research agenda in which Open Innovation as well as User Innovation researchers are involved. The table below gives a representation of this research agenda.

Table 66 Living Labs theoretical model research agenda

Level	Research questions	Research
Macro	How can Living Lab networks yield value for all involved stakeholders? How can the stakeholders be managed and knowledge tranfers orchestrated? How to cope with knowledge retention?	Open Innovation researchers
Meso	Overall methodology Managing the knowledge transfers between the levels	Living Lab researchers
Micro	Development of user innovation methods for real-life experimentation Insight in user motivation Relation between characteristics and value of the contribution	User Innovation researchers

On the macro level, Open Innovation researchers should look at Living Lab constellations from the perspective of an innovation network. We would suggest to explore the role of individual actors within Living Labs by means of the 'innovation champions' literature (Fichter, 2009) and of the individual level attitudes with regards to Open Innovation (Lichtenthaler, 2011). From the experience within our own sample of Living Labs we gathered that the Living Lab manager has an important stake in the success of the Living Lab constellation, but this can also be extended to the other three levels as the characteristics of the instigator influence the success criteria of a project, as well as the researcher characteristics are important for the methodological aspects. Related to this, we also suggest to further research the motivations of the different actors to engage in Living Labs, on the individual as well as on the organizational level. Some literature from a User Innovation perspective has considered the motivations of end-users to participate in Living Labs, but this should also be expanded to include the other involved stakeholders. We also looked into the nature of the knowledge transfers between Living Lab stakeholders, but did not take into account the exact exchange modes. Therefore the framework of Dahlander and Gann (2010) could be used to assess whether Acquiring, Selling, Sourcing and Revealing occur on the different levels within a Living Lab. Referring back to the European Paradox and to Living

Labs enabling exploitation, the act of selling enables a stakeholder to externally exploit internal knowledge. It also appeared that the retention process (Lichtenthaler, 2011) could play an important role in the sustainability and added value of Living Lab constellations.

Another area of future research would be the relation of the three levels within Living Labs in relation to the larger innovation system in which they operate (Wieczorek & Hekkert, 2012). As the sustainability of Living Labs appeared to be a major issue, this reinforces the need to explore the embedding of Living Labs within the overarching innovation systems and available systemic instruments. Moreover, regarding the operations within the Living Lab as an innovation network, these can be subjected to further analysis taking into account the four network-related success factors *trust*, *commitment*, *dependency*, and *compatibility* of the network actors (Rese & Baier, 2011) and looking into the process of network orchestration (Pittaway et al., 2004; Batterink et al., 2010; Klerkx & Aarts, 2013). Moreover, these findings and characteristics should be related to success criteria on the three different levels. The relation between the three levels of analysis and the impact they have on each other are also designated areas for future research.

Specific attention should also be devoted to the process of knowledge retention, as this was underresearched in Open Innovation literature, but looks like a promising avenue of research in order to enhance the value of Living Lab constellations by running multiple Living Lab innovation projects which would lead to knowledge accumulation.

Open Innovation researchers could also provide additional insights and evidence regarding solutions for the EU paradox. In the studied cases, Living Labs appear to be especially successful in facilitating knowledge exploitation of researchers and providers of services to the Living Lab, whereas the instigators of innovation projects are mostly successful in exploring new knowledge. Future research should aim at investigating if this more short-term knowledge exploration during a Living Lab innovation projects potentially leads to exploitation in the longer run, and also whether other Living Labs are better capable of facilitating exploitation.

Regarding the micro level we took the perspective of the instigators and of the researchers within the Living Lab projects to assess the characteristics and variables associated to User Innovation. We did this as we were able to systematically collect this data. However, future research should dig into user characteristics and their impact on user contribution, as the literature from User Innovation is inconclusive on these matters, but offers a lot of potentially interesting avenues of research. Therefore, the characteristics and contributions of the users themselves should be carefully measured and compared between different projects over a longer period of time. We have already been able to carry out some smaller experiments indicating that user characteristics might play an important role in optimizing user involvement and user contribution in Living Labs (cf. Schuurman & De Marez, 2012;

Schuurman et al., 2014), but more large scale research is needed to develop this potential. Moreover, different aspects should be measured and taken into account: user capability for innovation, user motivation to participate and the degree of involvement (Brockhoff, 2003; Enkel et al., 2005), and the stage in the NPD process (Jespersen, 2008). Based on Gassmann and Enkel (2004), who discerned between the locus of knowledge creation, the locus of innovation and the locus of commercialization, we would suggest to extend the notion of co-creation to these three stages. For the final stage, this would lead to users that engage in co-commercialization. Research on crowdfunding and similar initiatives could be used, but it seems like an interesting thought to assess whether this can be involved in Living Lab projects. Are users that have been involved during the innovation development process willing and motivated to engage in co-commercialization?

We see the position of the 'Living Lab researcher' situated especially at the meso level, where both levels merge and materialize in concrete innovation projects. Future research should focus on the overall methodology in function of the type of innovation in development and according to the characteristics of the instigator. The Living Lab researcher should also be seen as the 'gateway' between the macro and micro level and ensure that knowledge transfers and exchanges take place between the different levels. However, we see the knowledge retention process as a responsibility for researchers (or other actors) at the different levels.

By means of their position as applied researchers, Living Lab researchers are also potential enablers of Open and User Innovation 'experiments' and deductive, hypotheses testing research. This way, **Living Labs** could be the **subject of Open and User Innovation research**, functioning as study 'arena' for tackling research gaps in the current Open and User Innovation literature. For Open Innovation, we see the potential to fill the gap regarding levels of analysis, as through their three different levels of analysis, Living Labs allow to take into account different charateristics on different levels and relate them to the outcomes on the different levels. Moreover, within our studied sample it appeared that Living Labs were able to attract a lot of SMEs, especially in the utilizer role, which is an opportunity to add to the growing body of Open Innovation literature regarding SMEs. We also proposed retention as a process that deserves more attention and that might play an important role in the added value of Living Labs over a longer period of time. More attention for this process would also add to the Open Innovation literature, as this process was also underresearched compared to exploration and exploitation processes. We also proposed an analytical lens linked to success criteria on the different levels which enables the measurement of different Living Lab activities. The development of measurement systems is also regarded as a gap in Open Innovation literature. As it was stated that developing a coherent framework why and how users contribute to innovation is still a major challenge (Bogers & West, 2012), and a more quantitative assessment of user involvement and user contribution in innovation is still lacking, we regard Living Labs as major opportunities for User Innovation researchers as well. By having multiple innovation projects with user involvement running in a given Living Lab infrastructure, this enables to conduct experiments in order to test assumptions, and it also allows to gather more longitudinal data. Moreover, by measuring success criteria on the different Living Lab levels, the added value and exact nature of user contribution can be more precisely assessed. In the case of a panel-based Living Lab, where the same community of end-users is involved in multiple innovation projects, this also holds opportunities to research user motivations for participation in Open Innovation and to link these findings to the user characteristics. Moreover, a panel-based Living Lab offers the possibility to combine user screening for purposeful sampling and self-selection of users, which opens up a lot of opportunities for future research.

Summarizing, we see a lot of future directions for research and believe that this future research should work in two ways. First, Living Lab researchers should use the concepts, frameworks and insights from Open and User Innovation to develop their own research field and to connect to these other fields in order to gain more academic acclaim. Second, Living Lab researchers as well as practitioners should invite Open and User Innovation researchers to use Living Labs as study objects to develop their own fields, as because of the characteristics of Living Labs, they seem to be a perfect 'research arena' or even 'Living Lab' to test and validate assumptions and hypotheses from their own fields. If these guidelines for future research and recommendations will be taken into account by the Living Lab researcers and practitioners, and if we succeed in opening up the Living Labs field, we strongly believe that Living Labs have a bright future in sight, both in terms of theory and practice, as embodiment of distributed innovation based on collaboration and shared value creation.

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IV. Appendices

Appendix 1 *List of official meeting minutes of steering committees*
LeYLab:

- Nextlab Steerco Meeting – 22/09/2010
- Nextlab Steerco Meeting – 07/10/2010
- Nextlab IWT Meeting – 20/10/2010
- Steerco LeYLab Meeting – 17/11/2010
- Steerco LeYLab Meeting – 10/12/2010
- Steerco LeYLab Meeting – 17/01/2011
- Steerco LeYLab Meeting – 14/02/2011
- Steerco LeYLab Meeting – 21/03/2011
- Steerco LeYLab Meeting – 27/04/2011
- Steerco LeYLab Meeting – 24/05/2011
- Steerco LeYLab Meeting – 21/06/2011
- Steerco LeYLab Meeting – 12/08/2011
- Steerco LeYLab Meeting – 21/10/2011
- Steerco LeYLab Meeting – 17/11/2011
- Steerco LeYLab Meeting – 15/12/2011
- Steerco LeYLab Meeting – 25/01/2012
- Steerco LeYLab Meeting – 22/02/2012
- Steerco LeYLab Meeting – 29/03/2012
- Steerco LeYLab Meeting – 27/04/2012
- Steerco LeYLab Meeting – 04/06/2012
- Steerco LeYLab Meeting – 02/07/2012
- Steerco LeYLab Meeting – 29/08/2012
- Steerco LeYLab Meeting – 24/09/2012
- Steerco LeYLab Meeting – 23/10/2012
- Steerco LeYLab Meeting – 26/11/2012

Mediatuin:

- Progress report – 10/05/2011
- Progress report – 15/11/2011
- Progress report – 08/05/2011
- Progress report: 03/2011 – 09/2011
- Report user research – 30/06/2011

FLELLAP/ VPP

- FLELLAP Meeting 1 report – 23/11/2010
- User group report – 09/03/2011
- User group report – 24/03/2011
- User group report – 21/04/2011
- Steerco FLELLAP meeting – 28/03/2011
- Steerco FLELLAP meeting – 26/09/2011
- Steerco FLELLAP meeting – 15/12/2011

- Steerco FLELLAP meeting – 24/01/2012
- Steerco FLELLAP meeting – 28/09/2012
- Report user commissions – September 2011
- Report user commissions – 07/2011 – 12/2011
- FMT Meeting 27/10/2010
- FMT Meeting 26/11/2010
- FMT Meeting 22/12/2010
- FMT Meeting 09/20/2011

Appendix 2 List of initial project proposals

- REC Crossmedia Formats aanvraag definitief 12/10/2010 (Mediatuin)
- NGA-Proposal-Final_v2.0 03/08/2010 (LeYLab)
- 20100129-proposal-flellab_v1.0 31/01/2010 (Flellap)

Appendix 3 Deliverables from the Living Lab projects

- case summary_SmartSeats2 10/07/2014
- Case Summary Twikey 08/07/2014
- Jukebox21_case summary 08/07/2014
- Kianos_ case summary 08/07/2014
- Veltion_case summary 08/07/2014
- CEONAV_case summary 08/07/2014
- Qwison_ case summary 08/07/2014
- Streemr_case summary 08/07/2014
- case summary La Mosca 08/07/2014
- Case Summary Sonic Angel 24/06/2014
- Wadify27112012 24/06/2014
- Briefresults_Hoaxland_Mediatuin 24/06/2014
- Eindpresentatie_Coxo_Mediatuin 21/02/2014
- MuFoLive_evaluatie 13/11/2013
- Case Summary Planza 23/10/2013
- Presentation Sota WEBINOS 24/07/2013
- Casesummary_futurelegends 03/05/2013
- Final Resulaten Poppidups_LeyLab 15/04/2013
- Fietsnet resultaten fase 3 co-creatie 04/05/2012
- Cloud app Belgacom 11/04/2012
- FifthPlay FMT_09/02/2012

Appendix 4 Interviews

- In depth interviews with the three Living Lab managers from FLELLAP, LeYLab and Mediatuin

Informant	Function	Date
Tim Rootsaert	Mediatuin Living Lab manager iMinds Living Labs business developer	30/04/2014
Mark De Colvenaer	Flellap Living Lab manager	16/04/2014

Dirk Osstyn	LeYLab Living Lab manager	22/04/2014

- Semi-structured interviews with the 21 instigators from all the Living Lab projects from the analysis, consisting of open questions and a battery of statements and likert scales, and with the researchers in these projects

Name	**Project**	**Instigator**	**Interviewee**	**Date**
David De Wever	**Wadify**	SME PlayOut!	CEO	26/11/2013
Jean-Sebastien Gosuin	**Smart Seats**	Start-up	Co-founder	24/02/2014
Heiko Desruelle	**Webinos**	EU-project University research group	Senior researcher	06/01/2014
Peter Leyder	**Coxo**	Organization VTBKultuur	Project manager	18/11/2013
Dominique Adriansens	**Twikey**	Start-up	Founder	05/11/2013
Eddy Schuermans	**Ceonav**	SME	Founder	14/11/2013
Thomas Van Landeghem	**Veltion**	Start-up	Founder	07/11/2013
Jeroen De Smet	**Planza**	Start-up	Founder	24/03/2014
Geert Polleunis	**Qwison**	SME – Aconos	Founder	29/10/2013
Femke Mussels	**SonicAngel**	SME	Co-founder	22/11/2013
Geert Reynaert	**Hoaxland**	SME	CEO	06/01/2014
Kristof Van den Branden	**La Mosca**	SME	CEO	06/11/2013
Sven De Coninck	**Future Legends**	Organization – REC	Director	22/11/2013
Tom Vandoorne	**JukeBox21**	Start-up	Co-founder	20/11/2013
Pieter Ardinois	**Streemr**	Start-up	Founder	19/11/2013
Bert Cattoor	**Kianos**	Start-up	Founder	28/10/2013
Hans-Bart Van Impe	**OnCloud**	Large firm - Belgacom	Senior strategic consultant	22/11/2013
Hannelore Van Buyten	**Poppidups**	SME Prophets	Project manager	26/12/2013

Ronald Hermans	**Fietsnet**	Organization	Co-founder	12/11/2013
Dann Rogge	**Fifth Play**	SME/Large firm	Business Unit Director	20/11/2013
Koen Tanghe	**MuFoLive**	Start-up SampleSumo	Co-founder	29/10/2013

Informant	Function	Project involved in	Date
Bastiaan Baccarne	PhD student	Wadify Twikey Future Legends La Mosca SonicAngel Hoaxland Planza	17/10/2013
Lynn Coorevits	Researcher	Webinos	06/01/2014
Carina Veeckman	Junior researcher	Fietsnet Fifth Play MuFoLive	12/11/2013
Constantijn Seys	Junior researcher	Ceonav Veltion Qwison JukeBox21 Streemr Kianos	04/10/2013
Sara Logghe	Junior researcher	Coxo	18/11/2013
Annabel Georges	Junior researcher	Smart Seats	24/02/2014

Appendix 5 Interviews protocol from indepth interviews and semistructured interviews

Instigator interview guide

1) Waarom hebben jullie een proeftuinonderzoek laten uitvoeren? Welke alternatieven hebben jullie overwogen?

2) Wat zijn jullie grootste uitdagingen op dit moment?

*3) Geef aan hoe matuur de innovatie was **voor** en **na** het proeftuintraject:*

- ❑ Idee-fase
- ❑ Concept-fase
- ❑ Prototype-fase
- ❑ Pre-launch-fase
- ❑ Launch-fase
- ❑ Post-launch-fase

4)Hoe duidelijk hebben jullie op dit moment zelf voor ogen hoe de verdere evolutie van de innovatie er zal uitzien? (1: totaal niet duidelijk 10: erg duidelijk)?

5) Wat waren de positieve aspecten aan het proeftuinonderzoek?

6) Wat waren de negatieve aspecten aan het proeftuinonderzoek?

7)Op welke domeinen had de gebruiker inspraak tijdens het proeftuintraject? Specifieer ook dewelke.

- ❑ Enkel aftoetsen van idee/innovatie (evalueren) **/5**
- ❑ Verder verfijnen van idee/innovatie (incrementele verbeteringen) **/5**
- ❑ De gebruikersinput bepaalde de richting en aard van de innovatie (substantiële verbeteringen) **/5**

8) Welk type informatie heeft het onderzoek opgeleverd? (5-punten schaal) Resulteerde dit in concrete veranderingen aan de innovatie? Dewelke?

- ❑ Need information **/5**
- ❑ Solution information **/5**
- ❑ Evaluative information **/5**
- ❑ Business model information **/5**
- ❑ User innovation **/5**

9) Waarvoor werden de resultaten vooral gebruikt? (5-punten schaal Strookte dit met de verwachtingen?

- ❑ Input voor marketingstrategie **/5**
- ❑ Input voor business model **/5**

- ❑ Input voor shareholders **/5**
- ❑ Input voor innovatie ontwikkeling **/5**
- ❑ Interne kennis verhogen **/5**
- ❑ Input voor stakeholders **/5**

10) In welke mate had u voor het proeftuinproject ervaring met de volgende actoren? (1: totaal geen ervaring – 5: heel veel ervaring) Had u na het proeftuinproject nog nieuwe ervaring met volgende actoren? → indien ja, welke?

- ❑ Samen innoveren met andere bedrijven **/5**
- ❑ Samenwerken met academische onderzoekers **/5**
- ❑ Samenwerken met onderzoeksinstituten **/5**
- ❑ Samenwerken met iMinds **/5**
- ❑ Samenwerken met commercieel onderzoeksbureau **/5**
- ❑ Samenwerken met consultants **/5**
- ❑ Samenwerken met een Living Lab **/5**
- ❑ Samenwerken met een publieke actor/organisatie (overheid,…) **/5**
- ❑ Samenwerken met een NGO **/5**

	Helemaal niet akkoord	**Niet akkoord**	**Neutraal**	**Akkoord**	**Helemaal akkoord**
We zijn als bedrijf sterk in het zelf bedenken van innovatieve ideeën					
We zijn als bedrijf sterk in het detecteren van externe innovatieve ideeën/kennis					
We zijn als bedrijf sterk in het intern bijhouden van vergaarde kennis					
We zijn als bedrijf sterk in het extern opslaan van vergaarde kennis					
We zijn als bedrijf sterk in het ontwikkelen van innovaties					
We zijn als bedrijf sterk in het extern exploiteren van interne kennis					

We zijn als bedrijf sterk in het detecteren van externe innovatieve technologieën					
We zijn als bedrijf sterk in het exploiteren van intern ontwikkelde technologieën					
We kennen het ecosysteem rond onze doelmarkt goed					
Wij hebben kennis van de huidige technische oplossingen in onze doelmarkt					
We hebben intern een hoge ervaring met bestaande oplossingen voor de problemen die onze innovatie wil oplossen					
Wij hebben kennis van de wensen en verzuchtingen van de gebruikers in onze doelmarkt					
Wij zouden zelf een voordeel ondervinden door de innovatie te gebruiken					
We zijn zelf ontevreden over de bestaande oplossingen in de doelmarkt					
We ervaren zelf de noden die onze innovatie wil tackelen					
Wij worden gecontacteerd door mensen/organisaties die info rond dit onderwerp wensen					
Wij zijn doorgaans bij de eersten om nieuwe producten of diensten binnen dit domein te testen					
Wij hebben een uitgebreide kennis van alles wat met deze innovatie te maken heeft					
Wij delen actief onze kennis betreffende het innovatiedomein					
Tijdens gesprekken over het innovatiedomein dragen we zelf meer bij dan we zelf opsteken					
Het Living Lab heeft een significant deel van onze resources (tijd, geld) ingenomen					
We hebben aanpassingen aan de innovatie door gevoerd op basis van de resultaten tijdens het proeftuintraject					
We waren in staat om snel aanpassingen aan de innovatie uit te voeren					

Het proeftuinproject heeft ons in contact gebracht met interessante partijen					

Researcher interview guide

1) Hoe heb je het proeftuintraject ervaren?

2)Geef aan hoe matuur de innovatie was ***voor*** *en* ***na*** *het proeftuintraject:*

- ❑ Idee-fase
- ❑ Concept-fase
- ❑ Prototype-fase
- ❑ Pre-launch-fase
- ❑ Launch-fase
- ❑ Post-launch-fase

3) Wat waren de positieve aspecten aan het proeftuinonderzoek?

4) Wat waren de negatieve aspecten aan het proeftuinonderzoek?

5)Op welke domeinen had de gebruiker inspraak tijdens het proeftuintraject? Specifieer ook dewelke.

- ❑ Enkel aftoetsen van idee/innovatie (evalueren) **/5**
- ❑ Verder verfijnen van idee/innovatie (incrementele verbeteringen) **/5**
- ❑ De gebruikersinput bepaalde de richting en aard van de innovatie (substantiële verbeteringen) **/5**

6) Welk type informatie heeft het onderzoek opgeleverd? (5-punten schaal) Resulteerde dit on concrete veranderingen aan de innovatie? Dewelke?

- ❑ Need information **/5**
- ❑ Solution information **/5**
- ❑ Evaluative information **/5**
- ❑ Business model information **/5**
- ❑ User innovation **/5**

7) Waarvoor werden de resultaten vooral gebruikt? (5-punten schaal)

- ❑ Input voor marketingstrategie **/5**
- ❑ Input voor business model **/5**
- ❑ Input voor shareholders **/5**
- ❑ Input voor innovatie ontwikkeling **/5**
- ❑ Interne kennis verhogen **/5**
- ❑ Input voor stakeholders **/5**

8) In welke mate werd er in dit proeftuinproject gebruik gemaakt van een materiële/technische infrastructuur? **/5**

geen

9) In welke mate werd er in dit proeftuinproject gebruik gemaakt van een immateriële infrastructuur?

- Panelleden:
- Marktkennis:
- Kennis over de eindgebruiker:
- Contacten met stakeholders uit vorige projecten:

10) In welke mate was er een open communicatie en uitwisseling van resultaten en data?

11) In welke mate was er sprake van een gebruikerscommunity (interest vs. practice)?

12) in welke mate werd het ecosysteem betrokken bij dit proeftuinonderzoek?

13) In welke mate waren volgende zaken aanwezig?

1 = Research into the usage context; **/5**

2 = Discover unexpected ICT-uses and new service opportunities; **/5**

3 = Co-creation with the users; **/5**

4 = Evaluation of new ICT-solutions by users; **/5**

5 = Technical testing of the innovation in a realistic context; **/5**

6 = Familiar usage context for the users; **/5**

7 = Experience and experiment in a real-world context; **/5**

8 = Medium- or long-term user studies; **/5**

9 = Large scale user studies; **/5**

14) Publicaties:

Appendix 6 *Codebook: Data-set Living Lab projects*

Name	Label	Values
ID_number	Respondents	--
Q1_LL_time	Length of LL membership (YEARS)	--
LL1_usage	Investigation of the usage context See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL2_unexpected_uses	Discover unexpected (ICT-) uses and new service opportunities See coding des scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL3_cocreation	Co-creation with the user See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL4_evaluation	Evaluation of new (ICT-) solutions by user See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL5_technical_testing	Technical testing of the innovation in a realistic context See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high

LL6_familiar_context	Familiar usage context for the users See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL7_realworld_context	Experience and experiment in a real-world context See coding scheme for more details.	1 = very low 2 = rather low 3 = rather high 4 = very high
LL8_duration	Medium- or long-term user studies (YEARS) See coding scheme for more details.	--
LL9_scale	Large scale user studies See coding scheme for more details.	--

Appendix 7 Living Lab articles samples

Google Scholar Analysis: List of articles

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