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The “Research Day – Conference proceedings 2017” reports findings presented during the OpenLivingLab Days 2017, annual summit of the Living Lab community held in Krakow from the 28th August to the 1st of September. Now in its fifth edition (first call for academic contributions was launched in 2013), this publication is the result of the Call for Papers launched in February 2017 and tackles some of the numerous Living Lab related challenges recently investigated by scholars and practitioners around the world.

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Track I

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Drop-out in Living Lab Field Tests: A Contribution to the Definition and the Taxonomy

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Abstract

Studies on living labs show that the users' motivation to participate in a field test is higher at the beginning of the project than during the rest of the test, and that users tend to drop-out before completing the assigned tasks. However, the literature still lacks theories describing the phenomenon of drop-out within the area of living lab field tests. As the first step of developing a theoretical discourse, the aim of this study is to present an empirically derived taxonomy for the various influential factors on drop-out behavior and to provide a definition for drop-out in living lab field tests. To achieve this goal, we first extracted factors influencing drop-out in the field test by conducting a short literature review on the topic, and then triangulated the factors across 14 semi-structured interviews with experts in living lab field tests. Our findings show that identified reasons for drop-out can be grouped in three categories: innovation-related, research-related and participant-related. Each category in turn, consists of three subcategories with a total of 45 items for drop-out in living lab field tests. In this study, we also explore different types of drop-out and propose a definition for drop-out in living lab field tests.

Keywords
User engagement, Drop-out, Living Lab, Field test, Taxonomy, User motivation

Introduction

Individual users are considered as one of the most valuable external sources of knowledge and a key factor for the success of open innovation (Jespersen, 2010). One of the more recent approaches of managing open innovation processes are living labs, where individual users are involved to co-create, test and evaluate an innovation in open, collaborative, multi-contextual and real-world settings (Bergvall-Kareborn, Holst, & Stahlbrost, 2009; Ståhlbröst, 2008). A major principle within living lab research consists of capturing the real-life context in which an innovation is used by end users by means of a multi-method approach (Schuurman, 2015). In a living lab setting, a field test is a user study in which the interaction of test users with an innovation in the context of use is tested and evaluated (Georges, Schuurman, & Vervoort, 2016).

Involving individual users in the process of systems development is a key dimension of open innovation that contributes positively to new innovations as well as system success, system acceptance and user satisfaction (Bano & Zowghi, 2015; Leonardi et al., 2014; Lin & Shao, 2000). However, when it comes to testing an innovation, previous studies show that the users' motivation in an open innovation environment such as living labs, especially at the beginning of the test is higher than the rest of the activity (Ley et al., 2015; Ogonowski, Ley, Hess, Wan, & Wulf, 2013; Ståhlbröst & Bergvall-Kåreborn, 2013). Consequently, the users tend to drop-out of field test before the project or activity has ended as the motivations and expectations of the users will change over time (Georges et al., 2016). This drop-out might be due to internal decision of the participant to stop the activity or external environmental factors that caused them to terminate their engagement before completing the assigned tasks (O'Brien & Toms, 2008) and is occurring in all phases of the innovation process, from contextualization to test and evaluation (Habibipour, Bergvall-Kareborn, & Ståhlbröst, 2016).

Keeping users enthusiastically motivated during the whole process of open innovation is of crucial importance and a number of previous studies have acknowledged the importance of sustainable user engagement (Hess & Ogonowski, 2010; Leonardi et al., 2014; Ley et al., 2015). There are a number of reasons for this concern as those users already have a relatively profound understanding and knowledge about the project (Hess & Ogonowski, 2010), they are able to provide deeper and more detailed feedback (Ley et al., 2015; Visser & Visser, 2006). Moreover, a trustful relationship between the users and developers has already been established and it is positively associated with the project results (Carr, 2006; Jain, 2010; Padyab, 2014). Finally, drop-out in projects is costly in terms of both time and resources as the developers need to train new users and provide an adequate infrastructure (such as hardware, software and communication technology) for them (Hanssen & Fægri, 2006; Ley et al., 2015). Kobren et al. (2015) assert that a participant after dropping out will not have any additional value for the project or activity.

As far as we are aware, the literature still lacks theories describing the phenomenon of drop-out within the area of living lab field tests. To develop a theoretical discourse about drop-out in field tests, there is a need to define, categorize and organize possible influential factors on drop-out behavior. Such a taxonomy can form the basis for a theoretical framework in the area of this study. Accordingly, the aims of current study are: (a) to provide an empirically grounded definition for drop-out in living lab field tests, (b) to understand the different types of drop-out, and (c) to develop an empirically derived, comprehensive taxonomy for the various influential factors on drop-out behavior in a living lab setting.

To achieve this goal, we first conducted a short literature review and then, interviewed 14 experts in the area of field testing in a living lab setting. The next section outlines the methodology and research process for derivation of the taxonomy followed by the section that provides the results of the short literature review. After that, we present different types

of drop-out and a definition for drop-out in living lab field tests. Finally, the developed taxonomy for drop-out in living lab field tests is presented and the paper ends with some concluding remarks.

Methodology

As mentioned, the aim of current study is to provide a definition for drop-out, to understand different types of drop-out and to develop an empirically derived taxonomy for the various factors on drop-out behavior in a living lab field test setting. In order to better understand drop-out behavior of field test participants, a detailed and systematic study needs to be conducted in their natural setting within a qualitative approach (Kaplan & Maxwell, 2005). Since the qualitative research is generally inductive in nature, qualitative researchers might start gathering data without constraining themselves to an explicit theoretical framework which is called "grounded theory" (Glaser & Strauss, 2009; Strauss & Corbin, 1998). The use of grounded theory is justifiable in this study since, the literature still lacks theories and taxonomies describing the phenomenon of drop-out in living lab field tests. In contrast with a typology in which the categories are derived based on a pre-established theoretical framework, the taxonomies are emerged empirically within an inductive approach and are developed based on observed variables (Sokal & Sneath, 1963).

In order to develop a taxonomy for drop-out, we started gathering information about drop-out reasons within various qualitative data collection methods. According to Kaplan and Maxwell (2005), qualitative data may be gathered using three main sources namely, 1) observation; 2) semi-structured interviews; and 3) documents and texts. Accordingly, in this study qualitative data were collected in two major steps. First, we extracted possible drop-out reasons in living lab field tests by reviewing previous literature and then, these findings were triangulated by interviewing experts in living lab field tests to increase and ensure the validity and trustworthiness of the collected data to build a taxonomy for drop-out. Figure 1 shows the research process for this study.

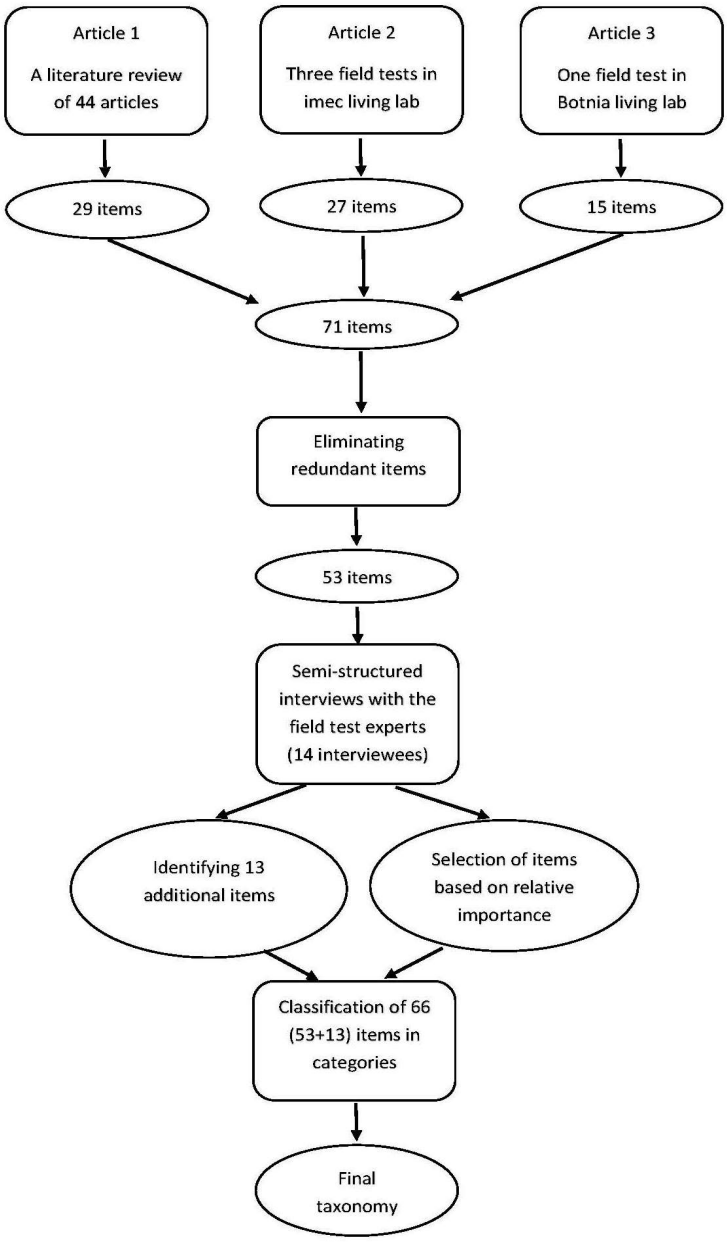

Figure 1. Research process for this study

In the first major step, we explored documented reasons for drop-out in field tests. As recommended by Strauss and Corbin (1998), within grounded theory research which still lacks explicit boundaries between the context and phenomenon, reviewing previous literature can be used as the point of departure for the research. Accordingly, this phase of data collection was done according to the results of a literature review on the topic (Habibipour et al., 2016). By doing so, we extracted 29 items. In addition, we identified other possible influential factors on drop-out from four different field tests in both imec living labs (three field tests) (Georges et al., 2016) and Botnia living lab (one field test)[1] (Habibipour & Bergvall-Kåreborn, 2016). In these field tests, the data was collected by conducting an open-ended questionnaire as well as direct observation of drop-out behavior. This also resulted in 42 items. After eliminating redundant or similar items, we ended up with 53 items.

[1] For a more detailed description of each field test such as the number of participants, field test duration and study set up, see Georges et al. (2016) and Habibipour & Bergvall-Kåreborn (2016).

In order to promote stronger interaction between research and practice and obtain more reliable knowledge, it is recommended by social scientists that different perspectives should be included in the study (Kaplan & Maxwell, 2005). This approach is in line with Van de Ven's (2007) recommendation to conduct social research which is labeled as "engaged scholarship". Engaged scholarship is defined as *"... a participative form of research for obtaining the different perspectives of key stakeholders (researchers, users, clients, sponsors, and practitioners) in studying complex problems. By involving others and leveraging their different kinds of knowledge, engaged scholarship can produce knowledge that is more penetrating and insightful than when scholars or practitioners work on the problem alone"* (Van de Ven, 2007, p. 9). Thus, in the second round of data collection, we conducted 14 semi-structured, open-ended interviews with experts in living lab field tests. 8 out of 14 interviewees were user researchers or panel managers from imec living labs in Belgium and 6 of them were living lab researchers from Botnia living lab in Sweden. The aim of these interviews was to triangulate the findings of the first data collection wave with the researchers that enables us to find an initial structure for the proposed taxonomy. In this study, we used both data and method triangulation to increase the reliability as well as the validity of the results and greater support to the conclusions (Benbasat, Goldstein, & Mead, 1987; Flick, 2009).

The topic guide of the interview consists of two major parts. First, the interviewees were asked open questions about living lab field tests, drop-out and components of drop-out (e.g. definition, types of drop-out, main drop-out reasons and when they consider a participant as dropped out). In the second part, we used the results of our short literature review as input for developing the interview protocol and thus, the interviewees were given 53 cards each one showing an identified factor. We asked the interviewees to put these cards in three main categories of: (1) not influential at all, (2) somewhat influential, and (3) extremely influential on drop-out in the living lab field tests they were involved in. They also were provided by some empty cards in case they wanted to add other items which were not presented in the main 53 cards. They then were asked to group extremely influential items into coherent groups with a thematic relation. This helps us to identify the main categories for drop-out and enables us to develop our taxonomy.

When it comes to analysis of the data, qualitative coding was used because it is the most flexible method of qualitative data analysis (Flick, 2009) and allows researchers to build a theory through an iterative process of data collection as well as the data analysis (Kaplan & Maxwell, 2005). In this regard, developing a taxonomy is the first step to propose a way to empirically build a theoretical foundation based on the observed factors (Stewart, 2008). This approach facilitates insight, comparison, and the development of the theory (Kaplan & Maxwell, 2005) and enables us to identify key concepts in order to develop an initial structure for the taxonomy for drop-out in living lab field tests. In order to properly analyze data and gain thorough insight, Microsoft Excel 2016 as a spreadsheet tool for coding and combining the collected information was used.

Literature Review Results

Previous studies show that, finding motivated and engaged users is not an easy task (Georges et al. 2016; Kaasinen, Koskela-Huotari, Ikonen, & Niemeléi, 2013) as they may tend to drop-out before completing the project or activity. However, to the best of our knowledge, there are few studies addressing drop-out reasons in the living lab field test.

Habibipour et al. (2016) carried out a comprehensive literature review to identify documented reasons for drop-out in the information systems development process. The authors in this study identified some influential factors on drop-out behavior and classified them in three main areas of consideration: technical aspects, social aspects and socio-technical aspects. When it comes to technical aspects, the main reasons which lead to drop-out are related with the performance of the prototype such as task complexity and usability

problems (instability or unreliability) as well as inappropriate preparation of participants to participate in the project or activity. Limitation of users' resources, inadequate infrastructure and insufficient technical support are other technical aspects. Regarding the social aspects, issues related with the relationship (either between users and developers or between participants themselves), lack of mutual trust and inappropriate incentive mechanism are the main reasons. In considering the socio-technical aspects, wrong user selection and privacy and security concerns were more highlighted in the studies. However, in the abovementioned study the authors did not focus on a specific phase or types of activity and extracted the drop-out reasons for all steps of the information systems development process such as ideation, co-design or co-creation and finally test and evaluation.

In another study, Georges et al. (2016) conducted a qualitative analysis within three living lab field tests to find factors that are related, either positively or negatively, to different types of drop-out during field tests. The field tests were carried out in living lab projects from iMinds living labs (now imec.livinglabs). The data in this study was collected via open questions in post-trial surveys of the field tests and an analysis of drop-out data from project documents. The results of this study show that several factors related to the innovation, as well as related to the field trial setup, play a role in drop-out behavior, including the lack of added value of the innovation and the extent to which the innovation satisfies the needs, the restrictions of test users' time and technical issues.

There has also been an attempt to present a user engagement process model that includes the variety of reasons for drop-out (Habibipour & Bergvall-Kåreborn, 2016). The presented model in this study is grounded on the results of a literature review as well as a field test in Botnia living lab in Sweden. In this model, influential factors on drop-out behavior are associated with: 1) task design such as complexity and usability; 2) scheduling such as longevity; 3) user selection process such as wrong users with low technical skills; 4) user preparation such as unclear or inaccessible guideline; 5) implementation and test process such as inadequate infrastructure; and 6) interaction with the users such as ignoring users' feedback or lack of mutual trust.

In total, we extracted 29 items from the first article (Habibipour et al., 2016), 27 items from the second article (Georges et al., 2016) and 15 items from the third article (Habibipour & Bergvall-Kåreborn, 2016). By removing redundant items, we ended up with 53 influential factors on drop-out behavior. As it can be seen, none of the above-mentioned studies have ended up with the same classification or category of reasons for drop-out nor presented a clear definition for drop-out in living lab field tests. In this study, we argue for the need of a clear definition as well as a taxonomy for possible drop-out reasons. Taxonomies are useful for research purposes to leverage and articulate knowledge and are fundamental to organizing knowledge and information in order to refine information through standardized and consistent procedures (Stewart, 2008).

Definition and Types of Drop-out

The results of our study showed that drop-out occurs in different steps of a field test and might be associated with various reasons. By analyzing the interviewees' responses to open-ended questions of "when do you consider a participant as dropped out?" and "what is drop-out in living lab field tests according to you?"; we ended up with different types of drop-out in living lab field tests. The **participant drop-out** where the participants only participate in the startup of the field test but they have not started to use that innovation. As one of the interviewees stated: "*Drop-out is when they have started the test period and they are not fulfilling the assignments and complete the tasks. First of all, we need to think of the term 'user'. If they drop-out before they actually used anything, can we call them user drop-out or should we call them participants? If they are only participating in the startup but they have not started to use that*

innovation we can't really call them user. If they have downloaded or installed or used the innovation or technology, then they are users."

Innovation-related drop-out occurs when participants stop using the innovation because of motivational or technical reasons related to the innovation. Regarding the innovation-related drop-out, the interviewees made comments such as: *"...people have to install something and they don't succeed because they don't understand it or the innovation is not what they expected or wanted"* Or: *"During the field test, the longer the field test, the bigger the drop-out. I've seen it, why should I still use it?"*

Research-related drop-out occurs when the participants stop participating in the research component of the field test, you don't get feedback anymore from them. As an interviewee stated: *"We as researchers must be particularly afraid of methodological drop-out, because then we cannot get feedback from test-users"*. Or as another interviewee stated: "*People that do not fulfill the final task (mostly a questionnaire) are also considered as drop-out for me."*

Our finding also supports O'Brien & Toms's (2008) argument that user disengagement might be due to internal decision of the participant to stop the activity or external environmental factors that caused them to terminate their engagement before completing the assigned tasks. Accordingly, the drop-out decision can be made conscious or unconscious by the participants but is characterized by the fact that they don't notify this to the field test organizers. For instance, an interviewee made a distinction between dropped out users and a defector which is someone who notifies to stop but still gives feedback: *"If you stop testing and you keep on filling in the surveys (participating in research), you are not a dropped-out user. You need to make a distinction between stop testing the application and stop filling in the surveys..."* What is common in all mentioned types of drop-out is that the participants showed their interest to participate in the field test but they stopped performing the tasks before the field test has ended. Thus, we propose this definition for drop-out in living lab field test as:

> *"A drop-out during a living lab field test is when someone who **signed up to participate** in the field test, does **not complete all the assigned tasks** within the **specified deadline**"*

Within this definition three elements are of importance: (1) the dropped-out participant signed up to participate, this implies that the participant must be aware of what is expected of him/her. Next to this, (2) the dropped-out participant didn't complete all the assigned tasks. Depending on the type of field test, this could be the act of using/testing the innovation, but could also refer to participating in research steps (e.g. questionnaires, interviews, diary studies...). This difference was already made by Eysenbach (2005) in his law of attrition (drop-out attrition and non-usage attrition). Finally, (3) the drop-out participant didn't complete the tasks that were assigned to him/her within the specified deadline that was agreed upon.

Towards a Taxonomy for Drop-Out in Living Lab Field Tests

As mentioned in the methodology section, the developed taxonomy is grounded on the results of a literature review article (Habibipour et al., 2016) as well as the results of four living lab field tests (Georges et al., 2016; Habibipour & Bergvall-Kåreborn, 2016). The findings of the previous steps were triangulated across 14 semi-structured interviews. This triangulation of the data strengthens the validity of the presented taxonomy and makes our results stronger and more reliable (Benbasat et al., 1987). The interviewees were asked to group the items that are extremely influential on drop-out into coherent groups under headings with a thematic relation. Our goal was to identify the most frequent suggested categories by the interviewees. Table 1 shows the categories of items that were initially suggested by the interviewees. B1 to B8 refers to the interviewees in imec living labs in Belgium and S1 to S6 refers to the interviewees in Botnia living lab in Sweden. In some cases,

an item can belong to different categories because the same item was interpreted differently by the interviewees. For example, two interviewees mentioned privacy and security concerns as "personal context" while six of them considered it under the category of "participants' attitude". Thus, we decided to put the privacy and security concerns under the "participants' attitude" category.

An important outcome of this study was to refine the initial list of items which was extracted from the previous literature. During the interviews, we asked the interviewees to express their feelings about each item if they have some comments or extra explanation about that item. By doing so, we eliminated some items that were similar and combined the items that were very closely related. In this study, we were also interested in discovering other factors on drop-out behavior that we were not aware of. Some of the interviewees also added additional items to our original list. As a result, we ended up with a revised list of items which was used to develop the taxonomy. The modified list of items is shown in Appendix A.

Category	B1	B2	B3	B4	B5	B6	B7	B8	S1	S2	S3	S4	S5	S6	Number of hits
Technological issues	*	*	*		*	*	*	*	*	*		*	*	*	12
Participants' resource limitation	*			*	*	*		*	*	*	*	*	*		10
Personal reasons / problems	*			*	*		*		*	*	*		*	*	9
Communication/interaction					*	*	*		*	*	*	*	*	*	9
Innovation related	*	*	*	*	*	*	*	*			*				9
Planning/Test design		*	*	*	*	*	*			*	*			*	9
Timing	*					*		*	*		*	*		*	7
Privacy and security	*			*		*	*					*	*		6
Personality / participants' attitude				*	*	*	*		*				*		6
Forgetfulness				*		*					*				3
Complexity				*				*		*					3
Motivational factors / benefit									*			*			2

Table 1. Summary of the suggested categories by the 14 interviewees

According to the results of the 14 interviews and based on the number of overlaps in the categories, nine categories seemed to us the most meaningful way of organizing the factors influencing drop-out in living lab field tests. The identified categories could be grouped under three main headings: innovation-related categories, research-related categories and participant-related categories. In the following, we discuss each of these headings in more detail.

Innovation-related drop-out

The categories under this heading are the ones that are directly related to the innovation itself. Technological problems, perceived ease of use and perceived usefulness were the categories that were suggested by the interviewees most frequently. Hereby we have to note that, the interviewees are experts in their domain, therefore we suppose that the concepts of 'perceived ease of use' and 'perceived usefulness' are based on work of Davis (1986) and Venkatesh et al. (2000) on the technology acceptance model.

Technological problems: As the results of the interviews revealed to us, technological problems are among the most important innovation-related factors which play a role in drop-out behavior. These group of items might be associated with the trouble of installing the innovation, flexibility or compatibility of infrastructure as well as stability and maturity of the (prototype) innovation.

Perceived usefulness: When it comes to perceived usefulness, users' need becomes more highlighted. When the innovation does not meet the user's needs, it might be difficult to

maintain the same level of engagement throughout the lifetime of a field test. On the other hand, a participant who is voluntarily contributing in a field test, must be able to see the potential benefits of testing an innovation in his/her everyday life.

Perceived ease of use: Regarding the perceived ease of use, complexity of the innovation might negatively influence on participants' motivation. When the innovation is too complex to use or is not easy to understand, it would increase the possibility of participants' confusion and their discouragement. Moreover, when the innovation is not mature enough, it is difficult to keep the participants enthusiastically engaged in the field test.

Research-related drop-out

There were some identified categories which related to the research setting. The categories under this heading were associated with task design, interaction with the participants and timing of the field test.

Task design: The results showed that there are various factors related to the design of the field test. For instance, when the tasks during the field test were not fun to accomplish, participants tend to drop-out before completing the test. The interviewees also considered the items such as long gap between the field test's steps or a lengthy field test as influential factors that might be associated with the task design in the field test.

Interaction: Interaction and communication with the participants was considered as one of the most important groups of items that are influential on participant's decision to drop-out. Unclear guidelines on how to do the tasks, lack of an appropriate technical support and insufficient triggers to involve participants are some examples of the items in this group.

Timing: When it comes to timing, inappropriate timing of the field test (e.g., summer holiday) and too strict and inflexible deadline are the most influential factors on drop-out behavior. When the participants are not able to participate in field test at their own pace, they would prefer to not test the innovation any longer.

Participant-related drop-out

Some of the suggested categories were directly related to the individuals. The participants' attitude or personality, personal context and the participants' resource can be classified under the participant-related heading.

Participants' attitude: There are a number of items that can be subsumed under the category of participants' attitude or personality. For example, when the participants forget to participate, when the innovation does not meet their expectation, when they don't want to install something new on their device, when they don't like the concept or idea, and when they have concerns about their privacy or the security of their information.

Personal context: Since in a living lab approach, the users usually are engaged to test in their real-life setting, their personal life problems can negatively influence their motivation and in conclusion, they might drop-out of the field test.

Participants' resource: Limitation of participants' resource can also be another category of items that are influential on drop-out. They might either have not had enough time to be involved in the field test, or need to consume their own mobile battery or internet data quota.

The developed taxonomy based on the resulted headings and categories is shown in Figure 2. To see the items under each of the headings and subcategories see Appendix A.

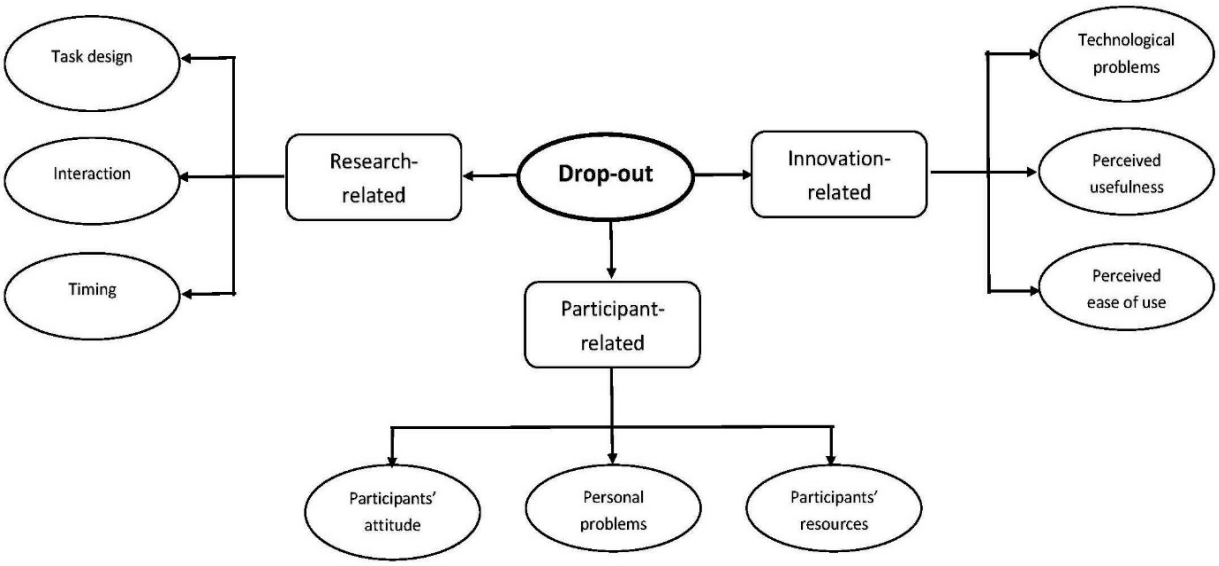

Figure 2. A taxonomy for drop-out in living lab field test

Discussion and conclusion

In this study, we developed an empirically derived, comprehensive taxonomy for the various influential factors on drop-out behavior in a living lab field test. To develop a theoretical discourse about drop-out in field tests, there is a need to define, categorize and organize possible influential factors on drop-out behavior. Accordingly, we first identified factors influencing drop-out in the field test by conducting a short literature review on the topic and then, interviewed 14 experts who are experienced in the area of field testing in a living lab setting.

According to the proposed taxonomy, the drop-out reasons were mainly related to the innovation, research setting and the participants themselves. Regarding the innovation-related items, technological problems, perceived ease of use and perceived usefulness were the main categories that mentioned by the interviewees. When it comes to research setting, task design, timing as well as interaction and communication with the participants were more highlighted in the results. Regarding the participant-related categories, their personality or attitude, participants' personal context and limitation of their resources were the main category of reasons for drop-out.

In this study, we also identified various types of drop-out in living lab field tests. The drop-out might be occurred in a field test when (a) the participants sign up for a test but they don't show up or don't start testing the innovation (participant drop-out); (b) the participants start using the innovation but due to a technological or motivational reason they don't complete the tasks related to the use of the innovation (innovation-related drop-out); and (c) the participants use the innovation but they don't give their feedback to the organizers (research-related drop-out). Combining these finding, we introduced our definition for drop-out in living lab field tests.

The presented taxonomy can be put to work in several ways. For instance, we believe that there is a need for practical guidelines that describe what the organizers of a living lab field test should do and how they should act in order to keep participants motivated and reduce the likelihood of drop-out throughout the innovation process. This taxonomy can be used as a framework to develop such practical guidelines for the field test organizers. As another example, this taxonomy might be used as the basis to develop a standard post-test survey to identify the reasons for drop-out in various field tests in different living labs.

Our study was not free from limitations. One limitation was that the drop-out reasons were extracted based on the field tests in two living labs (namely, Botnia and imec.livinglabs).

Therefore, we might not be aware and well-informed about the way that other living labs set-up, organize, manage and conduct their field tests and consequently, the drop-out reasons could be different in those field tests due to many reasons such as cultural factors. Furthermore, drop-out behavior might be associated with other influential factors such as degree of openness, number of participants, level of user engagement, motivation type, activity type and longevity of the field test. As an example, fixed and flexible deadlines to fulfill the assigned tasks might have resulted to different drop-out rate in a living lab field test (Habibipour et al., 2017).

This study also opens up several avenues for future research. As O'Brien and Toms (2008) have introduced re-engagement as one of the core concepts of their user engagement process model, an interesting topic for further research would be to clarify how and why user motivation for engaging and staying engaged in a living lab field test differ. Moreover, it is of importance to study how the organizers of a field test can re-motivate the dropped-out participants in order to re-engage them in that field test and what are the benefits of doing so. Our hope is that the presented definition and the taxonomy can be used as a starting point for a theoretical framework in the area of this study.

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Appendix A

Innovation-related			Research-related			Participant-related		
Technological problems	**Perceived usefulness**	**Perceived ease of use**	**Task design**	**Interaction**	**Timing**	**Participants' attitude**	**Personal context**	**Participants' resource**
I had trouble installing the innovation	There were no benefits for me in the innovation	The innovation was not user friendly	It was a lengthy project	There was no clear guideline on how to do the tasks	Timing of the project was inappropriate	There were no benefits for me in the field test	Personal context made me unable to keep on participating in the test	I had not enough time to be involved in this project
There were problems with compatibility of the infrastructure	The innovation did not meet my needs	The innovation was not mature	The tasks during the field test were not fun to accomplish	I was not satisfied with the technical support during my involvement period	I was not able to participate in this project at my own pace (e.g. strict deadlines, inflexible)	I forgot to test		I had to consume my own internet data quota
The innovation was technologically too complex	I have no faith in the future of this innovation (I wouldn't use it and don't think others would either)	The innovation was not easy to understand	The tasks were not easy to understand	It was unclear what was expected of me during the field test		I did not want to install something new on my device		I had to consume my own resources such as battery
The innovation was not stable	The innovation had too few functions	The innovation did not meet my expectations	I couldn't test where and when I wanted	I lost my involvement over time		The innovation was not reliable		I had to use my own device
	External context made me unable to keep on participating in the test (e.g. not enough content, not enough users)			There were not enough triggers to be involved in the field test		The novelty aspects of the innovation quickly disappeared		
				The field test organizers did not give me this feeling that my contribution is important		The innovation did not stimulate my curiosity		
				The guidelines and instructions were not easy to find or access		I had concerns about my privacy and the security of my information		
				I was not satisfied with the way(s) in which I received feedback from the project		I didn't like the concept/idea		
				There was no mutual trust with the organizers of the field test		There is no/too small incentive / prize to participate		
				I had not been informed about the project's details before the start of the field test		I was just interested in what the innovation would be like, but never had the intention to fully participate		

Track II

Living Labs versus other forms of collective and collaborative innovation

Track Chairs: Seppo Leminen and Artur Serra

An interdisciplinary community lab to facilitate citizen's participation and health: an exploratory study in developing lab tools for research, education and practice in nursing, social work and gerontology

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Abstract

We experimented with a so-called '*community lab*'. This community lab was initiated within a collaboration between our university of applied sciences, a municipality within a region in the Netherlands, and regional network partners in health, professional education, local authorities and businesses. This community lab aims to investigate how to support communities in initiating local community activities and developing community services and products in order to ensure health and quality of life of citizens. The purpose of this paper is to share our research work within this community lab regarding the following question: what are promoting and inhibiting factors and lab tools in the co-creation and research processes within a community lab?
Data are derived from two sources: the community lab (case study) and a mapping study. In researching the community lab, we followed principles of *Practice Development*. Data collection started in September 2015 and is ongoing. Data collection relating to the question how to support communities is performed mainly by undergraduate students of applied gerontology, nursing and social work. Data on community lab processes from research perspective is being collected by researchers. The mapping study was performed by one researcher and aims to gain insight in the various set ups of innovation-work-learning-communities in our university – faculty of health and social work. For this paper, all reports of students and researchers are analyzed in order to answer the research questions.
Organizing a community lab concept takes effort. The following factors affect the success of a community lab:

- ensuring a joint venture of practice, research and education by regular communication about and reflection on organizational structures, goals, roles and expectations
- paying attention to necessary competences for teachers as well as for students to participate in an innovation-work-learning-community

- being flexible in educational structures and comprehensible in research processes in order to efficiently collaborate with practice based partners

With these insights in the community lab's ingredients we currently develop a model and methods for innovative partnership in education, research and practice.

Keywords: community lab – innovation – practice development – health and social work – promoting and inhibiting factors – civil society

Introduction

How do we ensure our society's health and vitality, in a sustainable way? Many policy-makers and researchers try to find answers to this question. The continuous demographic and technological changes challenge our society's health and vitality.

In various western countries, these challenges have led to health care policy changes implying a decentralization of tasks and responsibilities towards local governments and individual citizens. These developments ask for different work processes and competences of health professionals as well as increasing collaboration between different health professionals (Vereniging Hogescholen, 2016; Van Vliet, Grotendorst & Roodbol, 2016). Professional's attitudes (should) change from '*illness and care*' towards '*health and behavior*', and professionals are stimulated to organize care at a community level, close to people's homes instead of in care facilities. On the other hand, an appeal is made to citizens' independence and empowerment in ensuring their personal health and well-being. That is, citizen's attitudes (should) change from '*using professional care*' towards '*organizing own health*' (RvZ, 2010; RvZ, 2013). Older adults and people with disabilities are stimulated to live independently as long as possible, with support of informal care networks. Preventive health perspectives should lead to resilient communities in which citizens form a civil society. This also requests new skills (21 century skills) and new professions (Van Vliet, Grotendorst & Roodbol, 2016)

All these developments ask for – innovative ways of – intensive partnership between citizens, clients, informal caregivers, volunteers, health professionals, companies, organizations, research, education and government. Society needs innovative partnerships in (1) organizing care, (2) education, (3) developing policies and in (4) developing new services and products. All in order to increase sustainable health, quality of life and resilience of our society (Peters, van Xanten & Scholten, 2017; Verdonschot, 2009).

One promising way in realizing this is working in Living Labs (Van Geenhuizen, 2015; Gasco, 2017), or, innovation-work-learning-communities. In such organizational structures, professional organizations and companies, education, research and citizens work together, learn together, generate new knowledge together and innovate in relation to complex issues in society. In such structures, there is great opportunity to experiment, work, learn and innovate simultaneously (Anonymous, 2017). In addition, researchers investigate the value and results of the innovations and processes: the quadriple helix (Cavallini, Soldi, Friedl & Volpe, 2016). However, there is not one recipe that makes a perfect Living Lab, or, innovation-work-learning-community (Cremers, 2016). Living Labs are only recently being subject of systematic research (Van Geenhuizen, 2016).

Since September 2015, we experiment with a so-called '*community lab*'. This community lab was initiated within a collaboration between our university of applied sciences, Meppel, a municipality within a region in the Netherlands, and regional network partners in health, education and businesses. The focus within this community lab was to investigate how to support communities in initiating local community activities and developing community services and products in order to ensure health and quality of life of citizens. This focus originates from the municipality of Meppel. In the past few years municipalities have become responsible for strengthening social cohesion in communities, optimizing living environments, increasing participation of (vulnerable) citizens, facilitate community initiatives and increase accessibility to public services. In order to be able to fulfill this task, local governments as well as health and social professionals need to know what citizens need and how they take care of themselves and other citizens within their community. Local policy-makers search for ways to facilitate citizens in optimizing a civil society, with an important initiating role for citizens and a supportive role for professionals such as

gerontologists, social workers and community nurses. A community lab can be a way to explore this as well as develop innovative practices at the same time.

Therefore, the goal of our community lab is to connect education, research and practice resulting in a powerful learning and working environment and sustainable practice innovations which meet the needs of citizens in the case of ensuring independence together. The following questions were formulated:

- what are **promoting** and **inhibiting factors** in the co-creation and **research** processes within a community lab?
- which factors influence whether **citizens** participate in a community lab and in (the development of) local community activities, services, products and support?
- what are the roles of the community health **professionals** in a community lab and in (the development of) local community activities, services, products and support?
- what are the roles of **policy-makers** in a community lab and in (the development and facilitation of) local community activities, services, products and support?
- what are the roles of **lecturers** and **students** in a community lab and in (the development of) local community activities, services, products and support?

The purpose of this paper is to share our research work within this community lab regarding the first question. The others give insight in our work within living labs.

Methods

Design

Data are derived from two sources: the community lab (case study) and a mapping study.

In developing the community lab, we followed principles of *Practice Development* (McCormack, Manley, Kitson, Titchen & Harvey, 1999; Munten, Legius, Niessen, Snoeren, Jukema & Harps-Timmerman, 2012). Practice Development is a systematic approach in innovation trajectories in communities, in which critically reflecting on the practices of different actors in a certain setting is a key element. Practice Development aims to develop an effective learning and working climate where specific groups play a central role; i.e. the citizens of a specific community/neighborhood in the case of this community lab. It is a continuous process in which changes and developments occur organically and are reflected in practice based data that are used to reflect on innovation progress (see data collection). That process leads to structural and sustainable improvements. Therefore, Practice Development fits researching a community lab.

Parallel, one researcher performed a mapping study in order to gain insight in the various set ups of innovation-work-learning-communities in which our university of applied science – faculty of health and social work – is involved, and the lessons we learned from theory and practice. The main focus of the mapping study was to investigate which factors contribute to innovation, generation of knowledge and competence development of students and health professionals.

Data collection

Data collection in the community lab started in September 2015 and is ongoing. Data collection consists of (street) interviews with citizens (>100), interviews with community professionals (11), desk research, visits to best-practices of citizen's initiatives (8) and (minutes of) regularly meetings (>30) with and between students and involved actors in the community lab (e.g. policy-maker of the municipality, researcher, local citizens(organizations) and community health professionals). Data collection is performed mainly by undergraduate students of applied gerontology, nursing and social work. Till May 2017, students performed their research in groups of 2-4 students per study semester (4

semesters in total). Students developed their own measurement instruments for the interviews and desk research. In addition, we used the Claims, Concerns and Issues (CCI) method in focus groups to reflect systematically on the working processes, progress and results within the community lab. The data were used to provide feedback to all involved stakeholders (e.g. students, lecturers, researchers, municipality policy workers, social workers, community nurses, local citizens committees, etc.) in order to ensure further development of and cooperation within the community lab.
The mapping study focused on research literature, regional communities and conference meetings and was conducted between February 2016 and February 2017. First, a literature search was performed in order to determine the factors that influence the success of innovation-work/learning-communities. Second, an inventory of existing innovation-work/learning-communities, in which the faculty of health and social work in our university of applied science participated, was made. Managers, professors, lecturers, and practice partners were interviewed, both in individual meetings (13) as well as in group meetings (6). Third, information was gathered from several regional network meetings (9) and national (2) and international (1) conferences.

Data analyses
Data collection resulted in a great number and variety of documents and raw data. Data analysis of the community lab is ongoing, and has thus far resulted in 6 reports and 2 progress reports. The mapping study has resulted in a framework which describes influencing factors in the success of innovating, learning and developing new knowledge. For this paper, all these reports are being analyzed within this newly developed framework using Framework analysis (Lacey & Luff, 2007)

(preliminary) Results
Students were researchers and facilitators of innovations in the community lab; they participated in community meetings, observed, interviewed many community stakeholders and suggested ideas for new practices. Students worked in interdisciplinary and multilevel groups, i.e. students from applied gerontology, nursing and social work, from higher vocational education and intermediate vocational education. A community platform, consisting of a group of community members (volunteers), was a key player in the community and community lab. The community platform advocates between community citizens and the municipality.

In general, students' input is highly valued by the community platform and the local government. Students have a critical view on processes and structures, personal contact with citizens, and provide community partners with energy to start new initiatives. An example is developing a social media campaign to increase knowledge about and awareness in citizens of the existence of a community platform. A community lab stimulates research close to citizens in real-life environments, on relevant social issues at a specific time in a specific area. This results in new or strengthened relationships and new information (for further research). However, starting a community takes much effort.

First, for a joint experiment, organizational structure, goals, roles, expectations, personal motives, values and beliefs of all participants should be very clear. From the start of the experiment, the organizational structure, goals, roles and expectations of the different actors in the community lab have been unclear. As a consequence, for the community platform, the experiment did not feel as a joint experiment. Therefore, clear and regular communication and periodical reflection with a range of stakeholders is essential in a community lab (e.g. students, lecturers, researchers, municipality policy makers, social workers, community nurses, citizens' representatives, etc.). Attention for development of a common language is important in this process because of the different functional

backgrounds. The more stakeholders involved, the more essential it is. E.g. if students from different educational levels and different educational organizations work together in one community lab, coordination in assignments, communication processes and learning support is needed to provide structure to the community lab.

In addition, for students working in a setting like a community lab is highly challenging. The community lab is a network organization rather than a physical workplace like a care facility. For this specific community lab, citizens were the main actors. Thus far, most students had been used to work for health and social professionals and organizations. Assignments were not formulated on forehand, but students had to formulated their own assignment based on citizens needs and priorities. Goals are characterized as directional instead of being formulated SMART from the beginning. It took weeks for students to understand what their role was in the experiment, and how to work on a concrete assignment in an abstract work setting. So, working on unstructured complex social issues requires competences, an open mind-set and guidance to make issues more structured and realistic to work on. Furthermore, although students had to collect their research question from the community in an organic way and in a multidisciplinary setting, assessment criteria from the university and schools remained strict. This caused tension between what was asked for in flexible community processes and in rigid university structures.

Third, educational processes need to be clearly organized. Students had regularly and close contacts with the community platform and the involvement of researchers and lecturers was at a distance. The members of the community platform were highly involved in the students' work and felt like teachers. Teachers and researchers at the university on the other hand felt like losing control in the learning process as research activities did not occur at one physical place and at a distance from the university. When a third group of students worked more independently and collected data also from other stakeholders, for the community platform it felt like losing control over what students were doing in the community. They felt responsible for what was happening in the community. Having students as researchers and facilitators of innovation in a community challenges the balance of independency versus guidance in learning and innovation processes.

Fourth, in current organizational and logistic structures it is a challenge to make sure that enough students work together in a community lab at the same time. In the experimental phase, we had 2-4 students working at a time. In order to make progress more rapidly and make results more visible, mass needs to be created.

The factors as described above arose from the mapping study as well as from the community lab research.

Conclusions

Organizing a community lab concept takes effort. The extent to which the following factors are being recognized influences the success of a community lab.

First, a clear structure in which citizens, community health professionals, education (students and teachers) and researchers all work together should be realized. This asks for clear and continuous communication about organizational structures, goals, roles and expectations and attention for personal motives, values and believes to participate in the community. It takes time – 2-5 years – to build up a community lab. Consequently, it comes with concerns in financial sustainability (Gascó, 2017).

For practice, a joint community lab is important for its success. To make it a joint venture, explicit attention needs to be paid to:

- knowing each other's individual motivations, values and believes
- developing a common language
- connecting individual's goals
- confidence in each other and in the concept

- a safe environment to enable constant reflection
- a 'we' feeling
- a communication structure that incorporates the development of a shared language and shared stories
- reflection on collaboration
- creativity and flexibility
- sharing successes

Relationship management is thus one important factor in facilitating co-creation in living labs. (May, Martinez, Jonas, Neely & Möslein, 2016; Van Geenhuizen, 2015) In addition, an open mind-set is important to be able to invest in a particular social issue parallel to existing organizations and structures, which research of Gascó (2017) supports: stimulating an open innovation perspective may be more important than obtaining specific innovation results.

For education, it is important to pay attention to what competences are needed for teachers as well as for students to participate in an innovation-work-learning-community, in order to fit the 'competences of the future' like innovation competences as well as motivation to learn. (Jukema, Harps-Timmerman, Stoopendaal & Smits, 2015; Smits, Harps-Timmerman, Jukema, Stoopendaal, Kamer, Strating & Bal, 2017; Veerman, Kingma, Van Alphen, Smits & Jukema, 2017) However, this asks for further research. Learning in such environment may not be suitable for every student due to its complexity, and supporting students in their learning process asks new teaching styles from teachers. In addition, working in multidisciplinary teams and in an organic environment asks for more flexible assessment criteria and dates. Predetermined learning activities and assessment dates hinder collaboration between students of different backgrounds and practice. And as Gascó (2017) found, we may need to consider a physical environment, a building, as a home base to make it more a concrete working space, more than an abstract concept.

For research, it is important to find ways to make processes less complex and abstract for students to understand. Coordination of the community lab was in our case in hands of the research department. It might be valuable to investigate other possibilities in coordination processes. Canzler et al. (2017) suggest 'socially skilled actors as border crossers'. In addition, in research projects explicit attention to expectation management, reflection and creative and flexible learning activities needs to be organized in order to facilitate the opportunity to discover innovative solutions to complex issues. As Gascó (2017) states, it should also be clear that living labs function as *innovation intermediaries*.
With this knowledge, we are currently developing a model and methods for innovative partnership in education, research and practice.

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City Logistics Living Labs – an ecosystem for efficient city logistics

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Abstract

The main objective of the city logistics living labs is to foster long-term co-operative relationships between local authorities, industry and academia to enable pro-active implementation of sustainable logistics measures along with monitoring and evaluation tools to enhance freight policy in urban areas. This contribution defines city logistics living labs as an ecosystem which is necessary for more efficient scaling up and uptake of innovations in urban freight. Within the project CITYLAB several cities are investigating how the living lab approach can be applied to city logistics.

Keywords: living labs, co-creation approach, city logistics, transport innovations

Summary

The main objective of the city logistics living labs is to foster long-term co-operative relationships between local authorities, industry and academia to enable pro-active implementation of sustainable logistics measures along with monitoring and evaluation tools to enhance freight policy in urban areas. This contribution defines city logistics living labs as an ecosystem which is necessary for more efficient scaling up and uptake of innovations in urban freight. In city logistics living labs the principles of the living labs approach, such as real-life setting, active user involvement, co-creation and iterative innovation processes are brought together on the macro level of the city, aiming to facilitate the uptake of logistics innovations in cities. Political and policy support for the urban freight, existence of the efficient stakeholder communication and cooperation platforms, monitoring and evaluation of the urban freight solutions and existence of the efficient knowledge transfer channels are defined as the key components of the city logistics living lab environment.

Within the European H2020 Civitas project CITYLAB (www.citylab-project.eu), several cities are investigating how the living lab approach can be applied to city logistics. The cities have different combinations of the elements of the city logistics living lab environments, facilitating the uptake of the logistics innovation at the local level.

Introduction

There is increasing interest in city logistics in the public domain due to the associated negative impacts on congestion, emissions, noise, and the use of space in dense urban areas. Many solutions are trialled to make urban logistics processes and transport more sustainable. However, a significant change towards more sustainable urban freight transport has not yet occurred:

- Many 'best practices' are very local and are often not transferred to other areas/regions;
- Even if proved to be successful, transport innovations have a difficulty in scaling up;
- Failed initiatives are usually not evaluated and not reported, thus limiting the knowledge and improvement possibilities;
- Many initiatives or demonstrations show that an intervention is technically possible, but implementation in real life city logistics operations on the longer term is often limited.

These issues are hard, and make it very difficult to make a real change in urban freight transport that lasts longer than testing or demonstrating the feasibility of a technical solution or soft measure. Causes of limited scaling up of innovations generally point towards a poor preparation of innovation deployment processes, due to limited stakeholder involvement, unclear business models or uncertainty in the environment (Quak et al, 2016). Urban freight transport innovations are often implemented within a context, where, for example:

- urban logistics is often not part of a long-term policy strategy and subject to change due to elections;

- data on urban freight transport is often either lacking or very scattered which makes acting on urban freight transport difficult;
- there is a high number of stakeholders involved in urban freight transport processes often with conflicting interests.

Research performed for the EU by Tomassini et al (2016) indicated that financial sustainability is the key factor that determines whether an urban mobility measure (performed under an EU-financed project) will be maintained over the lifetime of a project. Another key factor believed to influence sustainability performance in urban mobility is political commitment, including citizens' support. When the legal and political frameworks cooperate effectively to leverage a measure, positive results in the longer term may show up.

To really make a change and make a transition to a more sustainable and more efficient urban freight transport system, a new or another approach is necessary. The underlying assumption of this contribution is that by forming *city logistics living labs,* we can achieve more than by demonstrating a solution in urban freight. Applying the living lab principles of real-life setting, active user involvement, co-creation and iterative innovation processes to the logistics innovation processes on the city level contributes to the levels of innovation uptake. In concrete city logistics projects, we see that cooperation of the researchers, local authorities and industry partners is often highly beneficial, however, remains limited to that specific project / issue. The transition to a more sustainable urban logistics system requires a long term and continuous cooperation between industry, authorities, as well as research. City logistics living labs create an environment at the city level that enables this cooperation and facilitates a faster roll out of urban transport innovations.

This contribution is based on the research within the European H2020 Civitas project CITYLAB (www.citylab-project.eu). In CITYLAB seven cities London, Amsterdam, Rotterdam, Brussels, Southampton, Oslo, Rome and Paris) are exploring how city logistics would benefit from a living lab approach. The project focuses on four axes that call for improvement and intervention: highly fragmented last mile deliveries in city centres; inefficient deliveries to large freight attractors and public administrations; urban waste, return trips and recycling; logistics sprawl. Within these axes, CITYLAB supports seven implementations that are being tested, evaluated and rolled out. Each city has a different combination of the elements of the city logistics living lab environments, facilitating (or not) the uptake of the logistics innovation at the local level. Each city on the regular basis collects data on the progress of implementation, as well as on the living lab process it follows.

In this paper, through the examples of CITYLAB city logistics living labs we illustrate how the living lab approach is a suitable new way of working, facilitating the design, planning and uptake of urban logistics innovation and under which conditions. We first define how the living lab approach can be applied to city logistics, distinguishing implementation and city level. We then propose a definition of a city logistics living lab, highlighting how that is different from the traditional way of working in urban freight transport. Next, this paper focuses on the specific factors of the living lab environment which form the city logistics living labs. Differences in living lab environments are illustrated using the CITYLAB cities as examples. In the conclusion, we discuss the importance of the city logistics living labs as an environment facilitating the roll out of city logistics innovations.

City Logistics Living Labs

The concept of Living Labs owns its first insights in the potentials of information technology, when IT R&D was moved into in vivo settings—in other words, to 'wired' living settings such as in a building or part of a city—thereby enabling to monitor and respond to users' responses and interactions, with the ultimate aim to speed up development and deployment of innovations. In Europe, the concept of living labs was already recognized by the European Commission in 2006 as a key tool for open innovation. Since then, living labs have spread over Europe in various waves, first focusing on new ICT tools but later extending to other fields, such as sustainable energy, health care, and safety.

Leminen (2012) define living labs as "physical regions or virtual realities, or interaction spaces, in which stakeholders form public–private–people partnerships of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts". Hammer-Jakobsen and Bjerre (2011) see living labs as "collaborations between organizations with a shared interest in understanding people's unmet needs in the context of everyday life. They offer the possibility of gaining new insights into people's experiences and engaging in co-creation and co-production with end-users". Schuurman (2015) defines 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". Overall, various definitions of living labs commonly address the importance of the real-life environment, the involvement of multiple stakeholders, active end user involvement in design and operation process, co-design and co-creation processes and iterative knowledge and learning creation process.

However, in the living lab research grows the importance attributed to the context in which innovative solutions and whole specific living labs are set up. Coorevitsand Jakobs (2017) are saying that often the context of the living labs is not sufficiently taken into consideration but it proves to be an important factor influencing the development of the innovation process. This is also supported by Trousse and Verilahc (2016), saying that while living labs differ initially "because of the active participation of users early on in the innovation process and experimentation in realistic conditions, it also puts the emphasis on creating an innovation ecosystem based on a public-private-people partnership in the case of social projects and on developing intermediation processes to reconcile the conflicting interests of all those involved". They are arguing that "the concept of the ecosystem is central here, since creating a real momentum for dialogue between stakeholders in the form of collaborative processes, combining professional knowledge, activism and practical knowledge to encourage the emergence of both technological and social innovation is at the heart of the process". Thus, in this contribution we are inspired by the definition of the living labs given by ENoLL referring to living labs as to "user-centred, open innovation ecosystems based on a systematic user co- creation approach integrating research and innovation processes in real life communities and settings".

The achievements of the living lab movement go beyond fostering the development of demos, pilots, experiments and test beds: it changes the emphasis from the solution as an isolated object to the process of integration with its environment. It allows the creation of experimentation environments that are sufficiently connected with real world stakeholders and their business models, to allow near-simultaneous development and deployment. Interestingly, the Living Lab concept has not been used explicitly yet for city logistics,

despite the characteristics of urban freight systems being well suited by the living lab approach (Nesterova and Quak, 2016).

As defined previously, the living labs encompass a set of distinguishing characteristics: real life setting, multi-stakeholder engagement, co-creation, active end user involvement and iterative learning experience. Applying these principles is possible on the level of the individual companies addressing logistics innovations (e.g. P&G Supply Network Innovation Center). In this case, co-creation with frequent integration of the user feedback in the design and implementation of the solution, as well as possibility of the continuous improvement/adjustment of the solution during the design process are distinguishing features.

City logistics living labs are applying identified principles on the level of the whole municipality, addressing urban logistics innovations in the overall city context. In this case, city logistics living lab creates favourable conditions at the city level for the scaling up and uptake of logistics innovations. In city logistics, a living lab becomes a "test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different backgrounds and interests work together towards a common goal, as part of medium to long-term study" (Lucassen , 2014). In practical terms, it is a working partnership where local government along with industry, retail, commerce, services and academic partners collaboratively develop new approaches and policies to promote sustainable logistics. As issues arise, changes in policy occur and new concepts emerge, the parties involved in the logistics living lab can easily alter their focus and address and evaluate new ideas.

Set-up of a city logistics living lab has to fulfil three important conditions (Quak, 2016):

- Inclusiveness: connection of all relevant stakeholders and business models within a city, with a joint recognition of a problem and solution spaces.
- Anticipatory capability: means to (collectively) make predictions of the effects, based on simulations, gaming or more simplified means of analysis.
- Responsiveness: measuring of impacts and agreements to respond to this with the aim to ultimately deploy a solution.

The city logistics living lab provides a trusted environment where the individual parties can expose and discuss their problems with an urban freight transport community; identify potential solutions and understand how they have been applied elsewhere; work together with city authorities, industry partners and research partners to test the feasibility of such solutions; implement and trial live projects; evaluate projects medium to long-term through the collection of data between the partners.

Elements of the city logistics living labs

A city logistics living lab creates a context for the efficient implementation of urban freight transport innovations and comprises the following elements:

- Policy and political framework to work on the urban freight in the city;
- Established regular cooperation and communication mechanisms/platforms between the main stakeholders involved in urban freight innovations;
- Continuous monitoring and analysis of data on urban freight, that facilitate the decision-making process;

- Iterative learning process and consistent knowledge transfer.

Concrete logistics innovations/implementations are placed at the heart of the city logistics living lab supporting environment. It provides the researchers, local authorities and industry partners with an opportunity to work together at a more general urban freight level. A city logistics living lab facilitates that implementation builds upon the learnings from the previous trials. Supported by the current policy and mobilizing the strong cooperation between local authorities, industrial and research partners it has increased chances for the wider uptake and roll out.

Political and policy framework for the urban freight transport development

Political commitment to the importance of urban freight transport and its framing in concrete policy plans/measures are important factors for the stability of the city logistics living labs. Targeted urban freight transport policies create a framework for the local development of urban freight transport and establishes priorities where the efforts can be concentrated. Sustainable urban logistics plans (as one of the forms of the urban freight planning) support "local public decision-makers and stakeholders in "governing" city logistics measures and enhancing freight distribution processes towards economic, social environmental sustainability and efficiency" (IEE, ENCLOSE project).

As mentioned by Wefering (2014) "planning has become an increasingly complex task, and planners (as well as policy makers) are faced with many, often contradictory demands: maintaining a high quality of life while also creating an attractive environment for businesses; restricting traffic in sensitive areas while not curbing the necessary movement of goods and people; ensuring mobility for all while being confronted with financial constraints. In addition, there are wider issues to be addressed, with regards to public health, climate change, oil dependency, noise and air pollution, etc." An integrative approach to urban freight, looking both into cross-sectoral cooperation, as well as integration of multiple urban freight transport stakeholders is necessary in order to assure the continuation of the urban freight transport measures. This approach can be reflected within sustainable urban mobility or logistics plans which are currently being supported by the EU, but also can be a part of the regular urban freight transport plan, like in a case of Brussels or Paris (CITYLAB living lab cities). City logistics living labs provide a set up for the practical implementations of the cooperation approach to city logistics laid out in SUMPs (sustainable urban mobility plans), SULPs (sustainable urban logistics plans), and other urban freight transport plans.
In Brussels (CITYLAB example), urban freight is specifically addressed in the Strategic Plan for Goods Traffic (2013), which identifies priority axes and specific measures for urban freight to address until 2020. This plan builds upon several principles similar to the city logistics living lab principles:

- A collaborative approach for the improvement of urban distribution in Brussels-Capital region. As stated in the plan, the Brussels-Capital region "has defined an action plan that defines perspectives for all in an intense spirit of collaboration and determination to find win-win solutions". The common effort on the level of all 19 communes is encouraged, as well as overall collaboration of all the actors in the city logistics supply chains.
- Use the outcomes of a mobility thinktank and encourage research and innovation to adapt new urban distribution concepts to the Brussels context. Acting as a catalyst for innovation, this Think Tank will improve the information of the various players of goods traffic while allowing the development of innovative concepts. It aims to

make regional collaboration easier between public and private players and triggers changes in attitudes vis-à-vis goods traffic.

- In the plan only a limited number of actions are identified for each strategic axis, as focus is put on the continuous improvement process. The idea behind is that the action plan has to be updated every two years to broach the hugely volatile market of urban deliveries, with a possibility to add new actions or modify their scope.

In Paris (CITYLAB example), the Paris Charter for Sustainable Urban Logistics, since 2013, brings together more than 80 organisations, institutions and associations in urban freight transport, committed to progress in the field of urban logistics. This document represents the urban freight transport action plan for the city of Paris. It includes a clear ambition and scope and it identifies 16 projects presenting concrete initiatives for the logistics sector within a five-year duration (2013-2017), with some strategies aiming at a longer term (2020 – 2030).

Stakeholder cooperation

The higher the involvement of the stakeholders/users in the different stages of the Living Lab, the higher the expected benefits might be for both policy makers and businesses: higher acceptance of the proposed solution/technology, faster time to market, likelihood of higher adoption rate (Innovation Alcotra, 2011). Applied to the city logistics living lab, in practice, this means that on the city level it is necessary to have an established regular cooperation and communication mechanisms/platforms between the main stakeholders involved in urban freight innovations. These communication platforms should include at least local authorities, research institutes and industry.

"Bringing public and private sector decision-makers together in freight partnerships is an important step in building trust and enhancing the uptake of urban freight initiatives. Next, including researchers in these partnerships might not necessarily result in better interaction or understanding between actors, but it might help in finding common solutions or objectify effects of actions, which are required to improve the system" (Quak, 2016). City logistics living labs are an action driven freight partnership, where authorities, industry and research collaboratively work on the improvement of urban freight, fostering innovation deployment and improving communication and cooperation between different stakeholders of the urban freight transport system.

Dealing with involvement of external parties (stakeholders, users, customers) in a Living Lab is a continuous process. Experience from the existing urban Living Labs like Paris and London (CITYLAB living lab cities) show that there are several forms of stakeholder consultation (e.g. London freight quality partnership, London Freight forum, Paris freight charter, etc.). In Paris, in the wake of the Paris Charter for Sustainable Urban Logistics the freight forum was created, which is now providing the main platform of cooperation in urban freight transport. In this framework today, various representative organisations (shippers, carriers, 3PLs, store-owners, etc.) regularly get together in several implementation working groups to work with the various departments of the Paris municipality.

There is a lot of interaction between different groups of urban freight transport stakeholders in London which are formalized within the following frameworks:

- Central London Freight Quality Partnership (CLFQP) is a public/private partnership between the freight industry, local government, local businesses, the local

community, environmental groups and others with an interest in freight. CLFQP is set up to develop a common understanding of, and to encourage innovative solutions for, freight transport and servicing activity in central London.

- Transport for London (TfL) co-ordinates the London Freight Forum, which brings together 160 logistics providers. It was set up to coordinate planning and preparations for the London 2012 Olympic and Paralympic Games and continued as a result of its perceived success. The forum consists of operators, businesses, trade associations, regulators and highway authorities, and provides the focus for ongoing engagement.

Continuous monitoring and analysis of data on urban freight

One of the biggest current challenges in urban freight is the absence of proper knowledge on what is really going on within different city logistics segments. There is very limited and fragmented information available on what, how and by which means goods are transported within a city. At the same time, finding answers to these questions on a city level is crucial, if we want to take cost and time efficient decisions on what, how and when to influence in a sector. Getting relevant data on urban freight is not an easy task. Some of the multiple reasons are: predominance of small companies in a landscape of multiple city distribution actors; no interests or unwillingness of operators to provide the data; privacy issues, etc. There are also no yet best practices for data collection on urban freight, so from the start one is faced with a variety of questions: how to collect, what type of indicators, with which frequency, how long. And, once data collection has started a new question arises - what can we do with it?

City logistics living labs provide another approach to data collection and analysis, attributing a lot of attention to the importance of data collection and monitoring and considering continuous monitoring of a city environment as a key to the successful functioning of the system. Living labs are looking into how to combine traditional transport modelling approaches to urban freight transport data with more proactive data collection approach based on real-time data and predictive analysis. In Rotterdam, there are several ways to improve the existing data, that is mainly on traffic and not on city logistics. An innovative city dashboard, co-developed by TNO and Rotterdam, provides real time information on the traffic and air quality, based on combining enriching several (open) data sources. The next step is to see if and how it is possible to get better information on city logistics. Currently, data mainly shows large trucks, vans and cars, but logistics routes, load factors and motives are not clear. To better steer or manage urban freight transport, knowing the rationale behind the logistics is crucial. In several ways, new data is collected; 1) vehicle fleet scans provided information on the economics sector trucks and vans are operating in, 2) examining how existing cameras can be used for data in monitoring (now, these cameras are used for enforcement reasons) and finally 3) examine how logistics data from companies can be used; i.e. some companies shared their data (including trips, stops, etc.) from their vehicles with the city. The experiments showed that it was possible, but connecting many vehicles (with different transport management systems) is currently still too expensive.

Iterative learning process and consistent knowledge transfer

City logistics living labs are a working partnership where local government along with industry, retail, commerce, services and academic partners collaboratively develop new approaches and policies to promote sustainable logistics. Bridging experiences and

feedback from different stakeholders and knowledge from implemented projects/measures/solutions, existence of efficient knowledge transfer channels is an important requirement of a living lab environment. City logistics living labs with their iterative learning process are bringing added value to all the stakeholders of the urban freight transport system.

For industry partners, being part of the city living lab environment and taking an active role in the stakeholder cooperation process is beneficial in several ways. Enhanced stakeholder cooperation processes facilitate communication between different stakeholders and understanding of the market by individual players. They provide a platform for communication and knowledge exchange, but also a platform to influence to a certain extent the decision-making process. Very importantly, it aims to align the ambitions and goals of individual players in the most productive way, in order to achieve common and individual market-players ambitions. At the same time, it is necessary to keep in mind that stakeholder cooperation is usually a "give and take" process, where investment of time, financial resources or data can also be expected from the business partners.

For the city authorities, having a living lab approach to the city logistics provides new opportunities to enable a bottom-up policy coherence to be reached, including the needs and aspirations of local and regional stakeholders, as well as industrial parties. Urban freight stakeholder communication platforms support urban freight policies and help to gain a common perspective. City Logistics living labs contribute, among other things: the mixing of different competencies in order to stimulate knowledge sharing and to increase understanding of the involved stakeholder's/user's vision; the identification of the changes in key stakeholder ambitions or goals at the early stages; the identification of the risk of non-compliance from some organisations and the uptake of mitigating actions when possible. From this set up the city obtains: support for their planning; a better understanding of the real challenges facing the industry; evaluation of the effectiveness of their policy measures. Both, city and industrial partners can benefit from the added value brought by the research partners in the living lab process. This goes broader than innovative ideas brought by research, but also includes a neutral opinion on the relevance, efficiency and sustainability of the trialled solution and evaluation of the feasibility of the measure or solution. A research partner is also very well positioned to be a neutral coordinator of the city logistics living, having the ability to:

- Convene and host meetings between the partners
- Provide background literature and examples of solutions and best practice
- Undertake scoping and feasibility studies for the industry partners for minimal cost as part of managed student projects
- Act as secure data manager on behalf of the partners, undertaking analysis and providing longer term evaluation of any implemented measures.

In Southampton, the logistics Living Lab involves the city council, Meachers Global Logistics who operate the Southampton Sustainable Distribution Centre (SSDC), Southampton General Hospital and the two Universities. All the parties originally came together through a Memorandum of Understanding designed to promote best practice in sustainable logistics and to reduce their respective transport footprints, with the University of Southampton acting as the neutral co-ordinator of activities.

The city council has an urgent need to reduce CO_2 emissions as Southampton is one of several UK cities where pollution levels have failed EU emissions targets. The University of

Southampton as the trusted third party was able to co-ordinate discussions between the partners and undertake feasibility studies on their behalf \. The university identified personal deliveries to students living in halls of residence as an increasing issue. The volumes of packages being ordered were leading to increased workload on staff. Through dialogue between the living lab partners, the concept of consolidating halls post via the SSDC was conceived. The University undertook a survey of 400 students' retail habits whilst liaising with the halls managers to conduct an audit of packages received during the week immediately following the busy Black Friday (25 November 2016) sales event.

Working with Meachers Global Logistics, a consolidation scheme for halls post was designed and costed, suggesting that the current 13,000 annual courier visits to just under 9000 students in halls could be reduced to around 300 for an annual service cost of approximately £18 per student. After further dialogue between the partners in the LL, it was decided not to go ahead with a physical trial due to the uncertainty regarding 'same-day' delivery take-up by students going forward and how such services could be catered for. The whole activity has led to further ideas exchange and the two universities investigating the use of automated postal receipt systems and the use of locker banks in halls and other communal spaces to reduce vehicle impacts. This highlights how the collaborative approach with the logistics living lab can develop and transform ideas over time.

In an attempt to make cost savings but to also reduce their CO_2 footprint, Southampton City Council have been investigating the scope for switching elements of their 700 strong vehicle fleet to electric operation. This dialogue came about through the experiences of the living lab partners where the University of Southampton already operates electric service vehicles and through two student projects was able to evaluate the scope for such a switchover. Through interviews with fleet managers, tracking trials of vehicles and using historic round data, the council were able to understand which specific fleet operations would be most suitable for electric conversion and what the implications for infrastructure provision would be.

The existing business and personal relationships between the parties, emanating from the original memorandum of understanding have been key to enabling dialogue to continue and new ideas to be developed and explored as needs have changed.

City logistics living labs as enablers for the urban logistics innovations

Changing paradigms is not an easy task. The idea behind the city logistics living labs is that successful up-scaling of urban freight transport innovations requires a supporting environment on the city or neighbourhood level. In the field of city logistics many small-scale innovations and tests have taken place, but often large-scale deployment has not occurred. The living lab approach aims to contribute to innovation deployment in the city logistics, not necessarily by testing solutions never tested before, but in establishing the new ways of working that lead towards permanent and long-term change. By forming city logistics living labs, ambition is to establish a process in which implementations are tried out, supported by dynamic prediction and evaluation tools, where the direct environment is adapted to make it work, and where barriers are directly dealt with to have a maximum impact. In this article, we have presented examples of different elements of the city logistics living labs within CITYLAB cities. As the next step, the CITYLAB project will establish a link between the elements of the city logistics living lab environment and implementation results within each of the project cities.

A living lab differs from conventional demonstrations in that it creates an experimentation environment in which stakeholders together aim at achieving a long-term goal. How to get there is not yet defined exactly, but the goal is shared among all stakeholders, including the citizen, government, industry and research. Especially the city logistics environment, with its many stakeholders, often conflicting stakes and all kinds of different backgrounds, would benefit from such an approach. Living labs can be used by stakeholders for co-designing, co-exploring, co-experiencing and co-refining new policies, regulations and logistics actions in real-life situations. This implies a process in which solutions and actions are tried out, supported by dynamic prediction and evaluation tools, where the environment is adapted to make it work at the same time, and where barriers are dealt with directly to have a maximum impact. It is a major leap forward from the traditional city logistics initiatives, in which demonstrations run with the aim to "prove" that the developed solution functions within a limited and temporary organizational setting. The majority of these have involvement of a limited number of stakeholders, mainly from the same group. The road towards the goal is described in detailed demonstration plans without involvement of other stakeholders, so the goal is not commonly shared. When the demonstration proves that the solution has effect or when the demonstration's time is over, the demonstration is terminated and the situation goes back to where it was before. Because Living Lab approaches focus more on the environment, the ultimate goal is not only to prove that something works, but in addition, to allow absorption by the city, when it does.

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A Brief History of Living Labs: From Scattered Initiatives to Global Movement

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Abstract

This paper analyses the emergence of living labs based on a literature review and interviews with early living labs experts. Our study makes a contribution to the growing literature of living labs by analysing the emergence of living labs from the perspectives of (i) early living lab pioneers, (ii) early living lab activities in Europe and especially Nokia Corporation, (iii) framework programs of the European Union supporting the development of living labs, (iv) emergence of national living lab networks, and (v) emergence of the European Network of Living Labs (ENoLL). Moreover, the paper highlights major events in the emergence of living lab movement and labels three consecutive phases of the global living lab movement as (i) toward a new paradigm, (ii) practical experiences, and (iii) professional living labs.

Keywords: Living labs, Living laboratory, Open innovation, Emergence, Living lab movement, ENoLL

1. Introduction

Living labs are a prominent and novel form of open innovation suggesting numerous benefits for multiple stakeholders (Almirall & Wareham, 2011; Schuurman et al., 2011; Leminen, 2015a). They are "*physical regions or virtual realities where stakeholders form public-private-people partnerships (4Ps) of firms, public agencies, universities, institutes, and users all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts*" (Westerlund & Leminen, 2011). Prior research has differentiated living labs from other forms of innovation (Bergvall-Kåreholm et al., 2009; Almirall et al., 2012; Edvardsson et al., 2012). Today's living labs are complex innovation and experimentation environments. Studies frequently attempt to differentiate living labs from seemingly similar innovation activities and methodologies in different test and experimentation platforms (Eriksson et al., 2005; Ballon et al., 2005; Mulder & Stappers, 2009; Pallot et al., 2010).

Living labs have been documented to integrate a wide range of expertise (Abowd et al., 2000) and have been proposed to cross many disciplines and concepts such as innovation management, user-centered design, entrepreneurship, cognitive science, organization theory, management models, context awareness, human computer interaction, information science and social computing, among many others (Kviselius et al., 2009). Thus, living labs make a growing area of research crossing across multiple disciplines and being applied in many environments including buildings, cities, urban areas and rural areas (Intille et al., 2002; Schaffers et al., 2007; Leminen & Westerlund, 2012, 2015; Mulder, 2012; Sauer, 2012; Juujärvi & Pesso, 2013; Nyström et al., 2014; Tukiainen et al., 2015; Leminen et al., 2016).

Acknowledging diversity of covered topics and approaches in living labs, living labs offer ample research opportunities for researchers and scholars (Bergvall-Kåreborn et al., 2015; Brankaert & den Ouden, 2016; Dell'Era & Landoni, 2014; Femeniás & Hagbert, 2013; Guimont & Lapointe, 2016; Hakkarainen & Hyysalo, 2013, 2016; Leminen, 2013, 2015b; Leminen et al., 2012, 2015a,b,c,d; Leminen & Westerlund, 2009, 2014, 2017; Rits et al., 2015; Schuurman et al., 2016; Ståhlbröst & Lassinantti, 2015; Veeckman et al., 2013). Previous literature on living labs documents multiple meanings and interpretations (Leminen, 2015a), and attempts to review living lab concepts (Følstad, 2008; Dutilleul et al., 2010; Schuurman et al., 2012), methodologies (Fulgencio et al., 2012), research avenues (Leminen & Westerlund, 2016), and versatile definitions (Leminen, 2015a). Despite the attempts, scholars have called for further understanding of living labs, their characteristics and conceptualisations. In particular, previous research lacks the perspective of emergence of living labs (Leminen & Westerlund, 2016).

This study investigates the emergence of living lab activities. In particular, it addresses various intertwining perspectives in the emergence of living labs, and focuses on some of the main episodes and events as crucial elements in the emergence. The objective is to analyse the emergence of the increasingly global living lab movement. Our research questions are:

(i) What are the key perspectives to the emergence of living labs?
(ii) How are living labs emerging?

The paper is organized as follows. After this brief introduction, the paper reviews early theoretical papers of living labs to address the theoretical foundations of living labs. Then, it describes the research methodology. Thereafter, it describes the key perspectives to

understand the emergence of living labs, and creates an illustrative canvas to position the perspectives on a time span. Finally, the paper concludes by summarizing the results and proposing future research avenues.

2. Emergence of living labs and living laboratories

Current understanding of history or evolution of living labs is scant despite of the growing interest by practitioners and academics (Niitamo & Leminen, 2011; Schuurman et al., 2011; Ballon & Schuurman, 2015; Schuurman, 2015). Fulgencio et al. (2012) argue that the term "living laboratory" was probably used first time by Knight (1749) in reference to "the elements and conditions of a body and an environment of an experiment. Fulgencio et al. (2012) found another early usage of living labs in the Billboard weekly magazine (1956). The magazine explained a living laboratory as a way to study users' responses to TV commercials in their living rooms by making phone calls to the users. Later roots of living labs can be traced back to early 1990s in the United States. Such studies use living labs and living laboratories more or less as synonyms. Tarricone (1990) introduced a living lab as a concept house for materials and construction by researchers. Moffat (1990) views a living lab as a single country, which monitors its citizens to test connections between diet, lifestyle factors and disease. Bajgier et al. (1991) propose a living laboratory as a restricted city, where students learn real-life problems with other stakeholders. Lasher et al. (1991) define living labs as a development project in a vendor-customer relationship, where own employees provide information and test prototypes. Bengtson (1994) views it as mechanism of public involvement for developing and implementing nuclear safety.

Abowd (1999) describes living laboratory as restricted place, a class room that captures teaching and learning experiences by ubiquitous computing. Benne and Fisk (2000) propose that a living laboratory explains the approach in a zoo, where students analyse complex problems and practice their skills. Kidd et al. (1999) and Intille (2002) establish their living laboratories including embedded technology for understanding human behaviour in a real-life environment. Appendix 1 illustrates some earlier works and definitions of living labs from 1749 to 2003. Such studies are dominated by American scholars with few exceptions, namely Knight (1749) Markopoulos and Rauterberg (2000), and Hoving (2003).

3. Research design

This study is based on an *extensive literature review on living labs* from general management and innovation management perspectives. Further, we utilize a *qualitative research approach* to understand the emergence of the living lab movement in Europe.

3.1 Extensive literature review on living labs

This study conducted a bibliographic search from the following databases; (1) Association for Computing Machinery (ACM), (2) EBSCO Business Source Complete, (3) EBSCO Business Source Elite, (4) Directory Open Access Journals (DOAJ), (5) Emerald, Inderscience, (6) IEEE Xplore, (7) ProQuest ABI Inform, (8) Sage Premier, (9) Science Direct, (10) Springer Link, (11) Taylor & Francis, and (12) Wiley Online Library. The preliminary dataset encompassed the selected terms "living lab", "living labbing", and "living laboratory" covering title, abstract, and keyword list. The literature search resulted in number of publications on the subject of living labs publications, as shown in Appendix 1. The review included publications on living labs until 15th March 2015. The search included words "living lab", "living labbing", and "living laboratory" in the title, abstract, and keyword list of

articles both in a single and plural form. Only publications written in English language were selected for the analysis. Scientific and practitioner publications in journals, conferences, workshops, working papers and 'white papers' were evaluated as the part of the systematic literature review. In all, 15 publications on the topic of living labs until 2003 were consulted in this study (Table 1).

Table 1. Results on conducted literature review

Database	**# of publications**
Association for Computing Machinery (ACM)	65
EBSCO Business Source Complete	133
EBSCO Business Source Elite	190
Directory Open Access Journals (DOAJ)	38
Emerald	12
Inderscience	21
IEEE Xplore	140
ProQuest ABI Inform	2735
Sage Premier	12
Science Direct	67
Springer Link	1323
Taylor & Francis	26
Wiley Online Library	14
Total	4776
Analysed living lab publications in this study (total)	15

3.2 Qualitative research approach

Data collection

The data was collected between 2012 and 2015. We focused on understanding the emergence of living labs. We conducted 11 semi-structured interviews in six private and public organizations to reconstruct the emergence of living labs in Europe. The interviewees represented organisations performing diverse tasks and levels of living labs of living labs in Belgium, Finland, UK, and the US. Interviewees included directors, key account managers, EU officials, professors, and experts. All interviews were carried out via face-to-face meetings, and were audio-recorded for transcription and analysis. Some issues that emerged from the interviews were detailed over phone afterwards. The identities of the informants are withheld.

Data analysis

The main unit of analysis was an actor's role. Each interviewee described their organizational and/or own individual roles and those of the others in the living lab. Besides field observation notes, our research material comprised secondary data including content from web sites, bulletins, magazines, and case reports. The empirical data were organized according to the date of interview, and the interviewee. The empirical data were organized based on the time span, i.e. we analysed the roles of the informant and critical events and activities. The researchers coded the original, word-by-word transcribed data to identify and analyse the roles of the informants and critical events to capture and analyse data on other factors that allow for the analysis of link activities and their perspectives. Such data included, e.g., critical events and episodes, including activities, and how different

stakeholders where involved in such perspectives. Table 2 synthesizes the data analysis process and its phases.

The first round of coding focused on organizing living lab interviews and identifying relevant actors on that time span. The second round of coding focused on capturing data on events associated with each living lab interviews. The third phase focused on analysing the main events and their relations to each other. Our illustrative canvas on emergence of living labs framework classifies main events on different perspectives (Figure 1). However, we do not aim to confirm causality or correlation, but bring forth tendencies and aim at understanding the emergency of living labs.

Data analysis phase	Task	Outcome
1. Open coding	• Organize living lab interviews • Identify actors in each case	Overview of interviews
2. Focused coding round 1	• Identify events associated with each living lab interviews • Describe briefly events and its time point discussed in each interview	Classifying events on different levels of living labs
3. Focused coding round 2	• Identify and analyse main events and their relations to each other • Compare data to theory	Mapping of identified events in existing studies of living labs research
4. Theorizing the codes	• Synthesize phases #1-3	Findings on emergency of living labs

Table 2. Data analysis process

4. Cases of the emergence of living labs

This section reveals the emergence of living labs from different perspectives.

4.1 Research of every-day life behavior in home-like environment in MIT

Professor William Mitchell from the Massachusetts Institute of Technology (MIT) has been considered as a pioneer of living labs. He studied people's every-day life behaviour in home-like environments such as PlaceLab in 1999-2009. Soon the MIT pioneers realized that although such studies are time consuming, their results are promising. Professor Jarmo Suominen moved from Future Home Institute2 to MIT in 2000 to become a research scholar focusing on the challenges of mass customization as a part of William Mitchell's research team. Soon thereafter the group's research activities expanded to cover cities and people living there, and particularly their needs and challenges in regard to technology such as electrical vehicles3. Professor Kent Larsson and technologist, senior research scientist Walder Bender are remarkable representatives of research in every-day life behaviour at

[2] Accessed March 24th, 2015 Retrieved from [http://designresearch.aalto.fi/groups/livingplaces/]

[3] Accessed March 24th, 2015 Retrieved from [http://web.mit.edu/evt/]

MIT. The evolution of MIT's research tradition can be capsulized as moving from closed home-like settings to understanding citizens' behaviour and solving their challenges and needs in urban environments4.

4.2 Emergence of living labs activities in Nokia Corporation and Europe

Until early 2000 the development of living labs took mainly place in the US. Mitchell and his research team had a very influential role to interfere living lab activities in Europe. Professor Jarmo Suominen, Director Veli-Pekka Niitamo, and Antti Korhonen, Program Manager of Mobile Work Program transferred living labs ideas from US to Nokia Corporation in Finland and Europe. This lead to the establishment of one of the earliest living labs in 2001 in Europe. The living lab located in Nokia premises in Espoo Karaportti in Finland. Driven by Nokia, it was labelled NokiaSpacelab real-life research environment. Mitchell and his research team later had research on living lab activities in the established Nokialab research environment between 2003 and 2005. Professor Suominen developed the Massbe research program, which aimed to improve work efficiency with mobile devices and particularly in mobile environments in Karaportti. As a part of Nokia's Karaportti living lab activities, it was identified a need to understand and outline creative knowledge workers' real-life environment; Suurpelto in Espoo was planned to serve as the pilot.

Nokia piloted several research projects for understanding everyday life after the Massbe – project. Such initiatives targeted to understand creative knowledge work and make such work more efficient by different technologies used in different real-life settings. The results emphasized the importance of real-life contexts, and the demand for utilizing both open innovation and user centricity in real-life environments. Both pressure and benefits of opening the company's closed living lab research environment become obvious, and later lead to the establishment of Nokia Alfa and Nokia Beta laboratories5. The evolution process of "semi-closed" Karaportti laboratory toward open innovation supported sourcing a broader creative potential from crowds. Such broader creative business potential became new competitive resource between global ICT companies. In 2004, Nokia transferred Mr. Niitamo's Living Lab Research Portfolio to CKIR at Helsinki School of Economics. It was seen that the LivingLabs Portfolio Leadership Group tackled many aspects which were unmanageable by the corporation or were beyond its primary focus. Niitamo's role expanded to a temporary Research Director at CKIR while keeping in his Director position in Nokia Corporation at the same time.

4.4 EU- framework programs support development of living labs

DG (Directorate General) IST (Information Society Technologies) areas have had long traditions to study and support not only studies on collaborative and virtual work but also technologies associated such topics. Nokia introduced a living lab approach to Peter Johnston, Head of Unit in 2003. He encouraged to formulate the idea to a formal application with research partner in urban research. The first pilot included researchers on e-work in Tampere University Further Education research team, which developed new e-services for citizens as a part of e-Tampere program. Another pilot included the urban development

[4]Accessed March 24th, 2015 Retrieved from [http://www.media.mit.edu/]

[5] Accessed March 24th, 2015 Retrieved from [http://www.arengufond.ee/upload/Editor/events/Kohvihommik/Niitamo-091218-Arengufond-Living-Labs.pdf]

project the between Copenhagen and the airport. Suurpelto area in the Helsinki Metropolitan area would have been ideal place for further understanding of knowledge workers; thus, Nokia had plans for its further premises there, and it was planned to serve pilot needs. However, Suurpelto's the next component master plan was only in the planning stage, and it ended up in Arabianranta, and Virtual Village, where professor Suominen´s Future home institute is located. Later Nokia withdraw from its Suurpelto plans.

Suominen and Niitamo suggested to a Commissioner for Information Society, Liikanen an idea for studying new digital services for citizens in a real urban city environment on 2004. Liikanen encouraged to merge the plans on Helsinki, Copenhagen, and Tampere as a part of broader integrated project in terms of time and budget. Typically, integrated projects last 2-3 years and include 10-20M euros. Head of CWE (Collaborative Working Environment (CWE) Mr. Bror Salmelin and EU official, Olavi Luotonen realized its broader impact for developing new digital services for citizens. Simultaneously, Mr. Luotonen supported the emergence of AMI Community6, which is open network for innovations; he realized synergies between AMI-community and European living lab community, and European living lab community applied membership of the AMI community. At the very moment, several living lab projects were competing on financing but such projects did not manage to receive financing for their projects. Parallery started Intelcities project, which was coordinated by Manchester UK and included many research partners such as e-Government services- unit in National Research Center in Finland (VTT). Living lab activities started in many locations in Europe, for example in Manchester, UK, and in Arabianranta in Helsinki Metropolitan area in Finland with help of such large scale integrative project financing.

Such work was expanded to Sienna in Italy and Reykjavik in Island. Intelcities had close relations to the established European Telecity –network. Such connections created awareness of living labs and put them in the broad urban city network. The fourth EU framework program supported by different instrument enabled larger living lab financing in 2005. AMI Community tried versatile partly competitive living labs research projects as a part of its living lab portfolio. Mr. Niitamo representing Nokia and Helsinki region and Mr. Mats Eriksson representing Tieto/Ericsson and Luleå Region, were elected to lead the created bigger living lab portfolio (over 60 million euro). The living lab portfolio was labelled as LivingLabs Portfolio Leadership Group (LLPLG), and may be considered as a primary form and structure for ENoLL.

The fifth EU framework program enabled multidisciplinary and multicontextual research and its implementation in different contexts and cities including CKIR in Helsinki School of Economics, Turku Archipelago Living lab, Hungary living labs, Homokhátsag (Hungary) agricultural area, Sekhukhune Living Lab, Sekukune – Village in South Africa, and The Cudillero Living lab, fishermen in Spain. All those living labs target to understand and solve everyday life problems of citizens in rural areas. For example, Hungary living labs emphasized benefits for forecasting crops as a part of planning in supply chain. Fishermen underlined better processing of fish products. Turku Archipelago Living lab focus on developing on public services both for year-around habitants as well tourist visiting shorter period in the archipelago. The results of archipelago living lab activities lead as part to change voting practices in archipelagos. A broader description of such living labs activities may be found in the study by Schaffers and Kulkki (2007).

[6] Accessed March 24th, 2015 Retrieved from [http://www.quizover.com/oer/course/ami-communities-living-labs-collaborative-by-olavi-videolectures]

4.5 Emergence of national living lab networks

Regional living lab clusters were emerging as early as in early 2000. One of the pioneers was Oulu region in Finland. EU structural funds boosted development in Oulu 2003, where Octobus project bridged citizens, service innovations, and ICT. Such initiatives were very similar as in the other side of the Botnian Bay, namely in Luleå, Sweden. At the beginning activities started as test bed activities in 2001. Soon after that the activities emerged into living lab networks in 2003. The organization of living lab activities varied but Luleå University of Technology has had a crucial role in facilitating and managing living lab activities.

Living lab activities emerged in Helsinki Metropolitan Area parallel with activities in Oulu. More specifically, living labs emerged in many locations in Helsinki Metropolitan area. Particularly Arabianranta, Virtual Village, and RFID laboratories were very active. One of the pioneers was Manchester, which adopted the learning and knowledge from Arabianranta, and was developed to living labs in 2002. Regional cluster emerged in 2002 in Barcelona, and developed to living labs in 2006. Amsterdam cluster were developed 2003, and was formed to living labs in 2007. In Belgium, the first Brussels LL initiative and largescale LL project took place in 2003. In 2005, Crossroads Copenhagen and the Hasselt i-City lab were up and running.

A rapid emergence of single regional living labs in different locations created a need for developing a national living lab network in Finland in 2007. The Finnish National Living Lab Network was grounded on assumptions to combine self-minded people, which share their knowledge or living labs activities together rather than aiming to monitor or steer activities.

Mr. Niitamo was chairing the national living lab network activities. Such national living lab network encompasses a broad variety of living lab actors across Finland including companies, living labs, development organizations, universities, university of applied sciences, and other actors such as Digital Media Service Innovations – Finland (DIMES Association). Sweden followed to establish a national living lab network in 2007. Many European Countries, including Belgium, Italy, Netherlands, Spain, Slovania, UK, and Portugal set up their own national living lab networks in 2008-2009. There were multiple reasons for developing national living lab networks. First, there was a need to share, discuss and distribute practices and knowledge on living labs among participants but also ongoing challenges and future plans. The discussion on utilizing on broader development resources across different living labs and their networks have continued on ever since.

4.6 Emergence of the European Network of Living Labs

Actors from Arabianranta in Helsinki, Amsterdam, Copenhagen, and Lisbon attempted to create a pan-European network, as a part of MIESIE- project, CITY Network as early as 2002. Such project did not receive financing but their ground-breaking ideas on engaging users across borders were adopted by the participants, and finally laid a base for the emergence of the European Level of Living Labs Networks to be established some years later. Broader research and development community interested in living labs when AMI community and concurrent engineering activities were merged. Two European level living lab networks emerged in Europe, namely the European Living Lab Networks (ENoLL) and the Global Living Lab Network. The latter as a part of an independent consultant company.

The living lab movement was organised through the Helsinki Manifesto, which was led by the Finnish prime minister in 2006 during the Finnish EU Presidency. Later other countries´ EU Presidencies have adopted living labs and pushed them forward as part of their agendas. The first wave of living labs in the European Network of Living Labs (ENoLL) was organised in 2007

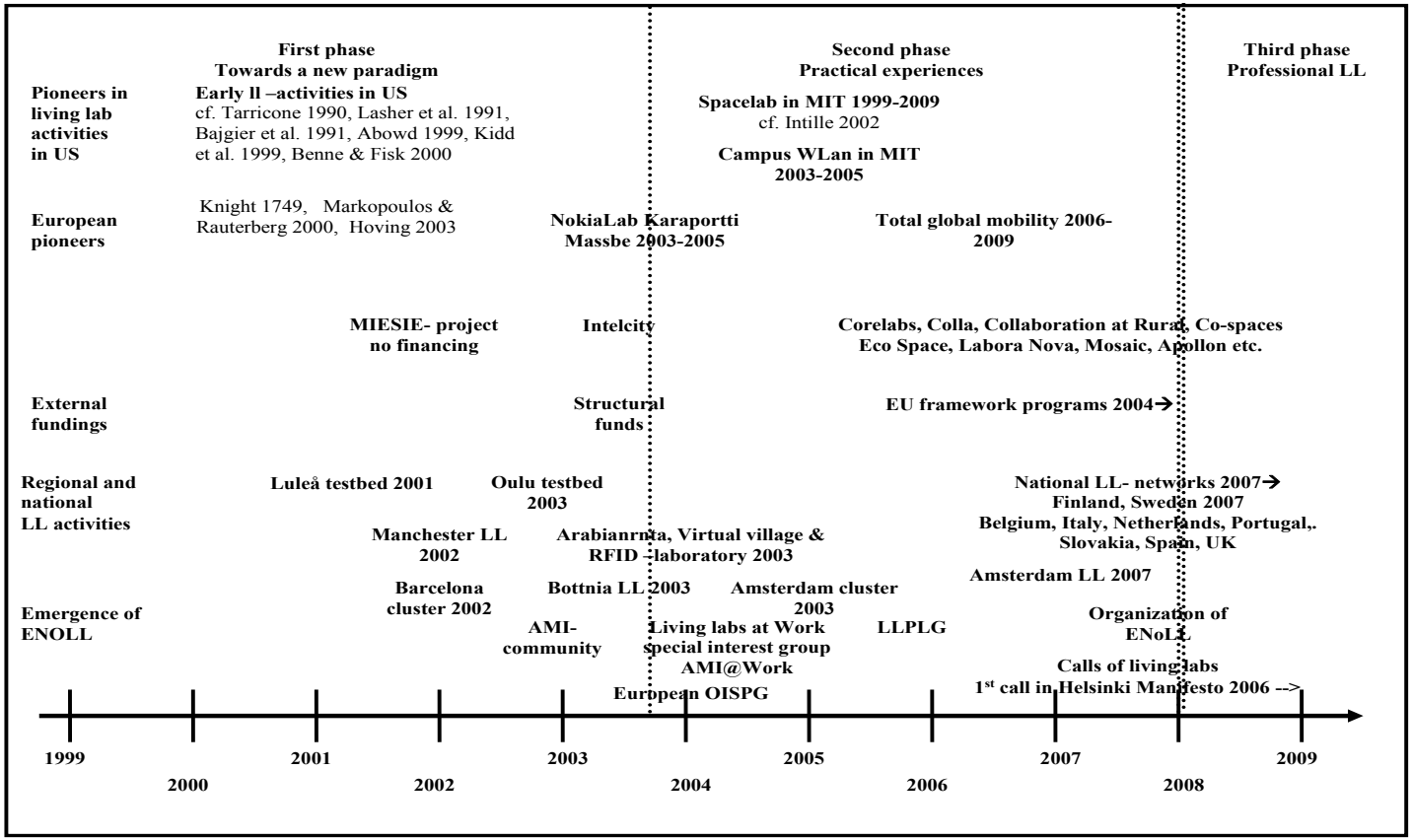

Figure 1. The emergence of living lab movement

By 2007, there were at least 19 living labs initiatives in Europe (see the first wave founders of ENoLL)7, and currently there are more than 400 living labs recognised in Europe and globally by ENoLL in 2017 (www.enoll.org).

5. Conclusion

This study analysed the emergence of the living lab movement. The early early living lab studies in US were identified by the found research papers, and European history of living labs relied on interviews of early living labs' experts. It provided two significant theoretical contributions to the discussions of living labs. First, the paper presented a new longitudinal analysis of living lab activities and main events in 1990-2007 and labelled three consecutive phases as (i) *towards a new paradigm*, (ii) *practical experiences*, and (iii) *professional living labs* (Figure 1). Second, our study makes a significant contribution to the growing literature on living labs by analysing the emergence of living labs from five diverse perspectives: (i) *early living labs pioneer*, (ii) *early living lab activities in Europe and particularly Nokia Corporation*, (iii) *EU-framework programs supporting the development of living labs*, (iv) *emergence of national living lab networks*, and (v) the *emergence of European Network of Living Labs*. Such five perspectives were intertwined together, which ultimately lead to an emergency of global living lab movement, European Network of Living Labs.

This study showed that until 2003, *the phase as toward a new paradigm*, of living lab studies were dominated mainly by many American scholars. Latter the, during the *practical experience phase*, an increasing number of European studies focused on living labs (Schuurman et al., 2011; Westerlund & Leminen, 2015; Leminen, 2015a). This was due to the pioneering work of living labs enabled by external funding. Particularly, the very pioneering work by the MIT's Professor Mitchell with his research team interfered the emergence of living labs by not only introducing the concept to living lab pioneers at Nokia Corporation, but also by visiting and participating research as one of the first living lab premises in Europe. The living lab movement began to spread through ideas of visionary people located in companies, universities, as well as national and European finance organizations supporting R&D activities such as Tekes, The Finnish Funding Agency for Innovation financed) projects and EU research and development funds.

The emergence of living labs is an eclectic but, to date, scarcely documented phenomenon. In particular, many incidents took place and were intertwined together on different levels. This study attempted to reconstruct the emergence of living labs from different perspectives, including (i) *early living lab activities in Europe and Nokia Corporation*, (ii) *EU-framework programs supporting the development of living labs*, (iii) *emergence of national living lab networks*, and (iv) the *emergence of European Network of Living Labs.* Based on the information, this paper attempted to reconstruct the main phenomenon and incidents that ultimately lead to the establishment of ENoLL living labs in 2006. This study summarised the emergence of living labs to three consecutive phases as (i) toward a new paradigm, (ii) practical experiences, and (iii) professional living labs.

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[7] The first wave founders of ENoLL: Arc Labs Waterford *Ireland*, Botnia Living Lab *Sweden*, Open Innovation Centre *Belgium*, Wirelessinfo Czech LL *Czech Rebublic,* Freeband experience lab *Netherlands*, Frascati Living Lab *Italy*, Györ Automotive LL *Hungary*, Gödöllö Rural LL *Hungary,* Hasselt&Leuven IBBT i-City LL *Belgium*, Helsinki Living Lab *Finland*, i2Cat Catalonia Digital Lab *Spain*, Manchester EastServe *UK*, Madeira Living Lab *Portugal,* Mobile City Bregenz *Austria*, Mobile City Bremen *Germany*, Knowledge workers LL *Germany,* Slovenia eLivingLab *Slovenia*, LL ICT Usage Lab *France* Retrieved from [https://www.google.fi/#q=first+wave+living+labs+enoll&start=20&spf=1498977348462] (Accessed June 2nd, 2017)]

Limitations

The present study grounds on retrospective perspective for understanding the emergence of living lab movement in Europe, where particularly Nokia Corporation had an influential role. As documented earlier, many important and visionary people were a part of the emergence. This study focused on building a longitudinal picture of the emergence of living labs covering several levels rather than focusing on a sole topic. Therefore, a broad variety of topics were discussed with the limited number of people that were possible to include in the study. We recognize that additional informants could enlighten the emergence of living labs from other perspectives as well. Also, the commercial network of living labs, which were set up around 2006 in Copenhagen, Stockholm as a direct competitor to ENoLL, should be studied more. Furthermore, acknowledging previous research on living lab research streams (Leminen & Westerlund, 2016), we call for more research on the emergence of living labs, particularly studies that examine other research streams that share similar assumptions than living labs; they can shed light on the development of living lab thinking.

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Appendix 1. Pioneering work of living labs until 2003 (Modified from Leminen, 2015)

Construct	Characteristics of Construct	Definition of construct	Source
Living laboratory	- Experiment environment - Human	As elements and conditions of a body and an environment of an experiment	Knight 1749
Living laboratory	- Users' response to TV-commercial - Citizen as user	As a way to study users' responses to TV commercials in their living rooms by making phone-call to the users	The Billboard weekly magazine 1956
Living lab	- Citizens to be monitored by epidemiologists	As a country for test connection between diet, life style factors and disease	Moffat 1990
Living lab	- Testing new materials and construction methods	As a concept house for new materials and construction methods by researchers.	Tarricone 1990
Living lab	- Development project - Employees as users in user groups - Multilevel co-operation (executive and operation level)	As a development project in a vendor - customer relationship to provide information and test prototypes by own employees	Lasher et al. 1991
Living laboratory	- Real world needs gathered from the city neighbourhood - Multistakeholder - Restricted area, city neighbourhood - Iterative - New model - Students as users	As a restricted city neighbourhood to enhance students' learning in real world problems with other stakeholders	Bajgier et al. 1991
Living laboratory	- Industrial plant - Multistakeholder - Own employee	As a mechanism for developing and implementing public involvement in nuclear safety	Bengtson 1994
Living laboratory	- Real-life setting - Ubiquitous computing environment - Restricted place - Users as developers - Students and teachers as users	As a restricted place, a classroom for capturing, teaching and learning experiences by ubiquitous computing	Abowd 1999
Living laboratory	- Home prototype - Computational environment - Initial occupants, students - Controlled experiment	As an authentic but experimental setting, computational environment to interpret and understand home	Kidd et al. 1999
Living lab/living laboratory	- Approach to real-world - Scaled simulations - Team members - Outcomes -	As *"an approach to integrate theory and practice, continuous process improvement, and tool development in collaborative system research". (p. 209)*	McNeese et al. 1999
Living laboratory	- Real-world situation (temporary project in Zoo Atlanta) - User Activities for complex problems	As a concept to *"analyze a complex problem and exercise component skills in a real-world situation, p. 2-78".*	Benne & Fisk 2000
Living lab	- Building - Experimental platform - Experimenting technologies - Not a project - Temporary residence - Differentiate from traditional lab setting	As a building that provides an experimental platform for home-related technologies with temporary residence	Markopoulos & Rauterberg 2000
Living lab/living laboratory	- Concept - Holistic approach - Socio-technical system design - Team members - Outcome	In accordance with McNeese et al. 1999	McNeese et al. 2000
Living laboratory	- Real-life environment - "A home" - Demonstrating technology - Studying interaction - Evaluating usage of technology for human behaviour	As a real-life environment to demonstrate building technology with embedded technology, studying physical-digital interaction in home and evaluation meaning of pervasive computing for human behaviour in home.	Intille 2002
Living lab	- Real life - Users as co-producer - Uncontrollable dynamics	*As "a setting that is created with specific targets and has a clear structure, but in the same time is dealing with the uncontrollable dynamics of daily life". (p. 4)*	Hoving 2003

	- Elderly, immigrants and people as a target group - Researcher intervenes in innovation activities		

Track III

Open Innovation and User Innovation in Living Labs for SME/business support, healthcare and urban & regional development

Track Chair: Dimitri Schuurman

Systematic tools to better identify and understand stakeholder roles and relations in Living Labs

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Abstract

Over the past years, living labs have appeared, which do not just focus on the development of new products, but which also try to create new solutions to complex issues such as regional development or mobility in a multi-stakeholder setting. Such living labs have to cope with a variety of stakeholders and with some challenges to identify, find and include the end user, as well as to deal with issues of Open Innovation. This paper focuses on a living lab approach in a recent regional development project on answering the question of which tools can support stakeholder identification and classification and how a systemic tool can help to better understand stakeholder motivations and, particularly, the relations between stakeholders.

Keywords

Living Lab, Stakeholder identification, Stakeholder classification, Stakeholder relations, Systemic constellations

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1. Introduction

The authors of this paper are affiliated with a research institution which is operator of a living lab. Within this living lab, a two-year regional development project has recently started. Regional development projects can be seen as complex projects in terms of themes and the heterogeneity of stakeholders. In every innovation project, the identification, selection, involvement and interaction of stakeholders are crucial success factors. "Therefore, it is important to understand the characteristics of complex systems as well as the systemic nature of required interventions leading to innovation and change." (Schaffers & Turkama, 2012: 25).

This paper investigates methods to deal with stakeholder identification and classification and to better understand relations within the innovation system, by trying to answer the following research question: *Which methods are suitable to grasp the complexity of regional living lab projects in terms of stakeholder identification, classification and relations?*

To answer this question, first, the characteristics of an innovation project in regional development were elaborated. Secondly, two methods were tested: an identification and classification model already used in general innovation projects but not yet known in living labs or regional development projects, and Systemic Constellations, a systemic tool which can help to grasp the complexity of social systems on a cognitive, emotional and affective level. The paper describes the experiences with the two above methods and discusses their value for living labs.

2. Living Labs in Regional Development

At present, there is still an absence of a generally accepted definition for the term "living lab" within the scientific community. Authors like Eriksson et al. (2005) or Lepik et al. (2010) consider the living lab approach as a research and development method, which aims to close the gap between technical and social innovation and to enhance collaboration between different relevant stakeholders. Dutilleul et al. (2010) attribute multiple meanings to the phrase - a living lab can be seen as i) an innovation system, ii) a vivid test-bed for technologies, iii) an approach for early user integration within innovation processes, iv) an organization which facilitates networking activities and v) a European innovation movement. In summary, a strong focus on user and stakeholder involvement, a pronounced relationship to real-life conditions and settings, as well as the associated creation of spaces for exploration and experimentation and method-based collaboration between the public and the private sector, are key elements of a living lab (Almirall et al., 2012).

a. Open and User Innovation

Chesbrough (2003a) states that the paradigm shift from closed to open innovation at the beginning of the 21st century was based on the emergence of several erosion factors, which led to the increasing opening of innovation processes. Furthermore, von Hippel (1978) identified a shift from the Manufacturer-Active-Paradigm to the Customer-Active-Paradigm, which changed the user's role within innovation processes (Gassmann & Schweitzer, 2014). Nowadays, organizations have to deal with increasingly informed and empowered users, who demand high quality products. On the one hand, open innovation processes, which facilitate active user involvement, are more likely to develop products or services that meet users' needs. However, on the other hand, it raises introduces serious

complexity into the innovation process (Braun, 2012; Hippel, 1994; Gassmann & Schweitzer, 2014). Due to the increased importance of open and user innovation, a need for new innovation approaches like living labs arose. While the structural and strategical aspects of a living lab are based on open innovation principals, the application of methods and the operational implementation of projects are founded on user innovation principles. Living lab projects, which combine strategic and operational aspects, therefore form the interface between the open and the user innovation paradigms (Schuurman, 2015).

b. Technically- Versus Socially-Oriented Living Labs

More recently, the living lab approach has become part of socially-oriented urban research agendas. It "evolved from the idea of co-developing cities and urban living environments" and comprises "empowerment, participation or co-creation and provides an open participatory and do-it-yourself environment that includes citizens (users) and local actors (producers) as agents in processes of co-creation and improved living spaces" (Franz, 2015: 56). However, this transfer does not seem to be an easy task, as there are some fundamental differences between technically- and socially-oriented living labs. Franz (2015: 56), based on Pascu and van Lieshout (2009), points out that the initial situation is the co-development of city and living environments with the involvement of the affected people[8]. Its aims are empowerment, participation and co-creation, whereas technically-oriented living labs rather focus on co-design, user interface design or user acceptance. The environment is open, participatory and do-it-yourself, rather than being a collaborative, multi-contextual and multi-cultural real-world environment.

Today's challenge is that, although more and more living labs are being utilized in the socio-spatial context, "the conceptual and methodological understanding of living labs remains focused on technology-based innovation processes rather than on socio-spatial research questions" (Franz 2015: 55). Følstad (2008) states a lack of systematic analyses and reflection on the available methods and tools and their suitability to the living lab context. Additionally, living labs can also be part of a bigger project or initiative, leading to the necessity of not only focusing on methods used within living labs, but also of analyzing and managing the whole innovation system, as research on "how these innovation processes are coordinated within these networks is largely lacking" (Schuurman et al., 2016b: 207). Franz (2015: 54) follows that "there is a need for a conceptual design of social urban living labs that moves beyond technological terms, norms and the idea of social-spatially isolated implemented labs."

c. Complexity of Regional Development Projects

Regional projects are complex (Cooke, 2013), as they usually need to cover a number of different themes. The actors (stakeholders) are heterogeneous (Nyström et al., 2014) and, as they are simultaneously both users and citizens, they have interests in their region and both individual and shared motives co-exist. In the case of several regions collaborating, political, cultural and economic differences are to be considered as well. There is broad agreement that, the more complex a project is, the more difficult it is to manage (e.g., Geraldi & Adlbrecht, 2007; Remington, 2011; Thamhain, 2013). Because complexity is not easy to grasp in general, several attempts have been made to explain and define the complexity of or in projects (Cooke-Davies et al., 2007). For example, Gul and Khan (2011:

[8] and not to gain better acceptance for a product or service by involving users.

153f) distinguish between three main categories of complexity. Structural complexity depends on the number of different elements in a project and their interdependencies. General uncertainties stem from goal uncertainties, method uncertainties and environmental uncertainties. The third category, which they emphasize the most, is people uncertainty, which means that projects contain (unpredictable) social interactions that follow certain rules of interaction.

Within living labs, the identification and selection of stakeholders is crucial. Because of the reasons mentioned above, one can assume that this task is even more challenging in regional development living labs. Additionally, rather little is still known on the roles users can take (Nyström et al., 2014). "The multiple roles residents play in regional and urban living labs have not yet been fully understood and need to be scrutinized in future studies" (Juujärvi & Pesso, 2013: 27).

3. Case Study and Research Method

The case study is a two-year regional development project in four neighboring leader regions, including two rural regions, one small town and its surroundings and the surroundings of one capital city. The aim of the project is to develop new ideas and solutions for the most urgent problems in all four regions, by using the living lab approach. The project started in autumn 2016 with an intense need-finding phase on very broad themes covering the economy, tourism, urban and rural development. At the present stage, 10 main topics and 10 smaller topics have been identified.

The project can be considered as complex because of the openness concerning the nature and number of themes and because of the regional segregation. The method used to create ideas, to develop prototypes and to test them until a pretested concept can be presented, is called design thinking. It is already commonly used in business innovation. The authors adopted it, together with design thinking experts, for use in regional development (Leavy, 2010; Johansson-Sköldberg et al., 2013; Wylant, 2008).

The authors are affiliated with a research institution and can be defined as one of the enablers of the project by providing expertise on process design, methods and stakeholder management and by conducting research on the issues mentioned in this paper. Further enablers of the project are a regional development agency, the leader managers of the regions and several regional municipalities[9].

The case study was analyzed according to Yin (2003). Two methods, as described in the following sections, were applied and analyzed within the research and management team using a qualitative content analysis (Froschauer & Lueger, 2009)

4. Stakeholder Management

An essential part of the living lab approach is the bringing together of different actors in order to enhance innovation processes. Leminen et al. (2012) describe the utilizers, the enablers, the promotors and the users as the most important groups. Undoubtedly, users play a central role amongst them (Folstad, 2008; Leminen, 2012). "As locally affected

[9] In order to keep the paper anonymously the involved parties are not described in more detail.

people, they provide a valuable source of insight and information" (Franz, 2015: 57), but they are also testers, development or co-designers, thus being subjects and objects at the same time. In regional development living lab projects, in particular, users are also citizens of their region and might therefore occupy multiple roles when taking part in a living lab. In order to bring together those stakeholders, they first need to be identified, classified and selected, and later involved and dealt with over the course of the living lab.

Stakeholder Identification and Classification Model

There are several stakeholder classification models available (e.g., Andriof & Waddock, 2002; Kumar et al., 2016; Mitchel et al., 1997). Vos and Achterkamp (2006) argue that, prior to the classification of stakeholders, their identification is an essential step, especially in innovation projects. They consider classification models as appropriate "for classifying an (unordered) list of already identified stakeholders. However, providing an as complete as possible list requires the additional identification procedure" (Vos & Achterkamp, 2006: 165). In order to make a classification model fit for the innovation context, they suggest dealing with boundary issues by including a role perspective (Ulrich, 2003).

Vos and Achterkamp (2006: 166) argue that "a role has to be specified in a concrete case in order to decide what individuals or groups of individuals stand for what roles." In order to tackle the most important roles, they first distinguish between passively and actively involved roles. Within the actively involved, they distinguish three roles according to Ulrich (2003): the client (whose purposes are being served), decision makers (who have the power to decide) and designers (who contribute necessary expertise). As an additional dimension, they add the major phases of an innovation cycle: the initiation, development, implementation and maintenance phases, arguing that in each of those phases the stakeholders to be involved in active and passive roles might differ (figure 1).

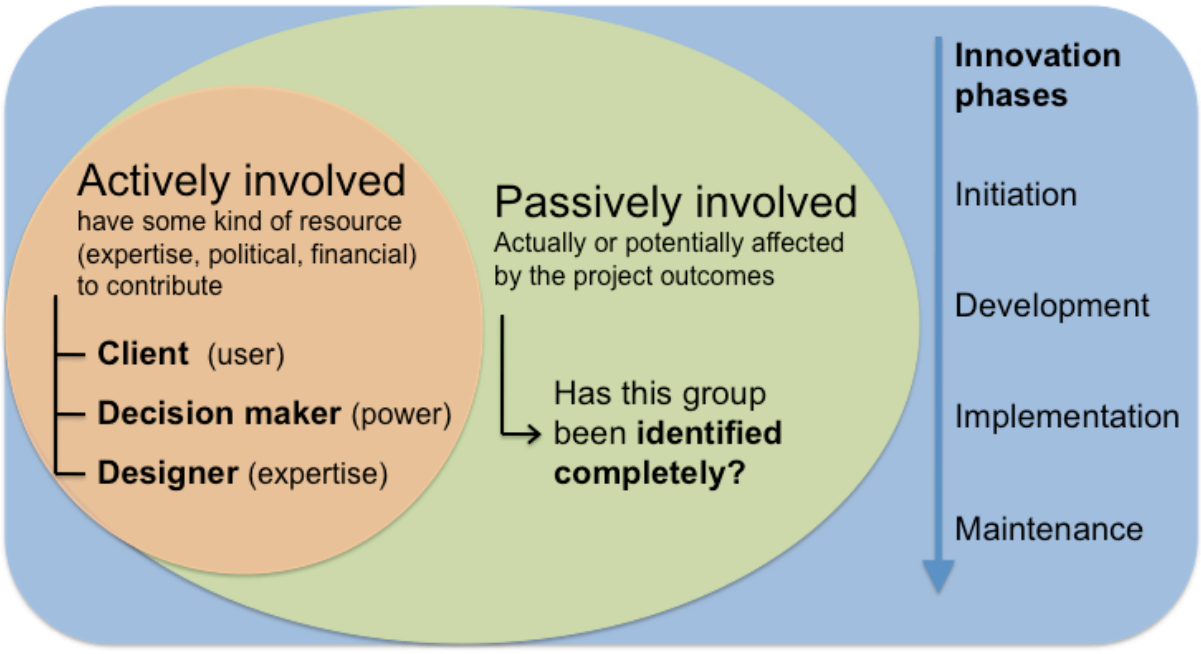

Figure 1: Stakeholder identification and classification model according to Vos & Achterkamp (2006)

For the identification and classification, Vos and Achterkamp (2006: 169) suggest a four-step procedure:

Step 1: Defining the goal of the project
Step 2: Individual brainstorm: identification of those involved
Intermezzo: explaining the classification model
Step 3: Group brainstorm: identification of those involved based on roles (with guiding questions)

Step 4: Group brainstorm: phasing the involvement

The authors tested the identification model in the planning phase of the regional development project. Vos and Achterkamp (2006: 169f) provide comprehensive guidelines on how to work with the model and have developed a set of guiding questions to use with a group (of project managers). Suggested identifying questions concern, for example, the clients: *What are the benefits of the innovation for the clients mentioned so far? Are there any others who also benefit from these effects? Are there any other benefits leading to different clients?* In terms of decision makers, the questions might be: *What are the power resources of the decision makers mentioned so far? Are there any other decision makers with similar power resources? Are there any other relevant resources; which decision makers use these? What are the topics these decision makers can decide on/cannot decide on? Which decision makers do have this ability,* and so on.

They turned out to be very helpful in collecting a wide variety of possible stakeholders and – even more important – in guiding an in-depth discussion during the identification and classification procedure regarding who needs to be involved actively or passively and who to involve in which phase of the project.

Stakeholders from the following groups were selected for the regional development program:

- Government on the national and regional levels (political representatives, local authorities, local decision makers, etc.)
- Industries
- Service providers on behalf of the private sector
- R&D units and experts (designers, etc.)
- Related organizers (e.g., other innovation labs/platforms, clusters, museums, etc.)
- Public actors (thematic initiators, citizens, etc.)
- Representatives of interests (in different regional areas - leader managers, etc.)
- Small and Medium-Sized Enterprises
- Service providers on behalf of governmental organizations
- Media
- Educational organizations (e.g., schools, universities)

Table 1: Stakeholders for the regional development project

5. Stakeholder Roles and Relations

The quality of innovation depends very much on the interaction between the actors involved. To understand the behavior and interactions between the actors in order to be able to manage the innovation process, it is inevitable to get to know the actors involved. This "requires a thorough understanding of each party's objectives and drivers" (Schaffers & Turkama, 2012: 25). Schuurman et al. (2016a: 330) provide a comprehensive overview of the potential motivations of utilizers, enablers, providers and users. In addition to that, several authors have developed and categorized a number of roles in living labs (Heikkinen et al., 2007; Nyström et al., 2014), such as webber, instigator, orchestrator, builder, messenger, etc.

Four main different approaches are discussed regarding the creation of roles: "The structuralist approach is grounded on predetermined roles in role behavior. The symbolic interactionist approach suggests a role as being created in a social structure. The resource-based approach views roles as a resource to create position, thus roles are linked to positions. The action-based approach is grounded on assumptions that the chosen role is based on activities or tasks to be conducted in the network, and considers a role in a development process" (Leminen, 2015: 62). Thus, the action-based approach "refers to the actions and reactions determined by other actors, in which role tasks are linked to conducted activities" (Leminen 2015: 61). Questions arise about "whether a stakeholder represents an individual in an organization or an individual represents an organization", suggesting that "a role represents the collective role of the actor in living labs" (Leminen 2015: 66).

The authors argue that understanding motivations is an essential success factor for the management of an innovation system, but want to add two hypotheses:

- Besides the motivations and expectations of each role, the constellation and interaction of the different roles (and subsequently of the actors) are also of particular interest for stakeholder management.
- The sooner hypotheses on the motivations, expectations and relationships in a living lab project can be stated and tested against observations in real life, the better a living lab can be managed.

Nevertheless, it is difficult to grasp and describe relationships within an innovation system. Nyström et al. (2014: 486) stated that they "focused on living lab actors instead of their relationships, because it is difficult to describe an innovation network with all its actors and the characteristics of the links between them."

Systemic tools can be helpful in doing so. Therefore, the authors tested a systemic tool that has been used in several other areas, such as project management, risk management, etc. over the past years: Systemic Constellations.

Systemic Constellations

Constellation work has been being developed in Germany since the 1980s, starting with work on Family Constellations by Hellinger (1994), which is based on several therapeutic approaches such as Psychodrama (according to Moreno), Hypnotherapy (according to Erickson), development-oriented Family Theory (according to Satir), Transactional Analysis (according to Berne) and Husserl's philosophical movement of Phenomenology

(Sparrer, 2009: 23ff; Varga von Kibéd & Sparrer, 2011: 235). In the late 1990s, a group of German-speaking authors transferred Family Constellations (for an overview, see Cohen, 2006) to organizations and other systems (e.g., Grochowiak & Castella, 2002; Sparrer, 2000; Varga von Kibéd, 2000; Weber, 2000).

Organizational Constellations, according to Weber (2000: 56), transferred the guiding principles of Family Constellations to organizations and added firm-specific principles such as the right of membership, the primacy of a senior and the primacy of leadership roles. Organizational Constellations are utilized today in various fields of systemic organizational consulting (e.g., Senoner & Rosselet, 2013), as well as in other endeavors, such as policymaking, administration, regional development and adult education (e.g., Gminder, 2005; Roevens, 2009).

According to Varga von Kibéd (2000; Sparrer, 2009), **Systemic Structural Constellations** (also called Systemic Constellations) coincide in most parts with the previous two. Their main characteristics are that abstract elements can be included (e.g., "the problem", aims, values, etc.) and that the concerns, explanations, interpretations and ideas of the client have a central status, whereas the facilitator strictly avoids his own interpretations. Open and hidden[10] constellations are possible and are part of preliminary feedback and consultation processes.

Features

In the English-speaking world, constellation work is not yet well-known, although in the U.S., somewhat similar methods have been developed and discussed under different terms and with some main differences. Social Network Analysis (Freeman, 2004), for example, describes actors and their relationships in social networks by means of nodes and ties. This method is quantitatively-oriented and does not involve the emotional component of relational structures. Soft Systems Methodology (Checkland, 2000) works with so-called "Rich Pictures" in its initial phase, which are graphic illustrations of the system created and analyzed by the actors. This is similar to the initial constellation image (starting picture), because it serves to make the implicit knowledge and feelings of a group explicit.

However, neither of the above methods includes one main feature of all types of constellation work: the observation and analysis of the interactions and relationships between actors and parts of a system to find out how they work so as to create new ideas for problem solutions. This is done by visualizing and externalizing the internal picture someone has of the relationships, orders, hierarchies, dependencies and communication patterns of a system (Grochowiak & Castella, 2002: 19). This explicit and implicit picture is arranged in the space by using either people or figurines and symbols (e.g., wooden figurines, puppets, cards) as representations of the parts and actors of a system.

In a first step, the system representatives are chosen and intuitively placed in the room by the client (starting picture). During this phase, the spatial orientation of the parts, such as the distance between them and the directions in which they are facing, provide important information. In a next step, the representatives give feedback about their feelings, perceptions and views that they experience at these particular positions; this provides important additional information on the underlying system dynamics. In a third step, the facilitator intervenes, usually by inviting representatives to move to different places, to

[10] where representatives do not know whom they represent and in which system.

show possible changes or solutions. If the analysis and understanding of a system is the focus and not the immediate solution to the problem, steps I and II are sufficient.

Benefits

When Systemic Constellations first came into use, Sparrer and Varga von Kibéd played a key role in developing their theory. Sparrer (2009: 17ff) describes it as a language of the system, going beyond the verbal and nonverbal communication of each representative within it. It only exists for the whole system and in relation to the other system members as a "transverbal language". Roevens (2009: 32) argues that it "is an appropriate technique to clarify and to picture the characteristics of a system as a whole", whereby the methodological elements, such as the externalization of the internal picture, the representation and the spatial arrangement all work as a basic vocabulary for looking into the "inside of social worlds".

Different authors name similar advantages of constellation work (e.g., Grochowiak & Castella, 2002; Weber, 2000; Weinhold et al., 2014):

- It generates information about a system that helps to understand the underlying structure and dynamics of a situation, problem situation or system.
- It allows a view from the outside of the whole system by making implicit knowledge explicit.
- The complexity of a situation and a system, respectively, can be captured at a glance, which is much more difficult to achieve through verbal communication.
- Constellation work enables the adoption of roles of other parts/members of the system and a better understanding of one's own position within the system.
- Persons who are involved tend to stay focused and are likely to reveal their inner picture and implicit knowledge of the system.
- The dialogue-oriented approach and open setting helps to gain additional information, new ideas and impulses in the decision-making process and to foster stakeholder communication.
- It simultaneously supports cognitive, emotional and affective learning and problem solving.
- The method is rather fast and easy to prepare and apply.

Thus, constellation work seems to be a method with high potential to support an understanding of complex innovation systems and the actors within a regional living lab project (Kopp, 2013; Kopp & Martinuzzi, 2016).

For the case study, a Systemic Constellation was carried out representing the actor groups of the inner circle (see figure 2) plus the management team: the core management team, the research team, regional actors, users, experts and local initiators. The aim of the research was to gain insights into the relationships of project stakeholders with the project aim, with the management and with others. To learn about roles, their position within or towards the innovation system, and their expectations and fears concerning the project.

The constellation was video-taped from two different angles and analyzed by the members of the research team. The spatial arrangement of the representatives, their movements and

what they said, as well as all associations and questions that were triggered within the research team during the analysis of the video, were taken into account in the qualitative content analysis (Froschauer & Lueger, 2009). In a qualitative analysis, first, all observations and associations are described in pictorial language, while hypotheses and generalized findings are developed in a second step.

6. Results

As design thinking is a particular process within the living lab approach, it was interesting for the management team to discuss which stakeholders are part of the design thinking group, which of them need to be involved actively in the whole innovation process and which are to be passively involved, as well as how they can be represented in the innovation process and afterwards. It was useful to divide the stakeholders into "three circles" in the case study project. The most inner circle of the design thinking team consists of seven-10 people actually working on a topic, such as experts, designers, extreme users, non-users and average users. The middle circle is involved actively at the start, in the further development of ideas and in some decisions, such as political representatives, leader managers, local initiators, some local authorities, service providers and some citizens. The discussion brought up the questions whether local initiators should be part of the inner circle. Finally, the outer circle of organizations or people are passively involved and need to be informed and asked from time to time, such as local decision makers or the public directly affected by a new development. Additionally, it became obvious that it is necessary to carry out the identification procedure for each of the 20 topics, to be undertaken by the management team together with some local actors who are familiar with other regional actors.

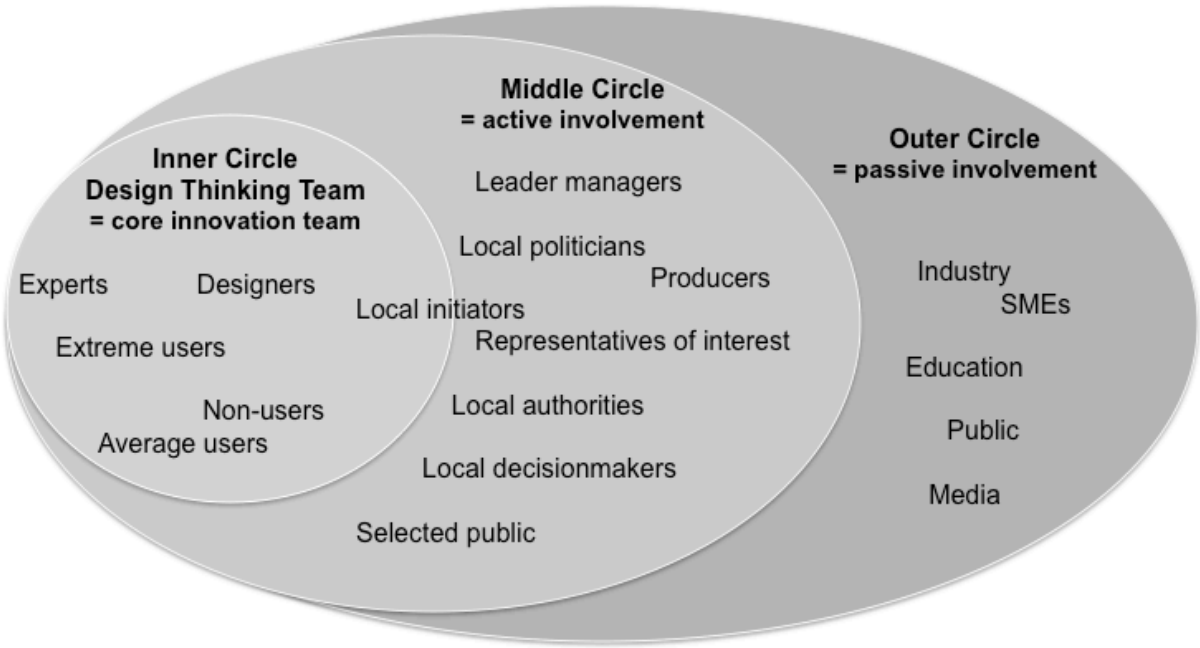

Figure 2: Level of involvement of stakeholders

Although the role of the users is commonly considered as central in living labs, they seemed to be rather weak actors within the system. The Systemic Constellation revealed that the users (as citizens) seemed to be strongly related to the other regional actors, but

seemed to feel uncomfortable and were mainly overwhelmed by the complexity of the innovation system. Although they want to influence and contribute to the aim, they had no idea how to do so and their role was not clear to them. They were looking for support, either from the research team or the regional actors.

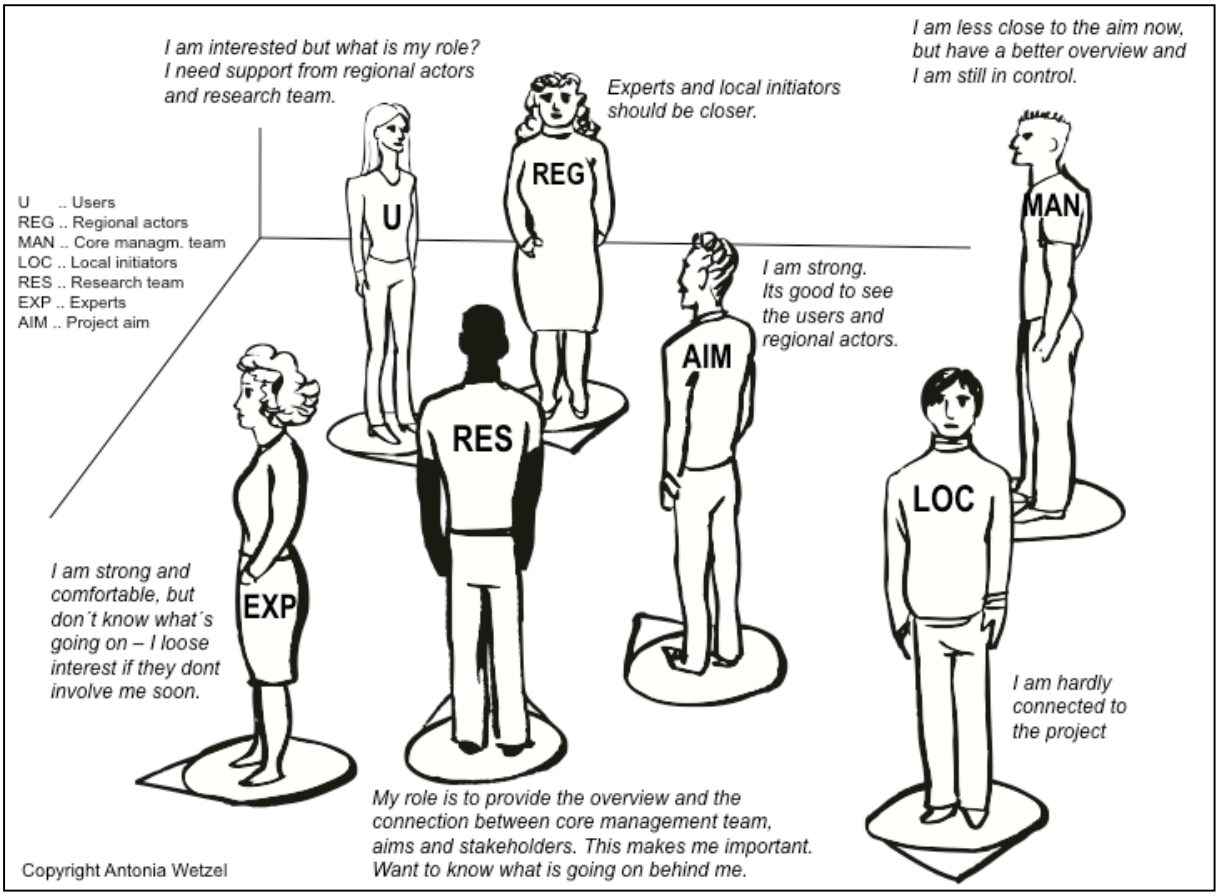

Figure 3: Systemic constellation of the inner circle stakeholders

In the Constellation, the experts and local initiators seemed not to be very involved or interested (turning their heads away), but articulated very similar feelings ("I don't know what to do here") and where seen by others similar (most other actors wanted to have them closer, mainly the regional actors and users). This led to the management's conclusion to create a new role in the project: for each of the themes, a local project leader would be put into place to ensure a good connection between the regional actors, users, experts, research team and core management team on the local level.

Although this was not the main purpose of the Constellation, interesting insights to the role of the management team were revealed. At the start of the project, the preparation of the core management team had defined the aims of the project, but it seemed that they had not considered the (regional) actors and users (in the Constellation, the "project aim" was too strong and the actors did not feel noticed). As soon as the research team started its work, a shift could be noticed: the research team was able to provide a profound overview of the whole innovation system, thus gaining more power within the management team; at the same time, it was able to connect to, motivate and convince the local actors of the

quality of the process, in order to make collaboration possible (the Constellation showed a strong connection between the aim, the research team, the regional actors and the users).

Analysis of systemic constellation			***Living Lab Setting***		
			Evaluation		
Factor	*Description*		*+*	*++*	*+++*
Structure and dynamics	understand the underlying structure and dynamics of a situation		●		
Point of view	view from the outside on the whole system				●
Implicit knowledge	making implicit knowledge explicit				●
At a glance	system can be captured at a glance			●	
Adoption of roles	adoption of roles of other parts/members of the system				●
Own role	get better understanding of one's own position within the system			●	
Inner picture	people reveal their inner picture and their "real opinion"		●		
Communication	the constellation fosters stakeholder communication				●
Learning	cognitive, emotional, and affective learning and problem solving at the same time				●
Pragmatic	method is rather fast and easy to prepare and apply		●		
Relations	insight into the relations of project stakeholders to the project aim, to the management and to others				●
Identify fears	learn about stakeholder fears concerning the project				●

Table 2: Analyses of the benefits of a systemic constellation

The systemic constellation process was discussed and reflected with the members of the research team afterwards. The personal views of four researchers are summarizes in table 2. It showed that it has clear benefits in most aspects drawn from theory, but the method, if used profoundly (including preparation, video analyses and discussion) is not a rapid process of 1-2 hours as sometimes claimed. The question of getting the "real opinion" of representatives arouse mainly in the form that is was not always clear if some of the representatives talked about their feelings or had already filtered them cognitively and added their own thoughts. And finally, the method does not help everybody in the same way to understand underlying system dynamics, rather some aspects of it.

7. Conclusion

A profound stakeholder identification and classification process is a vital part of an innovation system's management, and can be supported by the appropriate tools. It should be given attention and include the views of the whole management team before the project even commences.

Regional projects especially include a wide variety of themes, leading to a great variety of stakeholders to be involved, either actively or passively, over the course of a project. Systemic Constellations demonstrate a high potential to deliver qualitative information, not only on the motivations, but also on the relationships between the actors within the innovation system. Systemic Constellations are a helpful tool to visualize such interrelations with other actors (including the management team) and contribute to a better understanding of them on a cognitive, emotional and affective level.

The authors consider it necessary as part of a regional project to ensure that, from time to time a profound overview, a view "from outside", should be made so as to not lose the connection between expectations by commissioning agents, project aims, management, process quality and all the different stakeholders. To provide this, open innovation should already be carried out in the conception phase of a complex project. This can improve stakeholder management and the steering of hypotheses on relationships related to the innovation process can be built early in the stakeholder process. This is of particular interest in a regional development context, as groups of actors might represent more than one role, which can also change over time.

It also showed that the Constellation and roles within the management team are of great importance and should be harmonized, as they have a direct influence on the relationship between the actors which is necessary for the project's success. The group of users in a regional living lab is particularly heterogeneous in a region, as they are both project stakeholders and citizens. They are central actors in the innovation process, but at the same time, one of the weaker players when compared to the utilizers, enablers and providers. They therefore need special attention and support in a regional development innovation project.

The limitations of the project are the rather small number of Systemic Constellations so far carried out and the fact that representatives are needed who are willing and able to offer their immediate perceptions with few cognitive interpretations as possible, as well as researchers who are able to distinguish between the two. Both the identification and classification models, as well as the Systemic Constellation, should be further tested in different living lab projects. Future research should be carried out into the how the different stakeholder classification models can influence the perceptions the management team might have of stakeholders, and the effect that this can have on the management of such projects. Concerning Systemic Constellations, the authors suggest using the tool several times within one case study to also consider changes over time, as well as to use it in further case studies and to also experiment with hidden Constellations, in order to exclude cognitive assumptions by representatives as far as possible.

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Living Labs Managing the Intra-Organizational Knowledge Exchange Process when Transitioning from Closed to Open Innovation

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Abstract

Living Labs facilitate collaborative, open innovation by addressing user needs in real life environments so they can learn how these end-users embrace the appropriation of an innovation. Since within an organization, employees are the foundation to establish a culture of open innovation, it will be important for Living Labs to encourage their participation when the organization decides to transition from closed to open innovation. Exchanging knowledge is a key process in open innovation. This paper investigates the factors that can encourage or limit the participation of employees in the knowledge exchange process and will provide guidelines for Living Labs as mediators of this process.

Keywords: Knowledge Change, Living Labs, Open innovation

Introduction

Open innovation strategies have been researched for several years, because they allow organizations to be more effective in creating and capturing value. The essence of open innovation is to maximize value creation via internal and external ideas (Chesbrough, 2010). Value creation can manifest itself in many forms (e.g. increased productivity, process improvement, innovation or latent value perception), and created on many levels: individual, organizational and industrial (Lempinen & Rajala, 2014) .

The concept of value co-creation has been previously studied by using a service-dominant logic perspective (SD-L). This research stream assumes that value co-creation is realized by implementing competencies of one party (such as knowledge and skills) to benefit another party. In other words, social interaction and resource integration are the basic processes in value-co-creation (Lempinen & Rajala, 2014). Gronroos & Ravald (2011) suggest that to reach value-co-creation, different stakeholders have to become active participants in the process via interaction and exchange across and through networks. All social and economic actors are perceived as resource instigators. It can be assumed that value will have a different meaning for different stakeholders and therefore it is important to use their resources (knowledge and skills) to support value co-creation (Vargo & Lusch, 2007). The co-creation process involves knowledge inflows and outflows between complementary partners, including horizontal and vertical alliances (West & Bogers, 2010). Following Schuurman (2015) we recognize Living Labs as a mediator of value co-creation between users and firms in a real life environment (Schuurman, 2015). In other words, Living Labs act as an intermediary in the knowledge exchange process by encouraging the innovative capacities of different stakeholders and managing the purposive inflows and outflows of knowledge in order to collaboratively develop and/or commercialize an innovation (Schuurman, 2015; West & Bogers, 2010).

Living Labs accomplish this through a broad range of open innovation practices. The most popular are co-creation and informal networking across and within organizational boundaries in order to generate and evolve new ideas. Independent of where the idea finds its origin, human cooperation will be crucial to secure further enhancement of the innovation in terms of sponsorship, improvement and actual realization (Ibarra & Hunter, 2007; Obstfeld, 2005). Internal employees are ranked as the most important innovation partners in this process (Chesbrough & Brunswicker, 2013), yet often overlooked in academic literature (Kristiansen & Bloch-Poulsen, 2010). Especially effectively transferring the innovative knowledge between employees within an organization is important and should gain more attention because it increases the organization's innovativeness (Hansen et al., 2005; Tushman, 1997). This process of transferring knowledge is highly influenced by the norms, which are in turn dictated by the culture of an organization. In a culture of closed innovation, knowledge exchange is less common. For knowledge exchange to occur in such a situation, employees will have to showcase positive deviance, meaning they will have to depart from the norms in a positive way. Empowering employees can enable them to break out of their 'passive mindsets', to take risk and try something new (Spreitzer & Doneson, 2008). In other words, making innovation activities more open does not only require a substantial change towards more knowledge exchange across organizational boundaries but also within. High employee involvement will be a prerequisite for knowledge exchange, meaning the key to success resides internally in the organization (Chesbrough & Crowther,

2006; Lazzarotti & Manzani, 2009). Schuurman, Baccarne, De Marez, Veeckman, & Ballon (2016) already proposed Living Labs as open innovation systems facilitating this knowledge exchange between different stakeholders with researchers playing a central role as process mediators. They also indicated that more research is needed on a larger scale to identify how Living Labs can operate as open innovation systems. This paper will therefore explore and analyze the attitudes of employees towards intra-organizational knowledge exchange and how Living Labs can support this process by means of a large scale survey.

Living Labs managing intra-organizational knowledge exchange

The open innovation literature reveals a variety of ways in which Living Labs can support organizations to implement open innovation via inbound and outbound activities. Inbound activities are all activities that focus on discovery; outbound activities are those that focus on exploitation. Several elements can influence the preferred open innovation activities of an organization. Firms with less turbulent environments for instance, meaning they are subject to continuous and substantial changes which are uncertain and unpredictable, will be more interested in inbound activities. While firms with more environmental uncertainty will prefer the combination of inbound and outbound activities (Mortara & Minshall, 2011). Despite the best practices provided by researchers and practitioners, it seems that open innovation is still a process tailored to the individual needs of each organization. This makes it challenging for organizations to move from closed to open innovation practices because what works for one organization, might not necessarily be the solution for another (Huizingh, 2011). High failure rates reflect these challenges as well as the need for adequate management of the open innovation process via tools and methods that allow organizations to structure and optimize the innovation process (Brem & Viardot, 2013). Large companies suffer the most when opening up their innovation practices and this can be assigned to the functioning of the organization and more specifically the efficiency of their business model. It is often what makes organizations commercially successful, but simultaneously less flexible to deal with the chaos and risks of innovation. This is not something that is present in the organization from day one, but the employees' norms and behavior are created over the years. The shared rules, values and beliefs have deep roots in the organizations and are better known as the culture of that organization. The stronger the culture, the more shared values the employees will have to ensure everyone is on the right track (Martins & Terblanche, 2003). The literature on innovation suggests that by its very nature, innovation requires, at least partially, deviant behavior from the organizational accepted norms. This is because open innovation involves the creation, sharing and development of new ideas that are not held by the majority of the employees (Galperin, 2002). Therefore, large organizations typically work with innovation intermediaries to increase their internal knowledge exchange flows (Chesbrough & Brunswicker, 2013). Living Labs are well known for being innovation intermediaries that can foster knowledge transfers between different actors (Schuurman, Baccarne, et al., 2016). If Living Labs act as intermediaries in opening up the innovation process, they should understand the employees' willingness to show positive deviant behavior in the organization so they can better guide the change process towards open innovation. Managing the intra organizational knowledge exchange process that will lead to innovation, is not an easy task for Living Labs because a range of organizational units can be involved. These units vary tremendously in their level of empowerment and more

specifically the autonomy to practice knowledge exchange. R&D units for example will have more autonomy than procurement. Additionally, when dealing with hierarchical organizations, lower levels in the organization often do not receive enough autonomy to make decisions and practice open innovation. Many scholars stress the important influence of the climate such as the level of support in the immediate work environment on innovation practices (Matthiesen & Einarsen, 2004). In other words, it will be critical for Living Labs to support organizations in creating a more motivating environment that will stimulate knowledge exchange between employees.

Previous research for example has shown that the degree to which organizational members are a part of interpersonal networks affects the overall level of innovation within an organization (Albrecht & Ropp, 1984). Moreover networks that consist of members from different units within the organization can provide novel information and new perspectives that lead to creativity and innovation (Brass, 2012). These new ideas allow new, shared and sustainable routines, increasing overall organizational processes (Kristiansen & Bloch-Poulsen, 2010). Changing routines can cause a cumulative change of the organization towards open innovation. Via conversations, knowledge can be exchanged amongst employees and contribute to employee driven innovation. Eventually this will result in openness towards inbound and outbound knowledge exchange (and as such open innovation), because prior studies have shown that both firm capabilities and attitudes related to innovation can be developed through training and development of employees (Ehrhardt, Miller, Freeman, & Hom, 2011). It reduces the protective tendencies to keep knowledge for oneself and provides employees with skills and competencies that support the adoption of open practices (Burcharth, Knudsen, & Søndergaard, 2014). The basic idea is that we can tap into the knowledge of employees within an organization by stimulating conversations that cover sharing, daring and caring approach (Kristiansen & Bloch-Poulsen, 2010). Sharing means you let others partake in your knowledge and knowledge creation (and vice versa), dare means you are willing to take risks and question your own assumptions and those of others. Care means you treat each other with respect despite different opinions and interests. However, the evidence on employee attitudes and their willingness to participate in the knowledge exchange process is not only scarce, but also inconsistent. While most studies have found that employees tend to be unwilling to collaborate, i.e. negative attitudes to knowledge sharing predominate (Herzog & Leker, 2010; Mortara & Minshall, 2011), others have documented the existence of overly positive tendencies to knowledge insourcing (Menon & Pfeffer, 2003). Therefore, in this paper we will explore the different drivers and barriers that will lead to the willingness of employees to exchange knowledge in a large organization.

Research Questions: Employee's Drivers and Barriers for Knowledge Exchange

As previously mentioned it will be important to better understand why employees adopt or resist knowledge exchange so Living Labs can support them in reframing their negative viewpoint (Atkinson, 2005). Previous research indicated that innovations often tend to be incremental, smaller, stepwise improvements on a day-to-day basis (Kristiansen & Bloch-Poulsen, 2010). **Habits,** a regular tendency or practice (on a day-to-day basis), can impede innovation and agility, whether we are talking about the individual habits (Scott & Bruce, 1994) or the organizational routines (Adler et al., 2009). By better understanding habits,

questioning** and **changing them, we can create stepwise improvements on an individual or organizational level.

The power of weak **ties in a social network** has been established by Granovetter (1983) as a way to gather information from areas that are outside of one's immediate social environment. Burt (2004) points out the fact that weak ties often bridge "structural holes" in a social network. By importing knowledge from one cluster into another, or by synthesizing knowledge which exists in the different clusters, the person who bridges structural holes can obtain benefits that cannot be obtained by the individuals who just belong to one group. In addition, this bridging relationship provides earlier access to knowledge in other clusters, and therefore gives the participants in the relationship an opportunity to recombine the new knowledge with their own and be innovative before others (Burt 2004). In an organizational environment, levering weak ties to bridge structural holes translates to a willingness of people to ***collaborate with colleagues from other parts of the organization** and **making new social connections within the organization.*** On the adverse side of the "power of weak ties" stands Coleman's (1990) argument that it is in fact close networks that offer advantages, like the establishment of social norms and a lesser distortion of information as it travels from person to person. This argument translates in a willingness of people to ***collaborate with colleagues from their current team.***

The nature of one's social network that can be used to access information, influence one's capacity to be creative and therefore the innovation potential of the organisation in which one works. That creativity and **ideas** can occur by associating previously unconnected concepts in a cognitive system is widely recognised in literature (Cronin, 2004; Mednick, 1962). Chances that one will be creative will therefore be higher if concepts from different domains reside in one's cognitive system. What can then be connected in a way, which is less likely to have occurred before. To make this possible, one must be able to ***capture ideas more rapidly and transparently***. It is undeniable that more and better ideas will contribute to innovation, but the challenge in the innovation process will be to ***implement those ideas more rapidly***. Many companies are slow and reluctant to change or implement new ideas, because 'they always did it this way', which leaves little to no space for innovation, nor its implementation (Borza, Nistor, Mirta, & Bordean, 2009). Several elements can contribute to a rapid implementation such as providing the right channels or sponsorship (Tuulenmäki & Välikangas, 2011). Rapid implementation is the right approach to meet business needs and is also critical to knowledge sharing (Shields, 2011).

As much of the knowledge and information in the organization travels between people through conversations, it can be important to **spark relevant conversations between people on the workfloor**. Indeed, when one considers the possible conversations which any two people could have between each other, it can be useful to make sure that the conversations are guided in a way that they are conductive for increasing creativity and innovation (Coenen, Kenis, Damme, & Matthys, 2006).

According to Deci, (1971), a motivation for people to take action is their own feeling of **competence**. Therefore, both ***knowing where one stands in terms of behaviors in comparison with others in the organization*** and ***showcasing one's progress or change in terms of behavior*** can be powerful motivators to engage in knowledge sharing. Employees can be less willing to participate in the knowledge exchange process because they **fear the unknown**. In many cases this fear is related to the reluctance to leave the familiar behind because they have to

learn something new and risk failure (De Jager, 2001). The attitude towards the relationship with the manager can impact the willingness to exchange knowledge as well. The better the quality of the relationship between the manager and employee, the more readily the employee will accept and act towards knowledge exchange (Brunetto & Farr-wharton, 2007). This also means that if **managers do not support** employees, they will be less likely to exchange knowledge. Gupta & Govindarjan (2000) indicate that managers sometimes demote power of others to protect their own decision power. This in itself can impact the employee's feelings of psychological safety impacting the individual and organizational innovation potential (Kessel, Kratzer, & Schultz, 2012).
The availability of **support mechanisms** within an organization in terms of resources such as time and information influence the level of innovation (Martins & Terblanche, 2003). Resistance to change is often based on the inadequate knowledge of the proposed change (Atkinson, 2005). Inadequate knowledge can be related to ***insufficient information*** about the change in order to understand the change. Additionally, ***insufficient time*** will lead to employees resisting to exchange knowledge. ***Not having a systematic approach*** to learn this new set of skills that will create barriers towards the open innovation culture (Lichtenthaler, 2011).
Having an **unclear mission** can negatively influence innovation. Employees need to feel that the goal and expectations of the innovation are clear (Thamheim, 2007). Therefore, it can be expected that ***ambiguity towards employee expectations*** will create resistance towards knowledge exchange. This because employees seek approval from their superiors when performing their tasks and they also seek gratitude when deviating from normal behavior that can benefit the organization (Appelbaum, Iaconi, & Matousek, 2007).
Employees will influence each other in the organization. If an employee comes up with a new idea that can be valuable for the organization, it will increase the motivation of other employees to come up with new ideas (Borza, Nistor, Mirta, & Bordean, 2009). When employees observe that their **peers are resisting** exchanging knowledge, they become less confident in their own skills and the appropriateness of the new behavior. This means they will also be less likely to persist in the knowledge exchange behavior (Galperin, 2002).

All these elements lead to following hypothesis regarding the drivers and barriers of knowledge exchange within an organization.

Figure 1: initial model: drivers and barriers of intra-organizational knowledge exchange

Research design

This paper will focus on the employee attitudes of a large Belgian financial company engaging in a Living Lab project with a technological SME and the research institute iMinds (now imec). The financial company wanted to increase the intra-organizational knowledge exchange to generate innovative ideas and ensure a future competitive position in the market. Therefore, they asked the SME to develop a dynamic game that would support employees in the knowledge exchange process. The Living Lab researcher was responsible for the involvement of employees in the game creation and setup of the open innovation network. To identify potential drivers and barriers and tackle the identified challenges, the

Living Lab researchers launched a survey that was announced on the company's central communication platform. The employees could participate in a trilingual (Dutch/French/English) survey from the 14th of January 2015 till the 30th of January 2015. 408 surveys were started of which 354 completed. Upon data cleaning, we omitted outliers and performed the analysis based on 343 observations. The results were used to shape the next steps and the communication strategy of the Living Lab project.
Because the employees had to log in to the company's platform with their personal ID, we were able to limit the survey to the most important questions, while avoiding screening questions such as socio demographics because they could be deduced from their ID. The data was weighted on seniority, hierarchy level, gender and age to assure a representative sample of the employees in the company.
The questionnaire was designed based on a previous literature review (supra) creating scales for all mentioned constructs and their variables. The survey in total consisted of three parts: willingness to exchange knowledge via the game, drivers and barriers of knowledge exchange and willingness to participate in the next steps of the Living Lab project.
The adoption intention of knowledge exchange via the game was measured via the PSAP scale developed by De Marez and Verleye (2004). This is a simple scale consisting of three questions, making it easy to implement in large-scale survey research. The scale is able to make a more clear distinction between the adoption potential compared to the DSI scale (De Marez & Verleye, 2004). The questions estimate the hypothetical adoption intention starting off with an explanation of what knowledge exchange via the game is all about. This was explained as a process of continuous, systematic dialogue where employees communicate on equal footing and where they can inquire into a subject based on previous (work)experiences (Kristiansen & Bloch-Poulsen, 2010). After this explanation, the respondents are asked to what degree they would partake in knowledge exchange via the game. The second question introduces an optimal condition with the drivers of knowledge exchange, and the third question presents the suboptimal condition with the barriers of knowledge exchange while asking the respondents to what degree they are willing to exchange knowledge via the game.
The willingness to participate in knowledge exchange via the game was measured on a 5-point likert scale: I would immediately exchange knowledge, there is a high likelihood that I would exchange knowledge, I am not sure, I would rather wait, I don't think that I would exchange knowledge, I would definitely not exchange knowledge. The 10 drivers were operationalized according to the previous mentioned dimensions in this paper (cfr table 1). In each question, the respondents were asked on a 5-point likert scale to indicate to what extent they thought it was important that the elements should be present in the implementation: not at all important, low importance, neutral, moderately important, very important.

Table 1: Drivers of intra-organizational knowledge exchange

Construct	Operationalization
Idea Generation	Capturing ideas more rapidly and transparently
	Implementing ideas more rapidly
Habit Formation	Questioning daily routines/habits/behavior
	Changing daily routines
	Making new social connections within the organization
Social network ties	Collaborate with colleagues from my current team
	Collaborate with colleagues from other parts of the organization
Spark relevant conversations	Sparking relevant conversations between people on the workfloor
Competence	Knowing where I stand in terms of behaviors in comparison with others in the organization
	Showcasing my progress/change in terms of behavior

The barriers were operationalized according to the previous mentioned dimensions and existed out of 7 items in which the respondents were asked on a 5-point likert scale to indicate to what extent they thought the elements will impact a successful implementation of the knowledge exchange process: no impact, minor impact, neutral, moderate impact, major impact.

Table 2: Barriers of intra-organizational knowledge exchange

Construct	Operationalization
Limited management support	Limited support of the management
Peers resistance	Peers demonstrating resistance

Unclear mission	Ambiguity regarding the employee expectations (e.g. work-fun balance)
Fear of the unknown	Fear of the unknown (e.g. collaboration across silos)
Support Mechanisms	Insufficient information
	Insufficient time
	No systematic approach supporting the game

Our analysis consisted out of two steps. We started with a principal component analysis to reduce the numbers of dimensions in our indicators and to avoid correlations amongst dimensions. Next, we applied a multiple linear regression technique to explore and validate the taxonomy of drivers and barriers of knowledge exchange among employees.
The scales are 5-point likert scales and strictly taken they are ordinal scales, but the assumption of 'equal intervals' allows to consider likert scales with 5 answer categories as interval scales. The residuals are independent and have a normal distribution (Wijnen, Janssens, De Pelsmacker, & Van Kenhove, 2002). In large sample sizes (n=>30) the significance of the kurtosis statistics becomes too sensitive and therefore a bad criterion to test for normality. The central limit theorem indicates that in large samples of 200 or more, the visual distribution of the shape becomes more important. Therefore, in this study we only looked at the frequency distributions to test the normality of the data and can conclude that the data is normally distributed. We started with a Principal Component Analysis to reduce the multicollinearity of the data and confirm the anticipated constructs. We first tested if our data were suitable for a component analysis, by calculating Measures of Sampling Adequacy (MSA) for the individual variables (Hair, Black, Babin, Anderson, & Tatham, 1998). All the variables had satisfactory values (> 0.6) and were suitable candidates for a PCA. For the selection of the number of factors, we applied the latent root criterion, requiring that the eigenvalues are greater than one. KMO and Bartlett's test of sphericity met common standards (KMO= 0.77 and $p<0.001$). We used the varimax rotation and as a result we obtained a 6-factor solution explaining 62% of the variance. The first factor, **social network ties**, consisted of the items: collaborate with colleagues from my current team, collaborate with colleagues from other parts in the organization, sparking relevant conversations with people on the workfloor and making new social connections within the organization. The second factor **competence** consisted of the items showcasing my progress/change in terms of behavior and knowing where I stand in terms of behaviors in comparison with others in the organization. The third factor, **habit formation**, consists of the items: questioning daily routines/habits/behavior and changing daily routines. The fourth factor, **idea generation**, consists of the items: capturing ideas more rapidly and transparently and implementing ideas more rapidly. The fifth factor, **support mechanisms**, consists of the items: insufficient information, insufficient time and no systematic approach

in supporting the knowledge exchange. The sixth factor, **social expectations**, consists of the items: peers demonstrating resistance and ambiguity regarding employee expectations.
To analyze the impact of the different drivers and barriers on the willingness to exchange knowledge, we performed multiple linear regression with a cross section analysis.

Results

Sample

The demographics of the sample are presented in table 3. The cohort was 60% male and 40% female.
Roughly one third of the respondents were between the ages of thirty and thirty nine years old and the other largest group existing out of roughly one third of the respondents were between the ages of forty and forty nine years old. Overall, more than half of the respondents were 40 years or older.
The respondents primarily fulfilled a mid-executive level position in the organization.

Table 3: Sample Demographics

Gender	**N**	**N%**
Male	208	60%
Female	142	40%
Age	**N**	**N%**
<30 years	37	10%
30-39 years	100	28%
40-49 years	97	28%
50-54 years	64	18%
55+ years	53	15%
Hierarchical level	**N**	**N%**
Employee	25	7%
Mid-Executive	290	84%
Manager	29	8%
Seniority in organization	**N**	**N%**
<5	58	17%
5-9 years	58	17%
10-14 years	52	15%

15-19 years	54	16%
20-24 years	18	5%
25-29 years	54	15%
30+ years	54	15%

All determinants were added to the multiple linear regression analysis simultaneously (forced entry) for the knowledge exchange model. After deletion of 17 outliers, the multiple linear regression analysis was redone. When assessing the regression model, we notice that the determinants predict 14% of the variance in employees' willingness to exchange knowledge ($p<.05$). Although the predictive validity of the model is rather low, we still have a significant model.
The results of the multiple regression analysis are shown in table 4 and 5.

Table 4: Intercorrelations between dependent variables

	(1) Limited support of the management	(2)	(3)	(4)	(5)	(6)	(7)
(2) Fear of the unknown (e.g. collaboration across silos)	.082	1					
(3) Social Collaboration	.175**	.130*	1				
(4) Daily Behavior	.252**	0.045	.189**	1			
(5) Progress	.195**	.187**	.339**	.244**	1		
(6) Ideas	.297**	0.005	.324**	.378**	.323**	1	
(7) Resources	.194**	.265**	.266**	.200**	.184**	.217**	1
(8) Social Expectations	.271**	.256**	.263**	.180**	.120*	.230**	.324**

Note: *p<.05, **p<.01

The findings in table 5 indicate that the possibility to question and change daily routines via knowledge exchange will increase the willingness of employees to participate in the process ($p<.05$). Additionally, the idea generation aspect, with the ability to capture and implement ideas more transparently and rapidly will motivate them to participate in the knowledge exchange process ($p<.05$). Related to the transparent process, employees believe it is critical for the success to see how much progress has been made with the knowledge exchange ($p<.05$).

Table 5: Results Multiple Linear Regression Analysis

		B	SE B	ß	F	p value
Step 1	(Constant)	4,435	0,378		11,727	0
	Social network ties	-0,105	0,068	-0,089	-1,541	0,124
	Habit formation	-0,222	0,056	-0,223	-3,963	0
	Competence	-0,114	0,05	-0,133	-2,287	0,023
	Idea generation	-0,136	0,067	-0,122	-2,032	0,043
	Support mechanisms	-0,083	0,064	-0,074	-1,3	0,195
	Social expectations	0,02	0,057	0,02	0,352	0,725
	Fear of the unknown (e.g. collaboration across silos)	0,067	0,038	0,098	1,758	0,08
	Limited support of the management	0,021	0,042	0,028	0,498	0,619
	R^2=.16, Adjusted R^2=.14					
Step 2	(Constant)	4,212	0,288		14,605	0
	Habit formation	-0,222	0,056	-0,223	-3,997	0
	Competence	-0,121	0,047	-0,14	-2,551	0,011
	Idea generation	-0,166	0,064	-0,149	-2,615	0,009

R^2=.14, Adjusted R^2=.14

Discussion

The change process from closed to open innovation is a very complex process that needs more research and evidence from different levels of analysis. This study contributes with some first insights and answers on how Living Labs can approach and manage the change process better by focusing on certain drivers for intra-organizational knowledge exchange. We saw that, despite the previous literature, Living Labs should emphasize its focus on drivers -- not barriers -- when managing the intra-organizational knowledge exchange process.

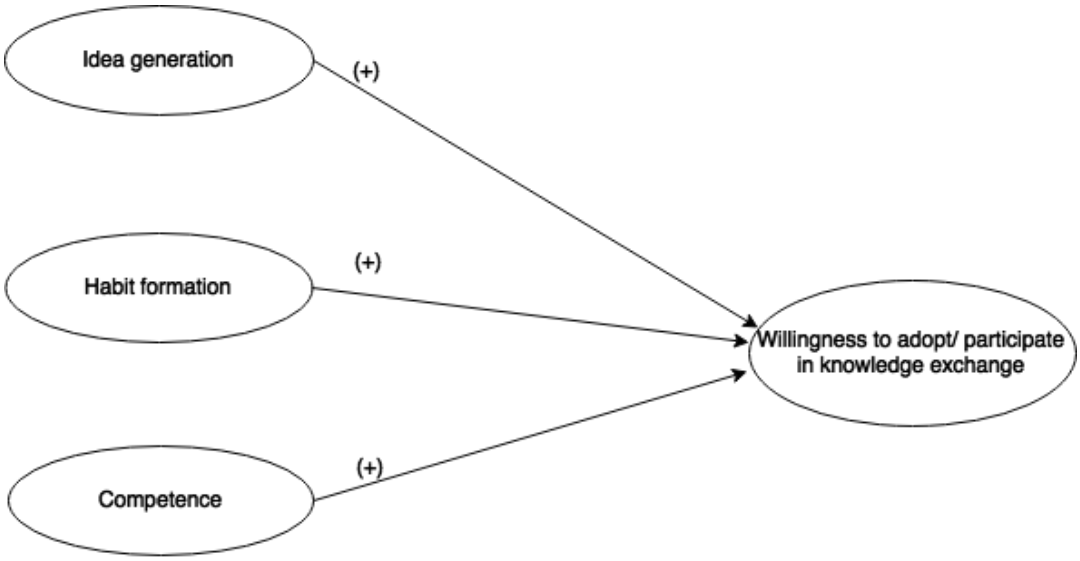

Figure 2: Final model drivers and barriers of intra-organizational knowledge exchange

The main drivers for employees to participate in the knowledge exchange process are the ability to generate ideas, form new habits and feel competent. This indicates that Living Labs can offer an added value compared to other innovation intermediaries because Living Labs are known to co-create value with different stakeholders and empower them to take action (Schuurman, De Marez, & Ballon, 2016).

This study confirmed hypothesis 1, the ability to generate ideas and implement them more rapidly, positively contributes to the willingness to exchange knowledge. User participation in the idea generation process is common in Living Lab projects. Schumacher and Feurstein (2007) provided an overview and methodological approach to involve users in the co-creation or idea generation process. They emphasized that all Living Labs are already using specific methods and tools to interact with end-users. However, Coenen and Robijt (2016) indicated that Living Labs are currently still lacking in the rapid implementation process of ideas and suggested FALL as a framework to capture and implement ideas more rapidly. For Living Labs to react more quickly to emerging and changing user requirements, FALL proposes to use agile development techniques like SCRUM to support the Living Lab process. As a result, FALL proposes a number of processes that can be leveraged in Living

Lab projects to structure the innovation process and guide the knowledge exchange process that has been the central focus of this paper.

The study also confirmed hypothesis 2, the possibility to question daily behavior and change it, positively contributes to the willingness to exchange knowledge. As previously mentioned the patterns of interaction and knowledge exchange between people within an organization represent a very complex environment. Habit formation can be influenced by several variables and make it flourish under the right circumstances. Understanding habits or daily behavior forms an integral part of Living Lab research, but changing these habits goes beyond the traditional Living Lab practices and highlights the importance of involving HRM as a stakeholder. Organizational culture, with the employee's habits, norms and practices forms an integral part of the general functioning of an organization and the HR department is the unit that understands the culture the best and knows how to approach/change it in an optimal way. This also the case for the last hypothesis (6) that has been confirmed in our study, feeling competent will lead to a higher willingness to exchange knowledge. Feeling competent comes from successful performances in which one can notice progress. One of the best ways to make employees feel competent is by involving them in well-designed training programs (Reece, 2012). Living Lab researchers and practitioners have less experience with these programs, but Human Resources researchers and practitioners have been dealing with similar challenges in their current position such as, how can we change the soft skills of our employees and by measuring improvement and providing them with KPI's (Key performance indicators) accordingly. As such, Living Labs can learn a great deal from them. Prior studies for example suggest that both firm capabilities and attitudes related to innovation can be developed through training and development of employees (Ehrhardt et al., 2011). It reduces the protective tendencies towards knowledge exchange and provides them with skills and competencies that support the adoption of open practices (Burcharth et al., 2014). Human resources can support the habit formation process by training employees towards the right skills set that can contribute to the process.

Although this paper recommends Living Labs to collaborate with HR management, knowledge management and exchange is multidisciplinary in nature. Successful initiatives will require the coordination of multiple functional areas of the organization. Knowledge exchange does not only require that information is shared among individuals within an organization, but employees feel motivated and empowered to try new ways of carrying their work and to analyze and detect new opportunities along the value chain (Cabrera & Cabrera, 2005). This indicates that Living Labs should not only define clear roles and responsibilities for the stakeholders involved, but they should find those stakeholders with the right competencies, expertise and skills to contribute to the Living Lab.

As any study, also this study shows some severe limitations. This study was done in one organization and not cross-organizations. Future research will have to focus on other organizations and should investigate the reasons for the insignificant variables. An additional limitation is that the study measured the willingness to exchange knowledge based on a hypothetical scenario. This scenario supposed being on equal foot with managers. In reality, the rather sensitive situation of reorganization might result in personal stakes being too high to openly express opinions. Additionally, the element of exchanging knowledge via a game might have influenced the results of this study. Future research

should study knowledge exchange in general and the long-term impact of drivers and barriers on knowledge exchange. Additionally, future research should investigate which knowledge and expertise aside from HR is important to include in the Living Lab to better manage and stimulate the intra-organizational knowledge exchange between employees.

Conclusions and managerial implications

Living Labs can provide an approach to enhance the intra-organizational knowledge exchange process by stimulating the idea generation, habit formation and competence level of employees. We will need to further explore the different roles of important stakeholders in this process and learn from experience in the years to come. While Living Labs can act as mediators for the change process, most of them will not be sufficiently set up to fulfill this potential. Many of them should still learn and involve other disciplines, such as consumer behavior, open innovation, organizational behavior, etc. This article contributed partially to this by studying a framework of drivers and barriers based on open innovation, innovation networks and organizational change literature that will can engage employees to partake in the knowledge exchange process.

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Annex: Survey

As you certainly know, we must win several battles to allow our vision 2020 to become a reality. To win our battles, we need a cultural change. Concretely to roll-out this new culture, we are now launching a game. This digital game, which will be co-created with you, has a clear objective: allow players to get to know other people, exchange knowledge and make open innovation more concrete in their day-to-day professional life.
This is why we need you!
By answering this survey, which will only take 5 minutes of your time, you will give us important input to build the game. Afterwards if you want to be more involved you can in a second step take part of workshops to shape this game even further.

To start the survey, please click the "Next" button below.

Here is a short introduction of the fundamentals of the game. The other elements will be shaped together with you. Therefore, we would like you to read the text carefully and share your honest opinion in the following questions:

The game is an engaging experience that will take place both in the digital and the real world, creating value through your interactions with it.

Through the game you will get in touch and exchange knowledge with colleagues you know already and many who will be new to you. You will be invited to have meaningful conversations regarding the open innovation program and what it will mean to you, discover the expertise and ideas of those around you and perhaps even share some insights from your personal life.

In addition, by participating you will be able to make the objectives of the open innovation program more concrete in your day-to-day professional life. How can we adopt this vision into every level of what we do? How can you start today? You decide!

The game allows you to join forces with others in 'teams' and enjoy a healthy dose of competition.
Scoring points for your teams is achieved simply by interacting, both online as well as offline. The physical components will be dispersed at different physical locations of the offices enabling you to 'check in' alone or with others, triggering meaningful interactions

with team-members. Using the online components on the other hand, you will be able to help define the collective definition of what the new behaviours in the open innovation vision actually mean and how we can all start living them today.

Following the release of the game, how eager would you be to exchange knowledge via the game?

- ❍ I will immediately exchange knowledge (1)
- ❍ There is a high likelihood that I will exchange knowledge (2)
- ❍ I would rather wait, maybe later (3)
- ❍ I don't think I will exchange knowledge (4)
- ❍ I will definitely not exchange knowledge (5)

On a weekly basis, how much time would you have to play the game?

- ❍ Less than 10 minutes a week (1)
- ❍ Between 10- 30 minutes a week (2)
- ❍ Between 30 minutes and 1 hour a week (3)
- ❍ More than 1 hour a week (4)

To what extent do you think following elements should be implemented in the game?

	Not at all important (1)	Low importance (2)	Neutral (3)	Moderately Important (4)	Very Important (5)
A well-balanced level of competition to motivate players (1)	❍	❍	❍	❍	❍
Capturing ideas more rapidly and transparently (2)	❍	❍	❍	❍	❍
Implementing ideas more rapidly (3)	❍	❍	❍	❍	❍
Questioning daily routines/habits/behavior (4)	❍	❍	❍	❍	❍
Changing daily routines (5)	❍	❍	❍	❍	❍
Making new social connections within the organization (6)	❍	❍	❍	❍	❍
Collaborate with colleagues from my current team (7)	❍	❍	❍	❍	❍
Collaborate with colleagues from other parts of the organization (8)	❍	❍	❍	❍	❍
Sparking relevant conversations between people on the workfloor (9)	❍	❍	❍	❍	❍
Knowing where I stand in terms of behaviors in comparison with others in the organization (10)	❍	❍	❍	❍	❍
Showcasting my progress/change in terms of behavior (11)	❍	❍	❍	❍	❍

Following the release of the game with all the elements you indicated as important, how eager would you be to exchange knowledge via the game?

- ❍ I will immediately exchange knowledge (1)
- ❍ There is a high likelihood that I will exchange knowledge (2)
- ❍ I would rather wait, maybe later (3)
- ❍ I don't think I will exchange knowledge (4)
- ❍ I will definitely not exchange knowledge (5)

To what extent you think following barriers will impact a successful implementation?

	No impact (1)	Minor impact (2)	Neutral (3)	Moderate impact (4)	Major Impact (5)
Limited support of the management (1)	❍	❍	❍	❍	❍
Peers demonstrating resistance (2)	❍	❍	❍	❍	❍
Ambiguity regarding the employee expectations (e.g work-fun balance) (3)	❍	❍	❍	❍	❍
Fear for the unknown (e.g collaboration across silos) (4)	❍	❍	❍	❍	❍
Insufficient information (5)	❍	❍	❍	❍	❍
Insufficient time (6)	❍	❍	❍	❍	❍
No systematic approach supporting the game (7)					

Following the release of the game, with the barriers you indicated impacting its success, how eager would you be to exchange knowledge via the game?

- ❍ I will immediately exchange knowledge (1)
- ❍ There is a high likelihood that I will exchange knowledge (2)
- ❍ I would rather wait, maybe later (3)
- ❍ I don't think I will exchange knowledge (4)
- ❍ I will definitely not exchange knowledge (5)

The development of the game is a work in progress that is constantly evolving. Therefore, we can use your assistance in the next steps. First of all, various co-creation workshops done by statements, questions and creative challenges will be organized to further shape the game. Afterwards a test phase will be set-up in order to optimize it. Do you want to be part of these?

- ❍ Yes, I would like to be part of the co-creation workshops (1)
- ❍ Yes, I would like to be part of the test phase (2)
- ❍ Yes, I would like to be part of both (3)
- ❍ No (4)

Thank you for your participation and the rich insights you shared with us. Naturally, we will keep you informed about the results of this survey and the next steps. Please note that there

are only limited places available to be actively involved in certain steps and we cannot invite everyone. Yet, we will try involve you as much as possible.

Let's game and win the battles together!

Overcoming Barriers to Open and User Innovation in Regional Development

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Abstract:

This paper examines the attempt of setting up innovation platforms using a LL approach in international development in rural South Africa. The aim is to enhance understanding on the role of innovation in regional development. This extends the literature on open and user(-driven) innovation (OUI) to include a regional development view. It also sheds light on possible barriers to OUI and LLs as catalysts for regional development. Stakeholders acknowledge the need of local involvement for user participative innovation in emerging LL initiatives. The paper offers OPI4D (open participatory innovation for development) as a solution to the undeveloped organizational properties that stand in the way to leveraging tangible product, process, and social innovation outcomes. The discussion leads towards a rethinking of regional or international development.

Keywords:
Open innovation, user innovation, regional development, participation

Introduction

User participation and network facilitation towards social value creation are two factors that constitute a Living Lab (LL) and are critical in regional development projects implementing open innovation (OI) (Schaffers, H., Cordoba, M.G., Hongisto, P., Kallai, T., Merz, C., & van Rensburg, J., 2007; Fahy, C., Ponce De Leon, M., Ståhlbröst, A., Schaffers, H., & Hongisto, P., 2008; Battisti, 2013; Schuurman & Tönurist, 2017). In their seminal article on LL approaches and on the role of users Eriksson, Niitamo, & Kulkki (2005) introduced the regional development aspect as part of LL impact. This paper studies how establishing a user innovation platform is perceived by network actors in a LL process located in rural South-Africa and sheds light on OI in LLs as an approach to regional development.

Recent literature on LLs, including the six special issues on LL of Technology Management Review since 2012, presents how research on the use of technology within open LL settings leads to innovations and consequently improves business and social processes. Knowledge is needed on how the LL practice implementing OI and user(-driven) innovation (OUI) meets the restraints of development contexts in terms of organizational challenges, especially in remote areas with underequipped spaces, lack of human capital, inadequate government policy, opportunistic behaviour of network actors, and localized learning processes that are detached from a systemic approach to development.

Evaluations of government-led ICT4D initiatives often reveal that the projects suffer weak impacts, and that development does not achieve set goals nor lasting improvements for communities (Kriz et al., 2016; Schuurman, 2015; Mog, 2004). ICT4D also fails to deliver in terms of sustainability and scalability of the proposed solutions (Heeks, 2008; Hosman & Fife, 2008; Quesada-Vázquez & Rodríguez-Cohard, 2015) and by permitting the disintegration of infrastructures initially set up to serve specific projects (Gunawong & Gao, 2017). Reasons to explain the mismatch between investments and results range from incoherent implementation to poor business models, to shortage of local infrastructure services, and finally lack of collaboration and appropriate assessment (Veldsman & Van Rensburg, 2006; Heeks, 2008; Pade & Sewry, 2009). With the focus on innovation in the LL approach the hope arises that new and sustainable solutions for ICT-enabled services can stem from users innovating with operators, thus arriving at innovation outcomes that secure products and business models appropriate to the circumstances of use (Paltridge, 2009; Cunningham et al., 2011).

Business, NGOs, and governments across Southern Africa acknowledge the relevance of innovation for mobile service and application development in African markets (Cunningham, Cunningham, & Herselman, 2011). In 2013, upon establishing the LL network of South Africa (LLISA) and upon launching a LL collaboration with the innovative region of Flanders, Netherlands, the South African Minister of Science and Technology confirmed that through LLs “research and innovation play a vital role in addressing our societies' most pressing challenges…” (DST 2013, para. 5). The minister announced that by launching LL related actions he seeks to develop “innovative ways of supplying every citizen with affordable … and more proximate … services” (para. 6). Already in 2009, at the launch of the Innovation for the South African Poverty Alleviation programme, South-African Minister Naledi Pandor referred to the benefits that a LL can bring in involving users: “New innovation will be stimulated using the "LLs" approach, with innovators from the community supported in creating technologies, and researchers and developers put in direct contact with the local community” (DST, 2010).

This paper focuses on elements of collaboration in OUI through stakeholder and user orchestration in LLs to overcome multiple barriers in ICT4D. The paper analyses perceived preconditions for OUI through a case of regional development in the Eastern Cape province of South Africa, the Siyakhula LL, and related LL initiatives, as an alternative to ICT4D. The paper continues as follows: after a conceptual framework relating LLs to open and user innovation, I present the case and introduce the methodology, followed by a reflection on open innovation as part of regional development practices and LL facilitation. After presenting the findings, the conclusion and implications follow.

Conceptual Frame

If, as a managerial research perspective assumes, tacit organizational capabilities (Möller & Törrönen, 2003) play a central role in successfully dealing with customers and suppliers, then it is beneficial to look at collective LL relational mechanisms and interaction capabilities among OUI stakeholders, including citizens. A regional development setting will also face organizational challenges as a collective of stakeholders, and as a community. Consequently, interaction capabilities and relational challenges need specific attention. Three conceptual fields of innovation management are combined with regional development: OI, UI, and LL.

Open innovation, based on Chesbrough (2003) is a firm's pursuit to integrate external inputs for new product development. Current work scans for key factors of how OI can intensify firms' efficacy in putting successful innovative products and processes on the market, mostly in a business-to-business innovation context (Chesbrough, 2006; Lichtenthaler & Ernst, 2009). OI is thus seen as a dynamic capability that produces new opportunities and affects a firm's performance (Teece, 2011) in new product development and knowledge exploitation (Lichtenthaler, 2011). OI processes engage stakeholders with each other. As a distinct collaborative and co-creative process, OI can provide a solution for regional development and international development projects (Vrgovic, Vidicki, Glassman & Walton, 2012). Thus, OI resonates with local, national, and international development objectives to render e-government and information technology widely accessible and to close the 'digital divide', while creating regional economic advantages, as intended in the foundational theory of development (Pike, Rodríguez-Pose, & Tomay, 2017).

User or user-driven innovation appear alternatively in this paper and refer to the involvement of users as innovators. To summarize various approaches to user innovation (Gambardella, Raasch, & von Hippel, 2015; Hasselkuß, Baedeker & Liedtke, 2017) we can say that user-driven innovation happens when consumers in their everyday activities look beyond ready products, take initiative to innovate, and are strengthened in their role as contributors in the production of not yet existing, or of unfinished products. They do so with the help of other stakeholders, or they diffuse their innovations through digital communities (von Hippel, 2017). The OUI literature shows a gap in considering whether these innovation processes are appropriate to sustain regional development by providing growth through local entrepreneurship. We need insights into how UI can leverage the user participation process in international development and have an impact on regional development in rural areas and in developing countries.

Regional development cooperation in ICT has recently prioritized establishing technology platforms that are able to promote business and sustain local entrepreneurial activities (Juma, 2005; Leach & Scoones, 2006; Juma & Cheong, 2005, The Steps Centre, 2010). ICT-driven development has been central to efforts in empowering communities in developing

countries (Brant, 2015). In the last decades, ICT-based development practices have stretched from applying a technology push, to progressing with a pull approach and participative models of citizen-inclusive and user-driven innovation (OECD, 2008).

Living Labs OUI orchestration. With the increasing ICT-based development, we can look at LLs as mechanisms to facilitate OUI in development, by combining several regional actors, and by adding distributed stakeholders that, though external, would enhance the local cluster of actors (Cunningham et al., 2011; Schuurman & Tönurist, 2017). Assembling LL operations with OUI can pool distributed knowledge to enhance regional innovation (Schaffers, H., Cordoba, M.G., Hongisto, P., Kallai, T., Merz, C., & van Rensburg, J., 2007). It is this combined knowledge and practices that can establish bridges between local and regional economic development, national innovation systems, and embed developing regions into global processes.

Intermediate collectively managed processes

Because OI relies on connections external to the organization, and aspires at user involvement and innovation, this paper conceptualizes two aspects relying on the social and managerial knowledge domain: collective *interaction capability* and *relational competence*. In combining OUI with LLs methods, this paper sees such collectively managed relational aspects as the vital basis for categories such as *reflective practices* in iterations and for leveraging on *emergent creativity* in real life innovation spaces leading to stakeholder benefits and regional economic advantages. These categories constitute intermediate collectively manages processes.

In managing these intermediate processes, we can conceptualize LLs as multi-actor executors (cf. Schuurman & Tönurist, 2017) and as mechanisms to balance creation and production processes including users in development settings. LLs can set in motion a process of local *emergent creativity* that fosters regional development by engaging public innovation facilitators, global and local business, and citizens as residents, users, and innovators. Such engagement persists and regains alertness through *reflective practices*. Can these intermediate processes answer questions on how the engagement of citizens and public actors is a viable OI approach in regional development creating opportunities to diverse stakeholders? How can OI and LL practices with these intermediate collectively managed processes attain and sustain regional development goals, whether desired or emergent?

Based on the proposed conceptual framework the paper avoids a techno-centric supply-driven approach in development and innovation, which often tends to highlight the benefits of technology diffusion per se. The stance of the paper is to turn the attention away from development benefits of quantifiable technology diffusion and rather favour the understanding of development based on participation and emergent co-creation, a facilitation that is constructivist in nature.

Case

This paper builds on a regional development case in the Eastern Cape province of South Africa. The Cooperation Framework on Innovation Systems between Finland and South Africa (Cofisa) set up LL collaboration for regional development through ICT. Cofisa supported ICT4D activities, in particular a LL project by two universities located in the

region, the Universities of Rhodes and Fort Hare. The LL was a showcase for Cofisa policy development objectives supporting South-African innovation.

The local universities' Information Systems and Telecommunication Departments in collaboration with the Departments of Anthropology were working with the chosen community (Gumbo, 2012a; Sibewu, 2010) when Cofisa joined the Siyakhula case. This initiative included local and international operators, and telecommunication companies. At the center was the idea to use the LL concept as a way to create a platform for sustainable, user- and community-driven innovation. The primary technical objective was to develop and field-test a simple, cost-effective, integrated e-business and telecommunication platform for user-driven mobile service development with active village volunteers (Gumbo, 2012b; Sibewu, 2010). The expected outcome was to provide a market for the global participating companies while local individuals would be able to expand their entrepreneurial activities.

Cooperation with the community utilized school-based computer centres and teachers, as community champions, who had proven to be able to take initiative to serve the community. The implementation would create valuable experience in building operations in an OUI setting where interests would be made apparent and negotiated for.

Methodology

This paper uses data gathered from stakeholder interviews at the particular moment of deciding how to determine the way to proceed in order to leverage the established collaboration goals in terms innovative and sustainable commercial solutions supported by global companies and sustain the social prerequisites of the local population. The rich interview data covers the initial process of OUI for ICT4D using a LL approach. Except for the academic team stakeholders were not familiar with the LL approach to innovation and interviews were a way to discuss its possibilities. Actors and stakeholders include representatives of development organizations operating at strategic level for local or provincial economic development. Other interviewees were representatives of innovation and research agencies, policy institutions in national government departments (DST) to raise their awareness of OI and LL facilitation of ICT4D projects. Users/innovators that were interviewed were the local volunteers who put their scarce IT or entrepreneurial skills at use for the community. These groups were all potential drivers, supporters, or beneficiaries of Cofisa LL initiatives.

Additional materials include notes on discussions at a national networking workshop organized by Cofisa in Pretoria in June 2008 to introduce LLs as a regional development mechanism. The workshop proposed to enhance OI and to set up a Southern African Network of LLs, which was prepared during the following years, and is not part of this study.

First, in the findings themes are extracted in terms of organizational perspectives dealing with implementing an OUI environment and with sustaining emergent creation in collective interaction. The themes emerge by bundling the multi-layered descriptions of interviewee experiences and responses. Their comments are grouped with regard to type of stakeholders, type of development contribution and innovation facilitation, as well as based on reactions to multiple goal settings. The interviewed groups differed in terms of strategic leadership, and positions of influence in regional development goals. The analytical approach is to create a narrative of adopting, or considering adopting OUI for development and managing multi-stakeholder participatory innovation facilities, such as LLs. The

analysis is informed by the 'push or pull' resource scheme and proceeds to extend it considering the innovation needs of emergent creativity and reflective practices applied to negotiating in multi-layered LL environments aiming as using innovation for regional development. The results and the analysis define action categories for OPI4D in LLs.

Findings

Pre-set organizational objectives

The main finding from the discussions with interviewees involved in the Siyakhula LL is the importance of understanding the orchestration of innovation projects, at project and systemic level. How development and research representatives depicted the rationale of their actions was tied to their pre-set organizational goals. Contextual knowledge of the areas to be developed was available and local needs were recognized, yet decisions followed the logic of organizational structures and narrow institutional objectives. With seemingly good intentions of avoiding risks and ensure improvements, projects prioritized the fulfilment of institutional pre-set strategic goals, even though the LL approach discussed in the interviews may have called for a collaborative rethinking.

Institutional organizational limits

Questions like 'Who owns the project?' were recurring in the interviews situations. While the worry prevailed to create adequate organizational settings, ironically the interviewees acknowledged that changes to mass user behaviour were often self-organized uses of technology, rather than 'controlled' parameters. Recognizing value in every party's specific knowledge contribution forms a leading principle of ICT4D, (Sterling & Rangaswamy, 2010) and is reminiscent of open innovation parameters. The interviews showed that this entrepreneurial and participatory vein was appreciated as an ideal of ICT4D. The interviewees expressed interest towards participatory practices and OUI interactions. They mentioned programs furthering capacity building and training towards this goal. They acknowledged the importance of a form of ICT4D that includes learning, research and innovation, and users, yet mechanisms for reflection and readjustment were unclear and their organizational measures could not go beyond the institutional limit. They could not envision how their organizations could reconcile their goal-oriented model and transform development processes into a still vague OUI process.

Divergent goals and collaboration

The regional coordinators agreed with thoughts of a holistic approach to developing services for communities including research, but a collaborative implementation was not pushed for in practice. Attention to divergent goals disturbed the relational aspects and potentially fertile collaborative practices. As a result, initially enthusiastic arrangements for service innovation including user communities, as users and providers, tended to lose momentum. A multi-stakeholder approach to reach the intended organizational or community specific goals was distracting. Interaction lacked compelling elements, or it was expected from other stakeholders. Commercial viability, or any attainable advantage through OI innovation, remained theoretically attractive, but practically suspicious.

Practical inclusion and methodological barriers

The setting up of the LL innovation development project lacked resource structuring to maintain pre-project implementation ideas. It turned out that the university research leaders had not visited the area and interacted with the users since the beginning of the project preparation. Though the reasons were not clear, hesitation in terms of the LL methodology played a role. While interviewees from the regional development agencies showed awareness of the possibilities of joint creativity with citizens, or citizens' roles as users and providers, and they assumed a positive systemic effect of this interaction with companies, the researchers in telecommunications were not confident with the open and participatory approach to innovation at practical level. Discussions on the collaboration between the telecommunication and computer science actors, who originally had been drivers of the LL, and the anthropology experts of the local universities revealed that the academic partners lacked the necessary mechanisms for interdisciplinary collaboration. Interdisciplinary perspectives were methodologically detached and focussing on real-life social and relational activities was not easy in practice. To accompany and supplement in the innovation of technical software development, the use of hardware and collective service production, specific skills were needed. User involvement in poverty environments was an additional challenge. The goal of the regional project was to set up a LL, yet practical knowledge of OI processes was missing.

Systemic considerations in ICT4D

Interviewees holding strategic positions in the region related to inclusive approaches positively, and considered that the networked and community centred models would bring improvement to ICT4D projects implementation. They were looking for ICT4D projects that would function as a push towards solutions to the digital operationalization among multiple actors, local and distributed. Interviews with the DST illustrated problems in achieving development goals because of unforeseen, yet revealing examples suggesting lack of interaction. For example, the DST interviewees presented a failure referring to computer equipped multi-purpose community centres (MPCCs) where cross-organizational interactions regarding basic maintenance functions had been overlooked, broken or missing chairs were unattended, and that became an obstacle to technology diffusion and training in MPCCs.

Systemic failures also included more wide-ranging examples of surprising social effects. For example, inclusive ICT development projects raised the perceptions of employment opportunities in urban areas. Hopes of employability through learning ICT skills caused migration from rural areas. The urban communities however, were not prepared for the influx of inexperienced population. Technical readiness for distributed services between urban and rural territories might have kept the rural population from migrating. Despite many innovative ICT4D initiatives implementation surprisingly gave minimal practical attention to the reality of rural and disadvantaged areas.

Also in the Siyakhula LL, unexpected changes in the involvement conditions of the international private stakeholders versus national companies presented a hurdle and a change in private interests. Projects' multi-actors relational roles began reshaping and delaying contributions, which in turn put the economic and regional development into question. For inclusion to put in motion the creation of new services and new technology locally, the local stakeholder needed to respond to new parameters for interaction. Interviewees perceived reforming of stakeholder collaboration was as a system risk in the LL approach.

Analysis

In interpreting the findings this analysis adopts a view grounded in reflective and relational knowledge domains such as the collective interaction processes of OUI proposed in the conceptual frame. While only one of the local researchers was a vital link to the user community, academics and regional officials were not involved in the collective interactions processes. Interviewees from all stakeholder levels (national, regional, and local) acknowledged an overall necessity for enhancing OUI in emerging LL initiatives. Curiosity for executing development through UI platforms was awakened, but viability could not be envisioned based on organizational properties. Leveraging tangible outcomes and OUI did not appear congruent.

The public sector representatives indicated with confidence that strengthening organizational structures was the way to achieve consistent implementation at grass root level. Consequently, we can say that a managerial view received high priority and was primary to relational, collaborative, and reflective actions enabling an open, participatory innovation approach to promote development (OPI4D).

The specific emphasis on UI, though appreciated, had little practical significance as potential evaluation criteria. Other than the expectation to secure project goals there was little thought about new relevant ways of assessment. Solving traditional organizational imbalances was the preferred mode to tackle development projects implementation, while innovations in LLs were not convincingly imaginable in practice. The interviewees could not (yet) position the novelty of LLs as they constantly encountered development projects where the local population is addressed. The themes exposed in the findings and listed below indicate that the obstacles to potentially rethink development projects are managerial, practical, methodological, and systemic:

- Pre-set organizational objectives,
- Institutional and organisational limits,
- Divergent goals and collaboration among stakeholders,
- Practical inclusion and methodological uncertainties,
- Systemic failures of ICT4D.

These shortcomings can be categorized in terms of problems in communicative resources (interaction capability and relational competence) and of practice orientation (emergent creativity and reflective practices). This study interprets the extracted ‘obstacles themes’ in development environments as the unresolved challenge of opening up innovation and deal with open-ended processes, capture evolving processes based on reflecting and learning, and dynamically redirect interactions based on changing needs of participants and stakeholders.

Hämäläinen (2008) proposes user driven ‘pull approaches’ that are flexible in accommodating diverse providers. He encourages the use of the resources consumers make available, and von Hippel (2017) examines the extensive resources set free by user innovation under the concept of free innovation. From left to right, starting with a closed push approach, Table 1 presents a progressive opening up of core factors in releasing resources moving towards increased participation and openness. The highlighted columns specifically refer to OUI and LLs in development as proposed ways to respond to the ‘obstacle themes’ in the findings.

Table 1: OPI4D (open and participative innovation for development)

Push Programs	**Pull Platforms**	**Push-Pull Negotiations**	**OPI4D**
Demand can be anticipated	Demand is highly uncertain	Demand is co-created	Use and demand co-designed
Top down design	Emergent design	Cyclic design	Reflective design
Centralized control	Decentralized initiative	Multi-layered initiatives	Looping initiative coordination
Procedural	Modular	Networked, interdependent	Networked, dynamic interaction
Resource centric	People centric	Innovation centric	Meaning centric
Participation restricted, few participants	Participation open, diverse multiple participants	Participation negotiated, multi-layered interaction	Participation as shared reflective process
Efficiency focus	Innovation focus	Systemic orientation	Practice and situated focus
Limited number of major re-engineering efforts	Rapid incremental innovation	Entrepreneurial and social innovation	Entrepreneurial, social, thus sustainable innovation
Zero sum rewards, extrinsic rewards	Positive sum rewards, intrinsic rewards	Alternating intrinsic and extrinsic rewards	Multi-layered incentives and rewards

Leaning on *Hagel & Seely-Brown (2008) and extended from Hongisto & Enkenberg (2010).*

OPI4D provides ICT4D with a focus on OUI in LLs as platforms that enable participatory and relational stakeholder processes. Answering local everyday situational needs through UI creates a pull that manages participation differently than the prevailing push approach. For private stakeholders this secures use, which enables preconditions for demand, scalability of innovations, and economic relevance. The aim of OPI4D key concepts is to prompt and maintain specific open processes creating new pathways for development.

In order for stakeholders to be equally motivated reflective processes can assist with readjustments or reaffirmation of goal orientation. Looping initiative coordination is a way to handle divergent goals, level out methodological uncertainties, or provide support to solve the recognized obstacle themes. A core focus, similar to project appropriation, is a key driving factor for development projects, and this was noticeable when interviewees narrated passionately about their projects and their specific objectives.

To position OPI4D as 'meaning centred' is a means to provide orientation for solving emerging instability challenges, or divergent goal settings disturbances, that can disrupt goal specific actions. Grasping and creating the meaning of consistently including users around a situated focus, suggests interactions that imply training, learning, and sharing. Thus, OPI4D as meaning centred resource orientation provides the opportunity for relieving the pressure to overcome the typical short-term nature of collaboration for development projects, and to warrant emergent alternative paths for reaching development goals. A focus on meaning negotiation, supported by communication in on-going interaction positions participants, developers, users and other stakeholders at equal level of interaction. In practice, these actions back sustainability and viability.

Discussion

This paper examines the attempt of setting up innovation platforms using a LL approach in international development, the aim is to enhance understanding on the role of open innovation in regional development. This extends the literature on OUI to include a regional development view. It also sheds light on possible barriers for OI and LLs as catalysts for regional development. In the specific context of the Siyakhula LL initiative, UI was part of basic research and development framework. The academic partners, international development stakeholders, private companies and individual users jointly participated in local activities towards user-generated solutions. During the stage of the observed process, the assumed strength of the initiative relied on the balance of stakeholder commitments to create sustainable foundations for a functioning LL in users' living environments. Individual, community, public and commercial interests were in a stage of re-negotiation as a looping cooperation needed to be kept in motion. In principle, and provisionally, the municipal, provincial, and national authorities that were interviewed were willing to support the activities further. In practice, this was not straightforward, due to unclear measurements of achievements and to changing commercial partners.

The OPI4D frame of action provides the flexibility of an ecosystem that presumably nurses the resources to support development projects when they encounter unexpected market mechanisms that affect implementation. Though OPI4D does not determine ownership in a project a 'looping initiative coordination' suggests that orchestration does not terminate when the project is faced with change. Instead, stakeholders reflect and reassess development goals and negotiate a new loop to the initiative to sustain user participation and innovation. OPI4D's vision is to move from a centralized ownership of development towards distributed, interactive, open innovation, in development regions.

The added value of OPI4D is not only achieved by creating research infrastructure, user input spaces, and governance or business mechanisms through a platform fostering stakeholder participation. OPI4D requires the stakeholders to focus on a solid basis of user groups interactions and relational practices with stakeholders. While multi-level stakeholder interactions may have already been a fundamental part of development projects in ICT4D, foregrounding ready ICT-enabled services to be tested and diffused easily sets off insights and ideas emerging in interaction with local users as innovators. OPI4D's potential is to tap into everyday consumption as well as into complex localized systems of knowledge. Dealing with the 'obstacle themes' exposed in this study and adopting the OPI4D resource dynamism in the development context would free resources for working within an innovation ecosystem. For this a LL setting would help, it would achieve a buffer of resources towards sustainability in implementing.

Implications and further research

Issues that lie beyond the realm of technology-push require dialogue on a wider social innovation basis that surpasses an industry – policy innovation relationship. OPI4D suggests that the role of users in innovation constantly be revised and practices be reflected upon as part of OUI and LLs. The OPI4D mechanism calls for placing less emphasis on measuring quantitative diffusion of ICTs and more on assisting development areas towards an active and creative role in the regional and national innovation with users. This means a step back for government and industry in their role as providers, and it requires a strong turn towards coordination as a relational competence and interaction capability.

Simultaneously it means a step towards an equal ground in an open innovation setting for local user participation and commercial (western) involvement as interactive response to emerging uses, applications, and processes innovated with users. Consequently, OPI4D supports the inclusion of marginalised areas into OI and OUI concepts.

Implementing *emergent creativity* and *reflective practices* as the paper suggests through OPI4D necessitates a clear understanding of the iterative and interactive practice of LL innovation processes. Long-term implementation needs a sustained emergent creativity. What follows is a need to counterbalance a development discourse where the areas to be developed are passive receivers, be it in practice, or in theoretical models of interaction, usually offered as intervention. Attention needs to be given to the gaps in innovation management and regional development studies.

Discussions with stakeholders however, did not yet lead to questioning the paradigm of ICT4D itself. The interviewees recognized collaborative platforms for innovation including users as crucial in development based on the existing knowledge of how communities would benefit from being part of the value chain of new business and service models. However, they recognized that mechanisms were missing in their own institution for OUI. Research is needed to understand efficiency in interactions and relational realities in the practice of LLs and thus securing speed in reaching fruitful reciprocal business opportunities through OUI to induce changes in everyday practices as outcomes of regional development.

Conclusions

The paper studies the potential of OUI as a guiding practice for participatory, user-driven models of innovation as implemented in LLs for regional development and ICT4D. Conceptually this paper frames innovation in LLs around collective interaction capability and relational competence, as sets of managerial skills to generate resources that are central to OUI and are specifically useful in side-lining prevailing technology-push approaches in development serving mainly global company aims to open up new markets. Based on experiences among project leaders for technology development cooperation between Finland and South Africa, this paper identifies 'obstacle themes' in the practice of regional development through user innovation executed in LLs. The study found a managerial gap between understanding and practicing OUI. Stakeholders perceived OUI as a crucial element for development, but stumbled on organizational limits to achieve viable results in the life and activities of users and citizens through LLs. The intermediary processes of OPI4D suggested in this paper aim to provide a way forward.

In the end, what we understand conceptually as participative innovation for development with users is, at systemic level, a change in discourse in regional processes. It implies a rethinking of innovation for development, which so far served the industrial search for competitiveness.

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Spatial Analysis of Leading Circular Economy and Living Lab Cities

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Abstract

This study presents the preliminary results of the *"Cities as Living Labs — Increasing the impact of investment in the circular economy for sustainable cities"* study by Santonen et. al. (forthcoming) which is to be published in late summer 2017. From innovation system and policy development point of view, it is vital to understand the impact and added value of EU-funded projects especially in context of the complex societal challenges such as circular economy in cities. By using publically available data sources the aim of this study is to A) map cities which have elaborated and implemented urban strategies relating the circular economy either by themselves or with the help of EU-project funding and B) to describe how these cities mobilise and interact with Living Labs. As a result, a strong correlation with urban strategy and EU-project activities was detected. Also, a weak correlation between Living Lab maturity and EU-project funding as well as Living Lab maturity and Urban strategy activities were detected. The TOP 10 cities executing urban strategy in circular economy, acting as a forum for EU-projects or having Living Lab activities is presented, which revealed that city of Barcelona was by far the leading city in Europe.

Keywords: Circular Economy, Living Lab, EU-funding, Urban strategy, Spatial analysis, Geographical mapping

1 Introduction

Innovations are vital to European competitiveness and therefore the EU is investing significantly in research and innovation through various funding instruments such as Framework Programme for Research and Innovation. From innovation system and policy development point of view, it is vital to understand the impact and added value of these investments especially in context of the complex societal challenges such as circular economy in cities. Circular economy promotes the idea that waste-output from a one actor can function as a valuable input to another actor e.g. in terms of raw material or energy and lead to environmental benefits by reducing intake of virgin material and/or reduced emissions (Graedel and Allenby, 1995). By definition circular economy therefore promotes resource minimisation and the adoption of cleaner technologies (Andersen, 2007) while maintaining the value of products, materials and resources in the economy for as long as possible and minimizing waste generation (European Commission 2015). The ultimate goal in circular economy is to generate economic growth without environmental pressure.

According to European Network of Living Labs (ENoLL), LLs are open innovation ecosystem based on a systematic user co-creation approach that integrates public and private research and innovation activities in communities, placing citizens at the centre of innovation. In this study LLs are considered as early markets for innovative products and services by consisting of advanced, risk-resilient consumers, innovative public/private procurement with open innovation dynamics. Furthermore, from an EU-level perspective, LLs existing in various locations across Europe offers a different social, legal, and cultural settings to explore and test innovative solutions in variable environments.

The number of LL have been steadily growing since the launch of the ENoLL about ten years ago. Historically there have been nearly 400 official recognised LLs across the world and currently there are 170 active Living Lab members in ENoLL. However, compared to traditional innovation research themes such as product, process, market or organizational innovation derived from Schumpeter (1934) typology, the maturity and evolution of LLs research is still in infancy. Many LL studies have more or less grounded on single or combination of few case studies which is typical approach when a particular research stream is still evolving strongly. Studies such Schuurman et. al (2016) are welcome exceptions since they are exploring the value of a LL approach for SMEs by comparing 27 projects. However, all these projects were conducted by single LL, which do not fully recognize the heterogeneous social, legal, and cultural conditions which are existing across Europe. Furthermore, the studies focusing on the impact of LLs at the city level are rare. Few pioneering studies are existing such as a comparative case study of three Asian and two European cities by Hu et al. (2016) and a snapshot of five case studies how the Urban Living Lab (ULL) concept was operationalised in urban governance for sustainability and low carbon cities (Voytenko et al. 2016). As a result, it is argued that there is a significant research gap relating (comparative) studies which are evaluating LL approaches and impact at European level. Therefore, the aim of this study is to A) map cities which have elaborated and implemented urban strategies relating the circular economy by using publically available data sources and B) to describe how the cities mobilise and interact with Living Labs.

2 What is Circular Economy?

Recently Ghisellini, et al. (2016) conducted an extensive review of the circular economy literature in order to define the main features and perspectives of circular economy including the origins, basic principles, advantages and disadvantages, modelling and implementation at the different levels (micro, meso and macro) worldwide. According to their study following observations were made:

- Circular economy roots are mainly being derived from ecological and environmental economics and industrial ecology.
- Both top-down national political objectives and bottom-up environmental and waste management policies have been applied.
- The implementation of circular economy is still in the early stages, but important results have been achieved in some sectors (especially in waste management). However, activities still mainly focus on recycle rather than reuse.
- Transition towards circular economy requires the involvement and capacity of all actors of the society to create suitable collaboration and exchange patterns
- Circular economy implies to A) the adoption of cleaner production patterns at company level in a way that an economic return on investment is gained to motivate companies and investors; B) increasing producers and consumers responsibility and awareness, C) using wherever possible the renewable technologies and materials and D) the adoption of suitable, clear and stable policies and tools.

Albeit, many dimensions for circular economy can be defined and identified, in this study a circular economy in cities is argued to cover one or several of the three following dimensions:

1. **Sustainable use of resources, natural and cultural capital** (e.g. waste management, urban mining, up- and re-cycling, new business models) (Dalhammar, 2016),
2. **Circular mobility** (i.e. offering more choices of mobility and promoting vehicles which can be shared, electrified, autonomous, multi-modal and looped) since transportation is a major contributor to climate change but efforts at reducing emissions in this sector has been challenging (Cruz and Katz-Gerro, 2016) and
3. **Resource efficient buildings and urban spaces**, since buildings causes 40% of Europe's energy consumption and globally it varies from 16 to 50% of total worldwide energy consumption (Pombo, Rivela and Neila 2016).

3 Research methodology

3.1 Unit of analysis – Selecting cities

In 2012, the OECD and the European Commission published a new definition of a city (Dijkstra and Poelman, 2012). This new definition is based on the presence of an 'urban centre', a new spatial concept which is purely based on population size and density instead of functions, funding or feudal history which can lead to problems when conducting cross-country comparison. To qualify as an 'urban centre', city must have a density of more than 1.500 inhabitants per sq km and more than 50.000 inhabitants. However, this study mainly focuses only on European cities having over 100.000 inhabitants (N=517), but the sample can include also cities less than 100.000 inhabitants in urban area since by some data sources a city is defined by administrative border instead of urban centre. A city selection was conducted according to following rules:

1) City has **an official urban strategy** with objectives to achieve one or several of the prior defined three dimensions of a circular economy,
2) Sample **cities represent different size** in terms of population and follows the population categorisation of Eurostat [i.e. A) cities having 100.000-250.000

inhabitants, B) having 250.000-1 million inhabitants, C) having 1 to 3 million inhabitants, and D) cities larger than 3 million inhabitants],

3) The **geographical location** of the cities includes cities in Central Europe, Western Europe, Eastern Europe, Southern Europe and Northern Europe. Unfortunately, there are several different approaches to define European sub-regions and therefore a country can belong to a different sub-region depending on a classification schema. As a result, various country grouping does not fully match. The county classification used in this study is presented in Appendix 1: Geographical classification of Countries.

3.2 Data collection and construction of measures

Data sources were classified into following three categories: 1) EU-funding, 2) Urban strategy, and 3) Living Labs.

EU-funding: CORDIS database was used to identify all the relevant FP7 and Horizon 2020 projects which thematically focused on various circular economy and/or Living Lab themes. Seasoned EU official executed the search by using circular economy and Living Labs related keywords. In all this search resulted 137 FP7 and Horizon projects. Next the participants profiles, objective descriptions from Cordis database were analysed to acquire for more detailed information about the project as well as well as the project's websites (N=101) when they were still available. As a result of this analysis in a project, a city could have following different roles which was defined as a reference to a project: 1) beneficiary, 2) lighthouse city, 3) follower city, 4) benchmark city, 5) observer city, 6) demonstration city, 7) case study city or 8) pilot city.

Urban strategy: The following web services which are known to focus on urban strategies or circular economy were evaluated in order to detect the maturity of urban strategy in city: Covenant of Mayors for Climate and Energy, Sustainable Cities Platform, Urban Innovative Actions (UIA), The European Green Capital Award, The European Green Leaf, European Innovation Partnership on Smart Cities and Communities Market Place, The Circular Europe Network, The Reference Framework for Sustainable Cities (RFSC), The European Capital of Innovation Award (iCapital), The Open & Agile Smart Cities initiative (OASC), The Ellen MacArthur Foundation, ICLEI - Local Governments for Sustainability, Eltis, C40 Cities Climate Leadership Group and EUROCITIES. Depending on the data source the following approaches were utilized to define an Urban Strategy measure: A) a city has a membership or signatory profile (or is a member of initiative) or B) is present in a case study or project, which was listed in the given data source website. Furthermore, if city had participated on multiple activities (e.g. in multiple projects or cases) each activity resulted one point. Then all the points were summed up which was used as an indicator of urban strategy intensity.

Living Labs: The list of ENoLL's effective members were used identify LL locations and their thematic areas. The Living Lab age in years, the number of different Living Labs and different thematic areas were used as indicators to measure the Living Lab maturity in a city. Furthermore, FP7 and Horizon 2020 projects having clear Living Lab focus, were also identified from CORDIS database in order to evaluate the LL and circular economy related EU-project ratio.

4 Results

4.1 FP7 and Horizon 2020 project distribution across the Europe

Over half of the FP7 and Horizon 2020 projects focusing on Circular Economy or Living Labs (N=77, 56.2 %) included a reference to a city, while for 43.8 percent of projects (N=60) a city reference could not be found. In Figure 1 the cities having 2 or more project references are mapped on the European map. The size of the blue circle is indicating the number of references (i.e. bigger the circle, more project references).

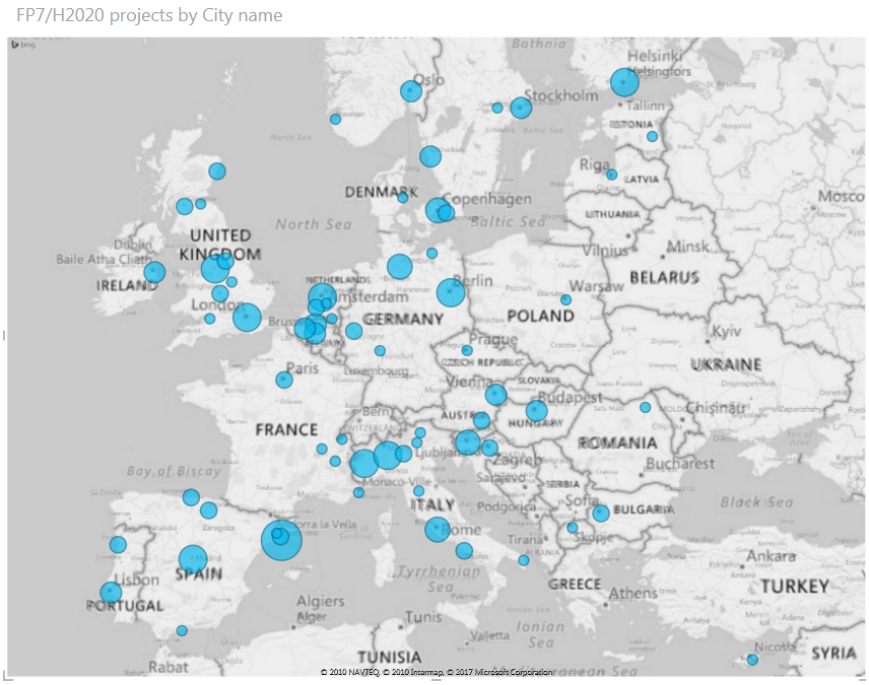

Figure 1: Cities having 2 or more project references

As a result, City of Barcelona by far was the most active city with 11 references. Furthermore, the first position of Barcelona's can be regarded even stronger since Sabadell with 3 references is only about 30 kilometres and Manresa with 2 references about 60 kilometres from Barcelona. In Figure 1 Sabadell and Manresa circles are masked below Barcelona's circle. The next best position was shared by 8 cities (Amsterdam, Berlin, Helsinki, London, Madrid, Manchester, Milan and Turin) which all had 6 projects. Third position was shared by Copenhagen, Hamburg, Ljubljana and Rome which all had 5 projects. Among the top three cities, South Europe had 5 cities (Barcelona, Madrid, Milan, Turin and Rome), North Europe 2 cities (Helsinki and Copenhagen), West Europe 3 cities (Amsterdam, London, Manchester) and Central Europe 3 cities (Berlin, Hamburg and Ljubljana). The best East European city was Sofia, which shared the 5th position with 16 other cities.

When a city reference to a project were evaluated in terms of South, North, West, East, Centre and Non-Europe countries it appeared that 21 projects (26.6 %) were executed only in one region, 27 projects (34.2 %) in two regions, 15 projects (19 %) in three regions, 10 projects (12.7 %) in four regions and 6 projects (7.6 %) in five regions. None of the project included all six regions.

4.2 Urban strategy activities

In Figure 2 the cities activity level in urban strategy (yellow colour) is mapped together with project reference activity (green colour). The similar notation as in the case of project reference was used (i.e. bigger the circle, the more activities). However, in some cases (e.g. Barcelona) the green circle (project reference) is masking the yellow urban strategy circle.

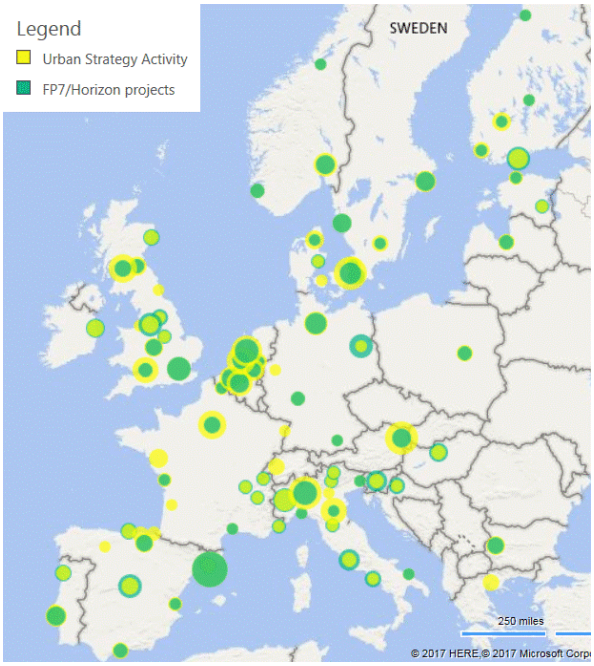

Figure 2: Top cities having active urban strategy and Cities having 2 or more project references

The visual examination of Figure 2 suggests that cities which having an active urban strategy has also acted as a forum for FP7 and Horizon projects. The correlation analysis between project reference and urban strategy measures validated this assumption and there is a clear relationship between these two measures (0.753, sig. 0.000).

4.3 Living Lab activities

In Figure 3 the most mature Living Lab (grey colour) cities are mapped together with project reference activity (red colour). The similar notation as in the prior Figures were used (i.e. bigger the circle, the more mature/active). Also in this case Barcelona's projects are masked by Living Lab maturity measure. The visual examination of Figure 3 suggests that there is a weak relation with Living Lab maturity and project references but clearly not strong as in the case of urban strategy measure and project reference. The correlation analysis between project reference and urban strategy measures validated this assumption since correlation between Living Lab maturity and project reference was 0.290 (sig. 0.000). There was also a weak correlation between urban strategy activity and Living Lab maturity (0.311, sig. 0.000).

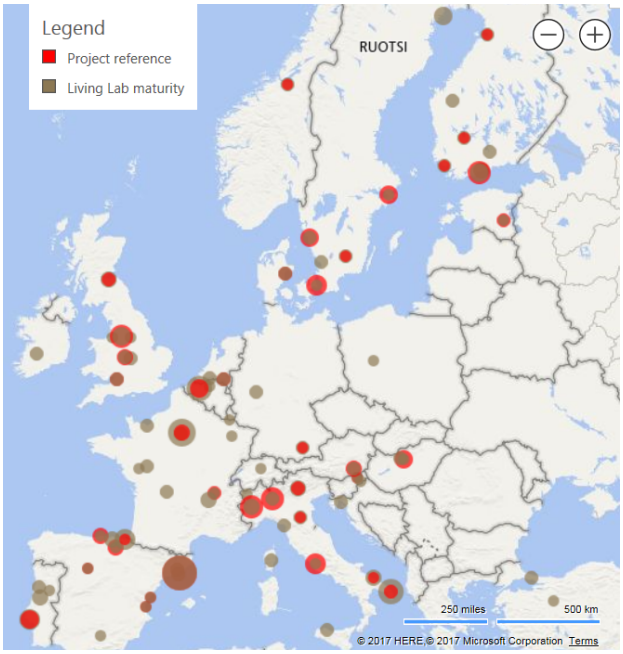

Figure 3: Most mature Living Lab cities and their EU-project references

4.3 Leading cities

In **Error! Reference source not found.** the TOP 10 cities executing urban strategy in circular economy, acting as a forum for EU-projects or having Living Lab activities are presented.

Table 1: Forerunner cities in Circular Economy

Name	Urban Strategy activity	EU-project activity	Living Lab maturity	Total
1. Barcelona (ES)	42	11	33	86
2. Paris (FR)	23	3	27	53
3. Brussels (BE)	44	4	0	48
4. Turin (IT)	25	6	14	45
5. London (UK)	35	6	0	41
6. Gent (BE)	13	4	23	40
7. Amsterdam (NL)	28	6	5	39
7. Milan (IT)	22	6	11	39
9. Lisbon (PT)	13	4	19	36
10. Gothenburg (SE)	20	4	11	35
10. Helsinki (FI)	12	6	17	35

As a result, the clear winner is Barcelona with 86 points. Furthermore, Barcelona has the highest score in Living Lab maturity (33) and EU-project activity (11) and second highest score (42) in urban strategy. After Barcelona, the close runner-ups are Paris (53 points) and Brussels (48), which however have very different profile. Paris has high living lab maturity but is not as strongly present in various web sites which highlight urban strategies. Brussels profile is just opposite to Paris and the city do not have ENoLL's effective member Living Lab. Also, the firth ranked city London do not have any ENoLL's effective members. City of

Amsterdam is also having a bit different profile since it has only recently activated in ENoLL network. Finally, the only smaller city in the list is Gent which has about 250.000 inhabitants in the urban centre.

5 Conclusions

By using publically available data sources this study conducted a spatial analysis of European cities which have elaborated and implemented circular economy strategy either by themselves or with the help of EU-project funding. Furthermore, it was also described how these cities mobilised and interacted with ENoLL Living Labs. As a result, it was found out that cities which had implemented active urban strategy, had often also been a forum for EU-projects either as beneficiary, lighthouse city, follower city, benchmark city, observer city, demonstration city, case study city or pilot city.

However, evaluation of the urban strategy activities derived from fifteen well known websites focusing on urban strategies or circular economy did not included in-depth content analysis. Therefore, it might be also possible that these particular web forums were also used as a dissemination channel for EU-projects. If that would be the case, then the EU-funding would play even more significant role in implementing the circular economy strategies in cities. If not, then this result would reveal that the cities participating in EU-projects are also promoting circular economy with other public and private funding sources. This additional funding will then help building up the capabilities needed to gain highly competitive EU-projects where the success rate is often marginal. The underlying assumption is that the leading cities are moving forward in many frontiers while the EU-funding is helping them to increase the gap to other cities.

Most importantly there is clear gap between Eastern and other European cities. Disseminating and transferring the knowledge between the forerunners, followers and laggards appears to be challenging. Therefore, it is suggested that forthcoming Framework Programme projects would better highlight the cross European participation. In this scenario Living Labs could play a significant role, if they play their cards right. So far ENoLL Living Labs have partially missed opportunities to participate Framework Programme projects even in the circular economy projects which by definition would be the nearly a perfect match to Living Lab methodologies. The results revealed only weak correlation with Living Lab maturity and EU-project references and urban strategy activities at city level. As argued in the introduction, in best case scenario Living Labs could offer systematic methodologies for evaluating novel innovations in different social, legal, and cultural. Currently the other approaches in the market are generating a better offering for EU-projects and therefore ENoLL member's market share has remained modest. Evidently only the strongest cities such as Barcelona are sufficiently attractive while other Living Lab cities need to find new ways to enhance their offerings to EU-project consortiums as well as to cities which are actively pursuing towards circular economy.

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Service Blueprint Model: A Tool to Improve the Co-Creation Process in Living Labs

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Abstract

Living Labs (LL) are complex multi-stakeholders ecosystems of innovation. When co-creating a service, each actor has his own strategic agenda. Finding a common ground for co-creating a service is not an easy task and requires tools to facilitate and structure the reflection.

This paper examines how "service blueprinting" techniques can contribute to improve the co-creation process in a living lab setting and develop a common ground. To our knowledge, this service development method has never been tested in a living lab process and no integrative analysis of this case has been conducted so far. The aim of this paper is to test this tool, thus creating bridges between service design (SD) science and Living Labs.

To test this process, a first generic blueprint of the existing service has been designed, before organising a multi-stakeholder focus group, based on the Quadruple Helix Model, in order to develop the new service. The context of the case study is to develop a service to facilitate the energy transition but it could be tested in different sectors as well.

The main findings are that the combination of these two approaches (LL and SD), launches the dialogue, contributes to set a common vision in a multi-stakeholders' ecosystem and forces the participants to integrate implementation constraints right from the beginning of the co-creation process. Even though Living Lab approaches are employed rather upstream of the innovation process and blueprinting methods more down-stream, top-down planning and bottom-up participation could be complementary when combined.

Keywords: service design, blueprint, open innovation, living labs

I. Introduction

Living Labs (LL) are complex innovation ecosystems. It is often hard to find a common ground in a multi-stakeholders context in order to co-create, as each actor has his own strategic agenda. Dimitri Schuurman proposes to analyze the Living Labs as three distinct parts: (1) macro level, composed of the innovation ecosystem of actors, (2) meso level, with the co-creation project as a focus and (3) micro level composed of the tools to facilitate the co-creation process (2015). As he describes it, these layers are interconnected.
Related to the last level of analysis, the question can be the following: What are the methodological tools to facilitate the service generation in a co-creation project with multiple actors? To answer this question, each LL practitioner brings with him specific tools from different disciplines, which enrich the interdisciplinary community with new methods. The Service Design (SD) science has also developed methodological tools such as the service blueprint, which is a drawing of the service experience involving all important actors. It enables the designer to model precisely the touchpoints of the customer journey (i.e. interaction between clients and providers). The aim of this paper is to test the blueprint model in situ with multiple stakeholders, in a quadruple helix configuration.

This paper is structured as follow: a thematic review of the literature explores the different literature streams namely Open Innovation, Living Labs, Co-creation and Service design. Then, the qualitative methodology is described. The test of the blueprint is proposed as a case study in a living lab project design. The main findings are then described and discussed. In conclusion, future researches on the thematic are proposed as well as limits of this paper.

II. State of the Art

A. Open Innovation

In response to difficulties encountered by firms to innovate in closed environments, a new type of Innovation has progressively emerged in 2003: the « open innovation » approach. As explained by the father of this theory, Henry William Chesbrough, in his first book *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Open innovation principle is a paradigm. It assumes that firms should use internal and external ideas to create value, as well as internal and external ways to reach new or existing markets (Chesbrough, 2006, p. xxiv).

Approximatively 10 years after the first book on the subject, a more precise definition is proposed comprising previous researches in this field: « we define open innovation as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model. » (Chesbrough, Vanhaverbeke, & West, 2014, p. 15)

Thus, researchers have found that the term «open» can be used when information or concepts resulting from the innovation process are considered as a public good and are not retained in the closed environment of a company or any organizations (Baldwin and von Hippel, 2011, p. 1400). In this case, the boundaries of the organization become permeable and let the information flow go through them. Moreover, in the previous definition, the term « innovation » refers, for the authors, to the « development and commercialization of new or improved products, processes, or services » (Chesbrough, Vanhaverbeke, & West, 2014, p. 15).

Open innovation processes usually involve the end users of the product or the service the organization wants to develop or improve. In this case, advantages for a firm, among others,

is that involved users can imagine and develop exactly what they want, without intermediaries (von Hippel, 2005, p.64). Open principle allows involved users to become co-creators while encouraging them to share and build on other's people ideas; hence we can affirm that this innovation process becomes user-centred reducing the failure rate at the market and increasing user-acceptance of new products, services or processes (Bilgram, Brem, & Voigt, 2008, p. 2).

Regarding the theme of this study, the present paper will focus more on the processes or services improvement that are using user-centric techniques than on physical products. According to Lusch & Vargo, the intrinsic function of goods is to deliver service as customers only pursue added-value (Lusch & Vargo, 2014). In this way, the goal was to explore what could be the fertile ground that would offer an ideal environment for an open innovation approach in living lab research context.

B. Living labs

The Living Lab approach seems to be an interesting proposition in terms of innovation because, as defined by The European Network of Living Labs (ENoLL) founded in 2006, «Living Labs (LLs) refer to user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings» (ENoLL, 2015, p.12).

In order to clarify this definition, Almirall & Wareham explain that LLs are research processes driven by two main concepts. The first consists in involving users, early on, in the innovation process. The second promotes experimentation in real world settings, aiming to provide structure and governance to user participation in the innovation process (Almirall & Wareham, 2011, p.2). This approach proposes environment's configuration framework applicable to Living Lab approaches.

Aiming to specify the existing arrangements used by the current Living Labs, Schuurman proposes to make a distinction between three different levels of analysis in LLs: a macro level (the Living Lab constellation), the meso level (consisting of a Living Lab innovation project) and the micro level (consisting of the different methodological research steps) (Schuurman, 2015, p. 185). However, the three levels are interrelated: macro level conduct innovation projects that are more included in the meso level by promoting user-involvement and co-creation. Moreover, all innovation projects include research steps that are led in the micro level (Schuurman, 2015, p.201).

C. Co-creation and Quadruple Helix Model

For this study, researchers were particularly interested by the highest level of analysis: the macro one, which consists in assembling multiple stakeholders, around the same problematic, in an open innovation ecosystem. This innovation concept was already exposed by Westerlund & Leminen (2011, p.20) who define living labs as: "physical regions or virtual realities, or interaction spaces, in which stakeholders form public-private-people partnerships (4Ps) of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts". This definition introduces a new dimension in terms of the internal dynamic promoted by living labs: the importance of the diversity among the actors of the collaborating. If we deeply explore these public-private-people partnerships underscored by Westerlund & Leminen, we can state that another model could represent this kind of development: The Quadruple Helix model.

The Quadruple Helix Model is the evolution of the Triple Helix model, which showed the link between three main entities (called "helices"): academia, government and industry. The idea was to encourage the collaboration of these institutional spheres in order to create new knowledge, technology, products and services (Etzkowitz & Leydesdorff, 2000, p.112). However, according to the open innovation principle previously presented, one important side seemed to be missing in this model. This gap has been recently corrected with the creation of an innovation model that finally includes a fourth "helix", the public. The word "public", in context of the Quadruple Helix, means all aspects related to the civil-society, culture, values and lifestyles, creativity, media, art, etc. (Carayannis & Campbell, 2011, p.338). The choice of adding the users in the innovation process proposed by the model seems to be relevant, considering the wide use of user-oriented innovation strategies.

According to Arnkil et al. (2010), from the Quadruple Helix (QH) perspective, LLs are an interesting innovation approach because "all four important actor groups of Quadruple Helix model are actively present: users, firms, public research organizations and public authorities".

In order to create tangible solutions in an ecosystem of actors that are using open innovation approaches, a LL needs recognized techniques and tools. For these reasons, and as the following study case concerns a Swiss subsidies service, the authors wanted to explore the use of the Blueprint Model whose reputation is firmly established in the service design domain.

D. Blueprint: a service design tool

In today's rapidly technological and economic advanced society, users and consumers associate a product with a service. Service experience has the potential to generate added satisfaction than just simply the product itself. This recent information cultured society, R&D in design is more oriented towards the intangible aspects of services. Researchers have studied the progressive emergence of e-services as, unlike in the manufacturing industries, both process and product outcomes are transparent to the customer. In fact, service customers are naturally involved in the co-production/service delivery and they concurrently assess both process and the products in their quality evaluations (Field *et al.* 2004). Research shows that to achieve an ideal service quality, it is crucial that customers and service providers collaborate and interact. Depending on their engagement in a service, customers can take different roles. For example, they can become a simple user or a co-creator when they interact with companies (Bolton *et al.* 2014). According to Bilgram et al. (2008) (mentioned by Schuurman, 2015), the added value of end users' involvement in the innovation process depends on different characteristics. These key points are the following: (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, product related knowledge, etc.), (3) extrinsic & intrinsic motivation, (4) extreme needs and circumstances of product use, and (5) opinion leadership and word-of-mouth.

Unfortunately, while the abilities of the service providers to understand users' needs and expectations remain uncertain, users also find it difficult to express their idiosyncrasies in an effective manner (Ylimäki-Vesalainen, 2015).

A well thought service design impact positively the interaction and experiences: people-to-people, people-to-system and people-to-environment. The outcome of a service related problem solving can be modelled through a service blueprint. Service blueprinting, representing the complex relationships among humans, products and processes, allows for

the accurate description and mapping of service system so that all participants can easily and objectively comprehend the operation of the business process (Wang *et al.* 2017). This effective tool, that illustrates the overall service architecture, help companies to establish and improve the modelling of their operations while formulating the individual responsibilities and roles of all stakeholders involved in the service system (Shostack, 1984). Through a service blueprint approach, the management can study possible errors and identify points of failure and weakness in the process to therefore improve or conduct a service design (Lee *et al.* 2015). Touloum-Idoughi (2013), using a service blueprint, showcased the interaction flow between stakeholders and the service activities and highlighted a significant and beneficial experience for all actors involved in crisis management industries especially in technological disruptions. Is this tool adapted to the co-creation phase in a complex, multi-stakeholder ecosystem?

This question outlines a research gap, as no relevant article appears on Google Scholar by combining the terms "Living Labs" and "Blueprint model". Moreover, in their document *"L*iving *Lab Research Landscape"* Pallot et al. (2010) does not mention the Service Design domain in their matrice. Thus, this gap will be explored in this applied research.

III. Methodology

In order to test the blueprint model as a co-creation tool in the service design phase of a LL project, a descriptive case study is proposed. This method does not allow generalisation of the findings but is a first exploration of the usefulness of the tool in situ.

We have selected a service that needed a thorough rethinking process in the actual context of energy transition: subsidies for new renewable energy production. The detailed context will be described below in the case study.

A group of stakeholders has then been selected according to the Quadruple Helix Model representing a mix of each sub-group: public institutions, private companies, consumers, and scholars. To collect qualitative data on co-creation, we have organised a focus group. It allows the stakeholders to exchange views and share ideas without intermediaries. The idea was to reunite them during 1 hour and 30 minutes and to initiate a dialogue in a co-creation approach.

Consequently, the following methodological steps have been applied:

1) Sending of the invitations with short description of the objectives, of the study's subject and the topic. No information was given about the blueprint model that we wanted to work on.
2) On the agreed day: presentation of each participants and brief introduction.
3) Presentation of the simple flowchart model with basic information.
4) Presentation of the complete blueprint with a general explanation of the reading grid.
5) Listening and data collection. Main objectives: (1) taking notes on the perceived initial situation, (2) writing common problem statement, (3) moderating and sometimes (4) reopening the discussion.
6) Explanation of the final goal of the meeting: creating the blueprint of a new service that will support the transition to a new energy subsidy system.
7) Completion of a blank blueprint with the intervention of a moderator.

8) Feedbacks collection about the discussion, the method and the feeling the participants had when using the blueprint technique.

Through this focus group, we wanted to test the blueprint model in a Living Lab research environment to enhance the co-creation spirit and to find new solutions. In a more general point of view, we wondered if the blueprint technique could help reach a common vision within an ecosystem of actors in the process creation of a new service.

IV. Case Study

A. Context

Switzerland has fixed high objectives until 2050 toward better energy production and consumption. To understand the current energy transition, it is important to differentiate two notions: “the renewable energy” and the “new renewable energy (NRE)”. The expression "new renewable energies" recovers all the renewable and non-traditional sources of energy. The current energy transition will be characterized in particular by a large-scale use of the "new renewable energy (NRE)" that necessitate public grant to be adopted by the population.

If Switzerland seems to have understood the importance of an energetic change, the part of the new renewable energy consumed in 2014 (without the hydroelectric energy) was only of 3% of the country’s consumption. This rate will probably remain under 5% for 2017 (OFEN, 2016, p. 5). In comparison with the other industrialized countries, Switzerland is well placed in the ranking but stays far behind Austria (30 %) and the Scandinavian countries. On the other hand, as regards only the NRE, Switzerland seems badly placed in international comparison. In 2013, Switzerland still produced only 2.9 % of his electricity thanks to the NRE, lagging behind the other industrialized countries: the European average for the proportion of NRE amounted to 12 % in 2012. (SwissEnergyScope 2017).

To increase the development of NRE and to encourage new renewable installations, funding and remuneration programs have been set up at a national level since 2008. The first program in force was the cost-price reimbursement of the injected current (abbreviated “RPC” in the Swiss common language) (OFEN, 2016, p. 1). Thus, all the unconsumed power is sold on the grid. These subsidies have been successful: 60’000 projects of new installations have been submitted. It is interesting to note that these requests concerned almost only photovoltaic panels, with a total of 11’164 announcements for this technology (Swissgrid SA, 2015, p.3-4).

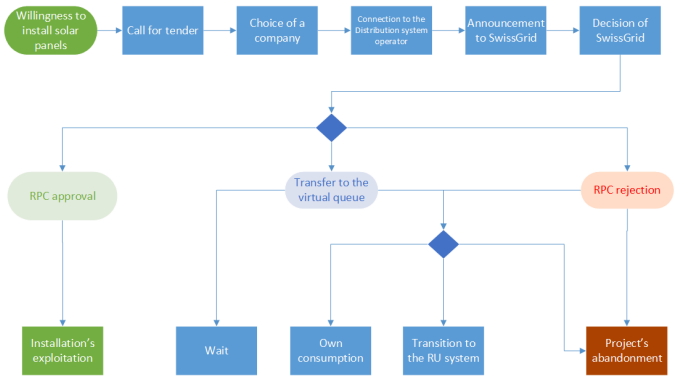
However, this first remuneration system was victim of his own success creating a virtual waiting line evaluated at 39'333 new projects in 2014. Meanwhile, in order to keep pushing Swiss citizens toward a green energy production, the Confederation has established a new simpler subsidy system called « Single reimbursement » (called RU in Switzerland). This second program comes in addition to the RPC and offers a new opportunity for those who wish to implement new renewable installations. If the desired installation has a power set under 30 kW, the client has the choice between a single subsidy of 30% of the price of the installation (RU) or the RPC solution (Swissgrid SA, 2015, p.14).
The main advantage for the client is that he does not have to stay for years on the waiting list before benefiting from the RPC. Unfortunately, the situation in 2016 has not seen a real improvement. With a registration of almost 1000 demands per months and financial resources that will come to end in 2018, the waiting list will continue to grow with a queue of 37’600 projects. Moreover, with an increasing interest for the RU solution, the

reimbursement delay tends to extend progressively creating a second virtual queue. An applicant to the RU has to wait about 9 months before obtaining its money.

Applicants have currently several choices to deal with the RPC's queue problem: to abandon the grant; to abandon the photovoltaic panels' project or to opt for the RU solution to minimize the waiting time. However, time presses as legal changes, about the energetic policy, will be decided in May 2017.

To have a complete overview of what can be called "the current Swiss subsidy service for renewable energy", two different models have been proposed: (1) a blueprint model of the complete RPC system (available in Appendix I) and (2) a simplified flowchart of the same service that is illustrated below.

Figure 2 : Simplified flowchart of the RPC service



B. Problematic

The review of the energy law provides for changes about RPC and RU conditions in terms of duration of the financial support. If the new Act is accepted, there will be a new subsidy delay for the NRE projects: the RPC support will stop by the end of year 2022 and the RU one in 2030 (DETEC, 2017). Thus, everyone still queuing by that time will never receive any financial help and will probably be left behind with a lack of information during this difficult transition. The rupture in the current system can be seen in the previous blueprint under the column "Disappearance of the RPC system".

At this point, the project holder will be confronted with one problem: the end of the current service proposition because, for the moment, the Swiss Confederation seems not to have prepared any transition phase to support the change. Hence, the questions that were submitted to the participants were the following:

- "How can the Swiss Confederation and NRE project holders deal with this virtual waiting line that will soon come to an end?"
- "How can Swiss confederation effectively transfer 40'000 waiting RPC projects to the RU program or to the own consumption mode?"

In order to put the following case study back in its research context, authors have synthetized the different dimensions of their problematic in a three-level table, inspired by the previous works of Schuurman (2015).

Table 1: Three-layer model of the case study (adapted from Schuurman, 2015, p.202)

Level	Definition	Case Study
Macro	Living Lab constellation consisting of organized stakeholders (PPP-Partnership)	Open Innovation : Plurality of the participants based on the Quadruple Helix Model
Meso	Living Lab innovation project	Open & user innovation : real-life experimentation with stakeholders involvement on the RPC queue's subject
Micro	Living Lab methodology consisting of different research steps	User innovation : Uses of the blueprint model

This paper aims at testing the blueprint model for the development of a new service to help the citizen toward the energy transition.

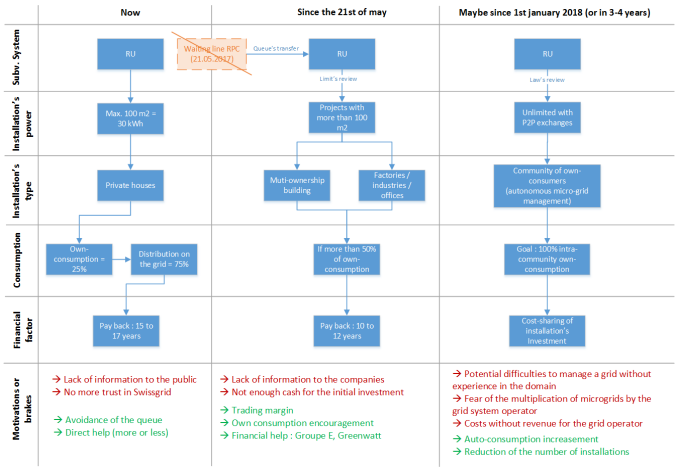
V. Results

The methodology previously explained allows the team to open the discussion between different actors on a common basis with a complex thematic. Thus, all stakeholders seemed to have accepted the flowchart and were ready to say that the RPC subsidies system was obsolete. However, they have gone quickly through this document and have not really dwelt on it.

A. Stakeholders' model

Actually, as soon as the discussion began, the director of the solar panels company wanted to draw on the wall and explain his own vision of the current situation without the use of the flowchart nor the blueprint. Thereby, the other participants have gradually adhered to his model and have started the creation phase by co-constructing on their own a common basis, which has been a freshly set. After some roundtables and exchanges between the actors, the last version of their common vision has been represented as follow:

Figure 3 : Model of the current situation spontaneously designed by participants



As the RPC system will be abandoned, this output shows the potential evolution of the RU system on a three steps time scale, which are: (1) the current situation, (2) the short-term situation after the acceptation of the new Act (since the 21st of May) and (3) the long-term

situation since the 1st of January 2018. Linked to these steps and according to the stakeholder, two main evolutions will appear. The first will concern a review of the solar panels' surface included in the RU system. The second will authorize peer-to-peer exchanges within a community of consumers. For each column, detailed information about installations, consumption, pay back, motivations and brakes have been written.

B. Problem statement

In parallel to the creation of the model by the participants, the academic team had time to write down all the comments and remarks that punctuated the discussion. In other words, the problem statement phase has been made by listening to the stakeholders' discussion in order to reflect their respective requirements. The table available in appendix II synthesizes the fears and concerns of the different entities represented by the participants of the focus group.

C. The final cross-functional flowchart

Once the problem statement has been made, researchers wanted to transform these data into a more concrete output. The answers that were given by the participants did not really match with the expectations of the academic team as some adaptations of the model were immediately made. Thus, at that time, the co-created model has been transformed in a kind of cross-functional flowchart to illustrate clearly the actions of each stakeholder at different process phases. The result of the stakeholder's discussion is available in appendix III.

The co-generated output presents the succession of actions that each actor must carry out in order to ensure an optimal subsidy system's transition (according to them). It includes four phases after the law review of the 21st of May and illustrates how customers could be supported by different actors during the transition phase from the RPC system to the RU subsidies system. Briefly stated: one of the retained solution would be a service proposed, at the choice of the customer, by solar companies, grid system operators or applied sciences academic teams (for specific mandates). They would have the mission to accompany photovoltaic project holders through the entire installation's process. The imagined service would handle the administrative parts as to facilitate and accelerate the succession of the request's process phases. The stakeholders mentioned that final customers have often no idea nor experience in those tasks and therefore should benefit from the help of experienced professionals in the domain.
To tackle the lack of communication, the group has imagined an important multi-channel communication strategy involving all stakeholders during, what they have called, and the "encouragement phase". In the current situation, those who are waiting in the RPC queue do not take into account Swissgrid's warnings about the up-coming changes while continue believing in their chances. Hence, every actor has a role to play and information have to be absolutely understood by project holders.

Moreover, actors said that municipalities should have an important role in terms of communication, tenders and investments by grouping these three aspects in order to increase the penetration rate of new renewable energies from citizens. In the other hand, according to previous projects led by certain stakeholders, municipalities can have a greater impact on the public than others actors. This affirmation has encouraged the group to think about a motivation program that municipalities could adopt in order to push inhabitants toward new renewable installations. Different initiatives exist in Europe such as Energy Neighborhoods, and could be replicated.

The two main obstacles are the ignorance, due to the lack of information and the initial investment. The group highlighted interesting potential investment supports by a local

utility or by private investors. Crowd-funding, crowd-investing and crowd-lending solutions were also addressed during the reflection in municipally led investment programs. Stakeholders agreed that physical installations have to be made by local companies to ensure a good customer and after-sales service. Indeed, according to the participants, working with big groups is often a source of trouble when unforeseen situation occurs because of their lack of reactivity.

Finally, according to the participants, the supervision by solar companies must be extended until the end of the RU request. Actually, useless administrative steps should never bother customer throughout the process.

D. Discussion

For the case study explored in the present paper, the blueprint model's contribution is questionable. Although this service design tool has been used mainly during the preparation phase of the focus group, its input as debate's trigger and problem statement's assistance should not be underestimate and deserves to be studied in more details. In practical terms, the blueprint model allowed synthetizing and clarifying the current complex situation of the RPC queue. It helped the group to proceed with a "sanity check" of the subsidies service. Moreover, it has been a technique to popularize and visually illustrate the entire process, in order to be sure that every participant understands the initial situation. This tool has probably weaved a first link between professionals and individuals and has surely contributed to reach a common ground in order to launch the dialogue. Moreover, the creation of the first blueprint has enabled researchers to deeply understand the RPC problem and to be capable of efficiently discuss with professionals.

Debate has begun thanks to the presentation of the initial blueprint model because of the disagreement of the actors with the subject to be treated. As they said: "The RPC grant model is already over for us!" For this reason, participants directly wanted to go further by exposing their points of views concerning the future of the renewable energy subsidies system. By starting the discussion on a common basis, the blueprint indirectly permitted to underline the current problematic and encouraged the expression of the brakes of every stakeholder. In this case study, this last point has been crucial because of the plurality of actors.

However, researchers cannot assert that participants have appropriated the blueprint model because, during the focus group, they finally used a different graphic representation in order to support and continue their dialogue. It seems that this type of representation was too complex and not enough user friendly to enhance the co-creativity. In other terms, it seems that this model could not serve the final objective of the focus group, which was to create a new service thanks to an open-innovation approach. Without bounds delimited by an existing service, participants could not see the logic behind the blueprint simulation and preferred to distance themselves from the imposed structured model. As a result, actors have intuitively chosen a more flexible way of illustrating their thoughts and the return to the blueprint has been hard to proceed. By the way, researchers did not end up with the blueprint model of a new service but with a cross-functional flowchart that was much easier to explain and represent with the help of participants.

E. Conclusion

Based on our experience, the blueprint model seems not to be the appropriate tool for the ideation phase such as the creation of a new service in a multi-actor focus group. Actually, the model seems too constraining to generate a free discussion between different

stakeholders. The combination of the uncertainty of the explored situation and the plurality of perspectives due to the number of actors inducts the complexity of the use of this model. Moreover, based on previous researches in the field, it has been noticed that blueprint modeling is often used to work on existing services in order to analyze specific touch points and to improve them.

Nevertheless, the use of the blueprint has permitted to give a decisive push to the discussion and set correctly the basis for a dialogue. In this manner, it seems that this model has effectively helped to reach a common ground within the ecosystem of the reunited actors. Participants have been confronted immediately to implementation constraints, which permits to delete irrelevant ideas at the source and to avoid additional corrective rounds in the service development process. Thus, the creation's power of the blueprint is to be questioned because of the restrictions imposed by its architecture, but not its federating aspect that permits to set a common vision and to support the discussion.

It allowed moving forward in thinking about the transition from the current subsidies system to the new one. The tool allowed generating a discussion around the subject of the RPC and the future issues related to the RU. The actors' ecosystem, their meeting and their discussion allowed giving a faithful insight into the operation mode and thought of the different stakeholders. On this basis, it was possible to highlight the main problems associated with this transition and to take the first step towards creating a new service. In line with previous studies on the subject (Wang et al., 2017, p.5), the use of the initial blueprint tool enabled us to effectively define the problems and expectations of the different actors.

The generated output should be taken over by a company in order to transform it into a real service. In order to pursue the development, this work should be the object of new workshops organized in order to pursue the service design phases (service requirement generation, service requirement choice, problem resolution, service resolution, service functions generation, service evaluation, service functions choice, new service blueprint model). Co-creation processes require time and stakeholders engagement in the long run.

F. Limits

Even though the methodology was clearly established, some limits have been identified in the research process. First, despite the knowledge of the Living Lab research approach, the use of the blueprint tool was new for the LL team. The discovery of the model has certainly played a role in the obtained results. Moreover, authors had only 1 hour and 30 minutes to encourage the discussion between the actors and to create a representation of a new service. In addition, the chosen problematic and the wide number of participants (from various professional horizons) enriched the discussions but complicated the blueprint model with multiple layers of actors.

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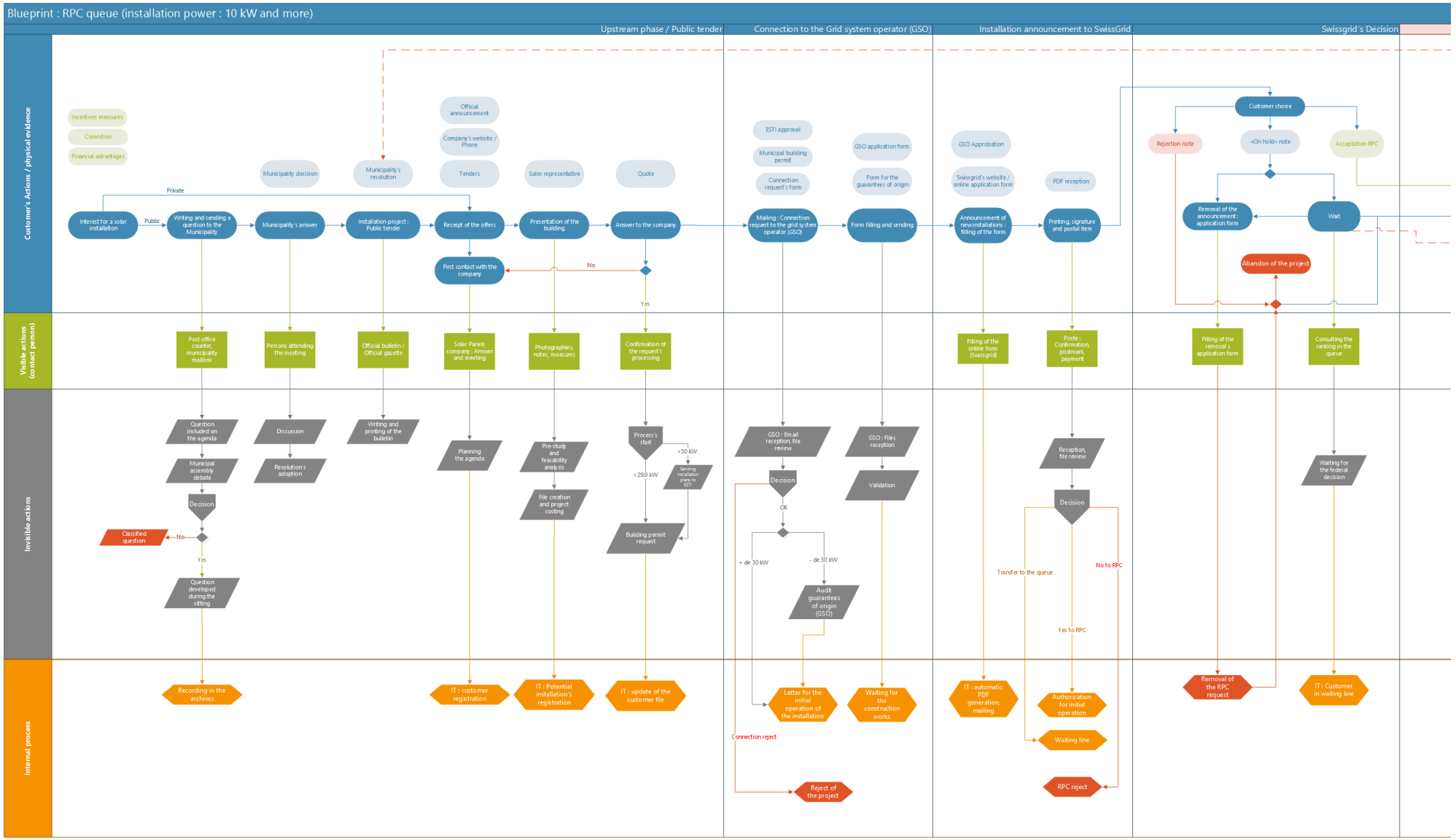
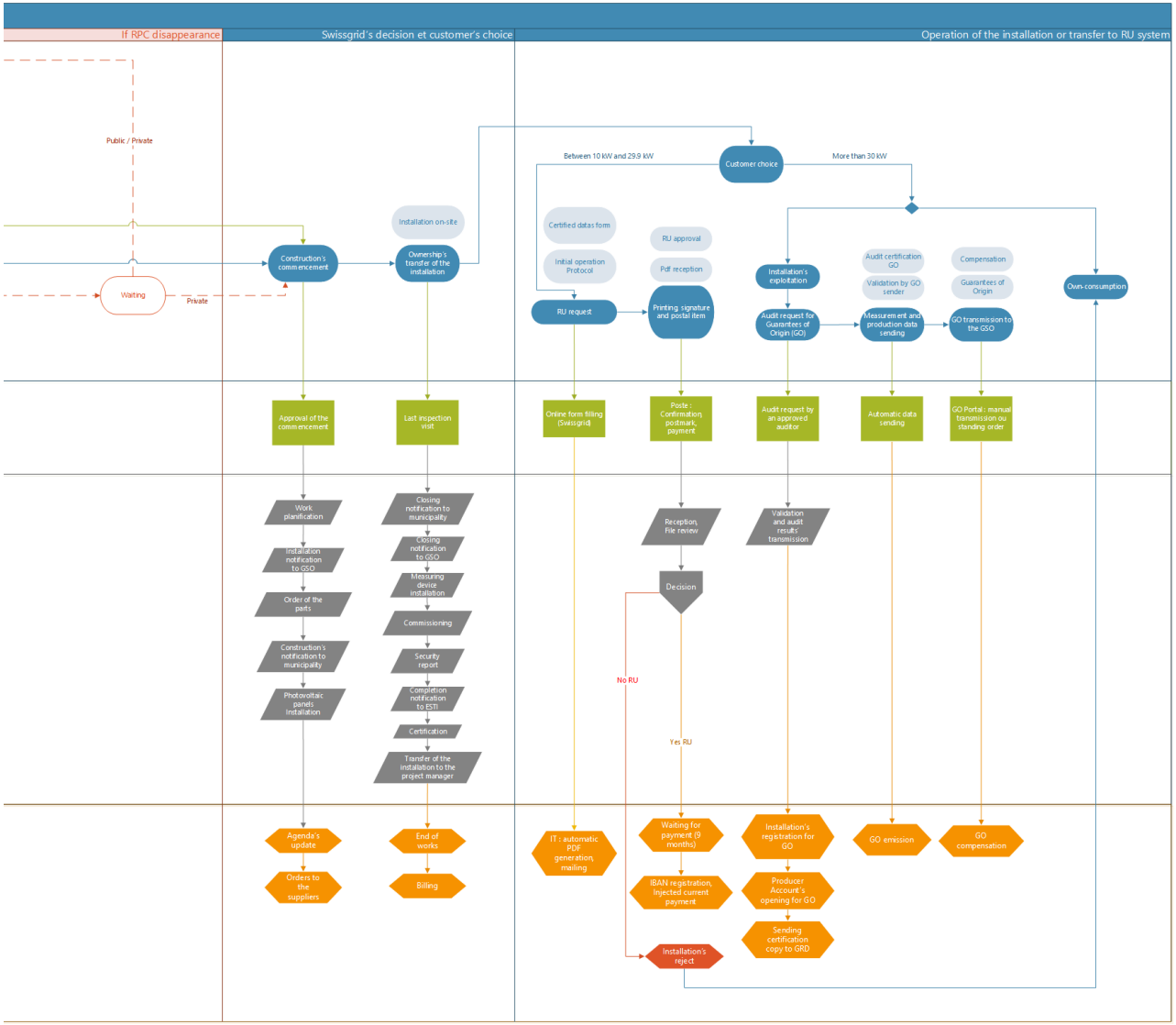
APPENDIX I: RPC BLUEPRINT MODEL (PART 1)



APPENDIX I (PART 2): RPC BLUEPRINT MODEL



APPENDIX II: PROBLEM STATEMENT

Stakeholders	Problems
The end user	- What are the current possibilities that I have in terms of installation ? Actually, I don't understand everything !
	- When we are interested in installing photovoltaïc panels, we hope that someone will do everything for us.
	- I know that there is a queue for the RPC but I don't want to be transfered in another queue for the RU ! I would get my money as soon as I chose the new subvention system.
	- I would have clear and simple informations on : how much does it cost ? What are the benefits ? Would I be the owner of the installation or a tenant ?
	- There are too much numbers in the current explanations and it's impossible to understand something for a non-professional.
	- How can I do if I want to be a producer but I have no money ? I will certainly be "punished" if I can't consume green energy…
The solar panels company	- Discussions about the RPC system are useless ! We don't propose this type of subvention any more since a while ! When a new projet is engaged, we directly propose the RU solution.
	- As the RPC system will propably disappear, people who already have taken a financial risk will be chosen in the queue before others.
	- Only 8000 projects will benefit of the RPC and the rest will chose another solution.
	- In our Region, the difficulty is that the cash comes always before the tourism, the moral or the ethical aspects...
	- The two biggest concerns in our domain are the lack of information and the cash.
	- For large roofs, people and companies don't know that solar installations are a good investement.
	- For some reasons, and mainly in the public domain, the willingness of installing solar panels depends often on one or two persons. If these persons are convinced, the barriers are easily overcome.
	- The auto-consumption is quite hard to sell because currently only 25% of the energy is usually consumed by the producer. This percentage may probably be improved in 3 or 4 years, when the efficiency of batteries will increase.
	- We think that medias have a important role to play in the energetic transition nevertheless we are not always supported by newspapers or TV.
	- The problem in our field is that big companies are stealing projects to the little firms by cutting prices with unbeatable offers.
	- The other risk is that the swiss confederation will maybe fix a rate in terms of renewable energy. If we cannot immediatly reach this level, we certainly will be reprimanded.
The municipal president	- I don't want to discuss about theoritical and inapplicable models ! I just want to have concrete steps in order to propose a tangible process to the municipality.
	- My objectives are to have a process, simple tasks, managers and delays.
	- My wish is to have a company that can do everything for the municipality and that can group the offers for municipal buildings and inhabitant's houses.
	- If we can propose costs-shared installations, the risk is that whom who have a lot of cash could invest more and would receive the majority of the payback. It would create some tensions in our municipality because richs will become richer and the others will receive less cash.
The grid system operator	- People doesn't trust Swissgrid anymore because they have done some errors in the past. Therefore, very few people have quitted the RPC queue in order to chose the RU solution.
	- We don't know yet what will be the power limit that could be supported by the RU system after the law's review.
	- The RPC system is dead too for our company !
	- We know that the money given for the injected current in the RU system is not attracting for the consumers.
	- It's hard to spread the word because a third of the people understand the current situation, a third undertand nothing and the last third don't care of the renewable energy.
	- The municipality is one of the most efficient vector in terms of RE encouragement. Unfortunately, projects launched by this type of actor stays unsufficient.
	- For the moment, the principle of the "community of own-consumers" is forbidden. The risk in the future is the problem of "abundance", since the operator must manage the entire network. This network also includes the self-consumers, while they do not pay anything !
	- The grid operator will probably have to make decisions about future community facilities as they have the knowledge of management, both technical and economic. Individuals will not want to do it because it will be too complicated to manage !
	- The problem for a grid system operator is the following : we have to launch new projects and to manage the current grid. However, the first activity penalize the second one as it complicates the management of the grid.

Appendix III: Co-created cross-functional flowchart