Methods and Techniques for User Contribution

– Challenges from a Living Lab Perspective

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Abstract. This paper discusses user contribution in innovation processes from a Living Lab perspective. We view Living Lab as a milieu in which specific methods are used to involve different stakeholders in open innovation processes to create and validate IT-products and services in a real world setting. The involvement of different stakeholders is of particular importance in a Living Lab to secure the development of usable products and services. In this paper we focus on methods and techniques for user contribution in innovation processes by discussing our own experiences based on 100 activities conducted within four different research projects. The purpose of this paper is to discuss our experiences of methods and techniques for user contribution in relation to three different aspects: a) phase in the innovation process, b) kind of user contribution and c) type of users, all in relation to a Living Lab perspective. We conclude that there is a need to translate face to face methods and techniques to distributed user involvement activities to be able to scale up and use these in a Living Lab setting.

Keywords. Living Lab, user involvement, user contribution, innovation process, methods and techniques

1 Introduction

User involvement in IT development and innovation processes is not a new phenomenon. Research about user centered design (UCD) (Norman and Draper, 1986), participatory design (PD) (Bødker 1996) and cooperative design (Greenbaum and Kyng, 1991) emerged in the late 70s and early 80s. By tradition, research within these fields has been focused on working environments where IT is designed to support defined working roles and tasks. One important aspect of PD has also been to empower the workers/users by involving them in the development processes (Greenbaum and Kyng, 1991). During the 90s, research relating to PD and user involvement in product development processes emerged. Instead of only working within organizational boundaries, IT-developers faced a mass-market of IT-product consumers and tried to incorporate elements from PD to IT-product development processes (Grudin and Pruitt, 2002). The role of a traditional homogeneous client that orders a tailored system was shifted towards a heterogeneous crowd of customers.

For the last decade IT usage has shifted even more from use in work/organizational settings to everyday use, and users have become consumers of IT. This shift has lead to

traditional notions such as usability need to be extended to user experience (Preece *et al*., 2007), and it has become important to identify customer needs and experiences to be able to launch successful innovations targeted against consumer markets (Rosted, 2005).

Several new trends that include user involvement as a means to strengthen innovation and development processes have emerged during the last years. Open innovation (Chesbrough, 2003) and user driven innovation (von Hippel, 1988) suggest that involvement of end users in the innovation process are important, hence they should be vital part of an innovation system. To increase creativity and create new ideas that can be turned into innovations and bring value through use, Eriksson *et al*., (2005) suggest collaboration between people of different backgrounds, with different perspectives and with different knowledge and experiences. Furthermore, the users are according to Thomke and von Hippel (2002) often the source of innovations.

Concurring with these trends, the Living Lab concept has been re-vitalized as supporting IT-innovation processes aiming at usable products and services. In a Living Lab researchers, firms, users, public partners and stakeholders of emerging technology collaborate in a real world setting. The individual is in focus in the role of a citizen, user, consumer, or worker and is seen as a valuable source of innovation (Niitamo *et al*., 2005).

However, rather few researchers have focused on possible methods and techniques that can be used within a Living Lab milieu to support open innovation processes and be able to produce the information needed to create and validate IT-innovations. To be able to launch successful IT-innovations from a user perspective, we need to understand and interpret the individual, cultural and social characteristics of the target group as broadly as possible, because future design solutions will be evaluated and assessed in relation to those (Mattelmäki, 2006).

In this paper we focus on methods and techniques for a Living Lab process by discussing our own experiences of user involvement activities in innovation processes. The discussion is based on 100 user involvement activities conducted within four different research projects. The purpose of this paper is to discuss our experiences of methods and techniques for user involvement in a Living Lab process in relation to three different aspects: a) phase in the innovation process, b) kinds of user contribution and c) type of users.

The paper is structured as follows; the next section present the theoretical framework followed by a description of the research setting in section 3. In section 4 we discuss our experiences of methods and techniques for different kinds of user contribution and section 5 concludes the paper.

2 Theoretical Framework

There exists numerous models that describe the traditional innovation process, most of them being in a linear fashion consisting of the four building blocks; research, development, production and marketing (Kline and Rosenberg, 1986). This simplistic model has been highly criticized since it assumes that the source of innovation is research as well as for its lack of feedback paths from users based on the notion that user feedback and evaluations are important parts of innovating.

Denning and Dunham (2006) suggest a language-action framework for defining innovation and state that invention is not enough. The authors suggest seven foundational practices of innovation. They portray these practices as a wheel consisting of six basic innovator practices

around the rim and leadership of the hub. The six practices are: (1) Sensing possibilities, (2) Envisioning new realities, (3) Offering new outcomes, (4) Executing plans and tools, (5) Adopting new practice, and (6) Sustaining integration into surroundings. They state that the first two are the heart of invention, the fourth to sixth are the main work of adoption and the third is the crucial point between pure invention and innovation.

Reichwald *et al*., (2004) suggest a simpler view of the innovation process by dividing it into the phases of; idea, concept, prototype and market. They further extend the model by suggesting *decision*, *information* and *creation* as three different categories of user contributions that can be made during the innovation process. In decision activities, users are able to decide or evaluate given facts. Examples given in this category is closed-questionnaire surveys and standardized voting. During information activities, such as for example focus groups, idea competitions and feedback hotlines, users are able to express preferences or needs. Finally, during creation activities the users are able to be creative in their own way, by becoming co-designers of the product or service, actitvities in this category can be exemplified by user toolkits or prototypes built by users.

Furthermore, Reichwald *et al*., (2004) suggest that different types of users could/should be involved in the innovation process. They refer to customer characteristics according to application and object knowledge, and suggest four different types; freshman, intuitive, nerd and pro. A more traditional way of categorizing types of users are: *primary*, *secondary* and *tertiary* users (Eason, 1987). Primary users are those who actually use the artifact. Secondary users are those who will occasionally use the artifact or those who use it through an intermediary. Tertiary users are persons who will be affected by the use of the artifact or make decisions about its purchase. In order for the design of a product to be successful, it is important to take a wide range of stakeholders into account of the artifact. All stakeholders need not to be represented in a design team, but the effect of the artifact on them must be carefully considered (Preece *et al.*, 2007).

There are several categorizations of methods and techniques based on what phase of the innovation process they belong to. For example, both Schumacher and Feurstein (2007) and Kusiak (2007) suggest suitable methods and techniques to be used during the different phases of an innovation process.

However, both these categorizations are somewhat unclear. This is because there is no guidance to areas or disciplines where more information about the suggested methods and techniques can be found. Furthermore, these papers do not discuss what type of information that is generated when applying the methods and techniques, and how this information can be used or in what phases the methods and techniques might prove to be suitable.

Another categorization of methods from the field of Human-Centered Design is described by Hanington (2003). The author divides these methods into three categories; traditional, adapted and innovative methods. First, traditional methods include market research, focus groups, surveys and interviews. The data acquired through these methods provides a good overall view of the design field. However, it does not fulfill all the needs of the design process for innovative IT products (Gaver *et al*., 2004; Hanington, 2003). The second category is applied methods, which refers to using research and development methods from design research. Examples of applied methods are qualitative methods of ethnography, sociology and culture studies, including observation, self-documentation and interaction methods such as thinking aloud or heuristic evaluations. Finally, the last category is innovative methods, these are mostly appropriate at the beginning of the design process, where these methods are used

to gain an understanding of people's emotions, feelings, values and dreams (Hanington, 2003).

Traditional quantitative methods are more appropriate for examining large groups, whereas innovative methods are suitable for qualitative analyses and more in-depth results when examining smaller groups and individuals. When planning user involvement activities the most important is to choose methods that support the information objective of the design process (Hanington, 2003). Designers need to understand and interpret the individual, cultural and social characteristics of the target group as broadly as possible, because future design solutions will be evaluated and assessed in relation to them (Mattelmäki, 2006).

The concept of Living Labs originates from Professor William Mitchell in Boston, and was initially used to observe users when they lived for a period of time in a smart/future home. Today, there is an ongoing trend in Europe to tailor a Living Lab concept in wider use to "enhance innovation, inclusion, usefulness and usability of ICT and its applications in the society" (Eriksson *et al*., p.5), and this concept of Living Lab has been described as "a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts" (Eriksson *et al*,, 2005, p.4). This trend has led to the emergence of several definitions of Living Labs, e.g. according to the European Network of Living Labs [1] a Living Lab is "both a methodology for User Driven Innovation (UDI) and the organizations that primarily use it". The European project CoreLabs [2] defines Living Labs as "a system enabling people, users/consumers of services and products, to take active roles as contributors and co-creators in the research, development, and innovation process". Hence, the concept of Living Labs can be seen as a methodology, an organization and/or a system. Based on this, we choose to look at Living Labs as a milieu in which specific methods are used to involve different stakeholders in open innovation processes to create and validate IT-products and services in a real world setting. Nonetheless, regardless of how one looks upon the concept, to implement openness the creative process of involving different stakeholders is crucial (Eriksson *et al*., 2005).

In this paper we will use the four phases (idea, concept, prototype, market) of the innovation processes (Reichwald *et al*., 2004), the three different kinds of user contributions (decision, information, creation) (Reichwald *et al*., 2004), and the three types of users (primary, secondary, tertiary) (Eason, 1987) to discuss methods and techniques for user contribution in a Living Lab based on empirical findings from a five year period.

3 Research Setting

In 2007 we established Halmstad Living Lab. Halmstad Living Lab is a member of the Swedish as well as the European network of Living Labs [21] and is active within the application areas of media and health technology. Halmstad University is the host of the Living Lab and organizes the lab managed by the researchers, and focus on research concerning methods for creation and validation of IT-innovations within a Living Lab. The University also provides the technology and the infrastructure for the Living Lab. In this paper we report from four different research projects, two from each application area.

DigiNews (ITEA 03015) was a two-year (2004-2006) collaborative research project, including several major technology firms, newspaper organizations and universities across Europe. The project aimed at defining, architecting and demonstrating a solution of a digital

newspaper. We mainly worked with seven Swedish newspaper partners and their newspaper staff, as well as with users and advertisers in all phases of the innovation process.

The *UbiMedia* project was a Swedish project with partners from 9 Swedish newspapers, the Swedish Newspaper Publishers´ Association and Stampen. This two-year project (2006-2008), targeted the challenge of designing ubiquitous media services for a multitude of devices and contexts to be consumed anytime and anywhere. In this project we also worked with newspaper staff, users and advertisers in the first three phases of the innovation process.

Secure at Home – Living Lab is an ongoing two year project with Halmstad Municipality, the Health Technology Alliance, 11 SMEs and organizations for senior citizens and their next of kin as partners. This project aims at exploring methods and tools for user involvement in innovation processes that are suitable in a Living Lab. In this context we are working with seniors, next of kin, and care giving personnel in different innovation processes concerning product and service development and refinement.

In parallel we have an ongoing one year product development project called *Secure at Home – Smart Locks* together with two SMEs and an organization of next of kin to elderly. In this project, a special lock and alarm product and service is being developed with a user driven innovation approach with seniors and next of kin.

In the four projects we have used methods like e.g. future workshops, prototyping, tests, evaluations, validations and surveys with techniques such as interviews, questionnaires, diaries, think aloud, observations, scenarios, image boarding and mock-ups.

All together, during the last five years we have conducted 100 activities in all stages of the innovation process in the four research projects described above (Table 1). We have involved about 500 individuals in face to face activities and over 7000 individuals have contributed in online surveys.

KIND OF USER CONTRIBUTION	TYPE OF USERS	PHASES OF INNOVATION			
		Idea	*Concept*	*Prototype*	*Market*
Decision	*Primary*	2	12	14	1
	Secondary	2	2	6	
	Tertiary	1			
Information	*Primary*	4	10	4	2
	Secondary	1	3	1	
	Tertiary				3
Creation	*Primary*	9	6		
	Secondary	4	3	3	
	Tertiary	7			

Table 1. Empirical activities

The empirical activities all relate to different innovation processes concerning products and services. The innovation processes have involved different stakeholders such as companies, researchers and users who have worked in an open environment to create and validate

innovations. We have worked with users that we met only once, and with users we have met on a regular basis in for example focus groups. We have worked with different kinds of users; primary, secondary and tertiary users, and with users of differing age, gender and social backgrounds. We have worked with different types of methods such as focus groups, future workshops, prototyping, surveys, test, evaluation and validation. Some of these methods, such as focus groups have traditionally been used within for example marketing to enable fruitful group discussions between representatives for stakeholders (Preece *et al*., 2007). While others methods such as future workshops has been used within the PD field to vision how computers can be used to support future work situations (Kensing and Halskov Madsen, 1991). Furthermore, we have used a multitude of techniques, e.g. the creation of personas representing archetypes of possible future users (Cooper, 1999), scenariobuilding of use scenarios (Carroll, 2000), the construction of mock-ups during early design (Ehn and Kyng, 1991), image boarding, interviews, questionnaires, diaries, observations and think aloud. Most of these activities have been conducted face to face with the users, except for online questionnaires and a virtual focus group.

4 Experiences of User Involvement Activities

In this section we will discuss our experiences of different methods and techniques from a Living Lab perspective. To be able to achieve a process that enables users "to take active roles as contributors and co-creators in the research, development, and innovation process" [2], methods and techniques for user contribution in the different phases of the Living Lab process are important. However, the term user is rather diversified and complex which is also the case for the terms co-creation and contribution. We therefore start this section with a more general discussion about different methods and techniques, followed by a discussion of these methods and techniques in relation to the phases of the innovation process. Thereafter we discuss about different kind of user contribution and conclude by discussing contribution from different types of users.

4.1 Different methods and techniques

The methods and techniques that we have worked with were selected based on the information needed in the different innovation phases. The methods have also generated different types of data. Future workshops, prototyping, evaluation and validation methods have primarily generated qualitative data suitable to present a richer view on people's wants, needs and preferences. Surveys and tests have primarily generated quantitative data suitable to provide an understanding of for example if a design is functional or if users are willing to buy, adopt and use different products and services. The resources needed for conducting the activities and analyzing the data differ quite substantially between the qualitative and the quantitative methods.

All methods used in our projects are heavily dependent on facilitators or test leaders as well as observers to be able to gather useful information. It is also very time consuming to analyze and provide concrete information about different needs, requirements and design solutions. The exception can be surveys and prototypes. If descriptive statistics are used this can alleviate the needed resources. Low-fi prototypes generated by users can be used as a way of finding new design solutions, but also to use as input data for other users to evaluate and comment on. High-fi prototypes are often used in the same way, but a higher amount of resources is needed to have a functional prototype that can serve as an evaluation tool and to

validate for example usability of different functions. Our experience of the future workshop method is mainly positive. These workshops have served as a foundation for generating ideas and making them tangible by the usage of scenarios and mock-ups. For example, in the DigiNews project over 27 mock-ups were generated by users and were analyzed with the aim of identifying new design solutions but also to find out the most preferred format and functionality. The critique phase in the workshops has also served as a way to inform and produce a rather rich picture of user's viewpoints, preferences and needs.

We have similar experiences from the two "secure at home" projects, during these projects different user groups consisting of seniors, next of kin, care giving personnel and care giving managers have worked both individually and together with future workshops. The outcome of the workshops has generated both research and commercial spin off projects. In these cases scenarios and mockups have provided enough concrete results to inform the decision to continue or start up new innovation processes.

There are also similar resource constraints for the different techniques that we have worked with. User generated scenarios, personas, mock-ups and image boards are quite similar to low-fi prototyping. Much information can easily be gained from these techniques and the only resources needed are the users that are involved as well as a facilitator that ensures a high degree of creativity in workshops. In our projects, these techniques have generated a lot of valuable information. For example new design solutions and functionality have been generated from scenarios and mock-ups. These techniques have also served as a base for new ideas of IT-products and services. For example, in the UbiMedia project future media services were envisioned and described by readers with the help of scenarios and low-fi prototypes. These scenarios where later used in online questionnaires to receive various input concerning for example what possible user value these future media services could leverage. Furthermore, the questionnaires generated input regarding willingness to pay and how advertisement could be handled. The questionnaires also provided an opportunity to ask for new scenarios from the respondents. Therefore the scenarios generated in the workshops served as a concrete way to evaluate and validate the ideas. Finally, the scenarios in the questionnaire worked as triggers for generating more examples of scenarios of future media services.

In our projects, mock-ups, personas and image boards have served as a means to shape the design of new IT-innovations as well as finding requirements and guide the developers of how to shape IT to better fit specific target groups with the help of for example personas and image boards. From a Living Lab perspective the methods and techniques have generated valuable input in all phases of the innovation process. However, the extensive work that has been conducted within the research projects might be problematic to implement in innovation processes, due to the extensive resources needed.

4.2 Different phases in the innovation process

We have worked with different methods and techniques in different phases of the innovation process according to the categorization of Reichwald *et al.,* (2004). In Table 2 both methods and techniques (*in italic*) are presented.

	IDEA	CONCEPT	PROTOTYPE	MARKET
Face to face activities	Future workshop *Scenarios*	Future workshops *Image boarding* *Mock-ups* *Personas* *Scenarios*	Low-fi prototyping Hi-fi prototyping Tests Evaluation *Think aloud* *Interviews*	Tests Validation *Interviews* *Observations*
Distributed activities	Surveys *Questionnaires*			Surveys *Questionnaires* *Diaries*

Table 2. Methods and techniques according to phases of innovation

Our experiences from the idea phase are that future workshop is a method that is very useful in generating ideas early in the innovation process. However, the facilitator role in this activity is crucial, making sure that all participants have their saying and to shift modes during the workshop is of importance regarding the outcome of the activity. We found using the scenario technique helpful in generating new ideas. Having users imagine a future scenario helped them see beyond today's obstacles. We also used questionnaires to generate initial ideas from a larger crowd of users and we think that this is a good compliment to the ideas generated in the future workshops. Questionnaires in this phase could also be used to validate the ideas that have been expressed in the future workshops as described earlier.

We have used several techniques in the concept phase that have served as a way to make the ideas more concrete and tangible. The outcome of for example the scenarios and the mock-ups in our projects have worked as a way to communicate design and concepts between different stakeholders in the innovation process. The results from these techniques have also generated concrete input guiding the design in this phase as well as serving as input to the prototype phase. For example, in the Secure at Home – Smart Locks project three mock-ups of a remote control was created by one of the user groups. These mock-ups were created with basic modeling material during one of the workshops. The mock-ups concretized the discussion and evaluation with other focus groups regarding issues about size, weigh, screen display, the size of buttons, placement of feedback indicators and much more. As described earlier, similar mock-ups where created in the DigiNews but also in the UbiMedia project where they served as tools to discuss for example the size and the format of an e-newspaper or the design of the UbiMedia bracelet.

In the prototype phase we have used low-fi prototypes developed by users and high-fi prototypes developed by both professional designers and students. These prototypes have been used to develop the design and functionality of the IT-innovations by iteratively evaluate and test them in focus groups, workshops and in individual tests with users. Our experience is that prototype tests can be successfully complemented by for example the think aloud technique as well as interviews, providing an opportunity to generate a rich picture of why something works or not from a user perspective. In the DigiNews and the UbiMedia project interviews following prototype tests also enabled discussions about the concept of the e-newspaper and the UbiMedia services. In these interviews questions were asked about for example opportunities and threats to traditional and online newspaper reading as well as business models, advertising models and barriers to adoption.

Finally, in the market phase we also have experiences of tests, interviews and observations. The difference is that in this phase we have worked with first versions of products. In DigiNews for example, an actual newspaper delivered on an e-reader device was used to conduct a two week test in a real world setting. The involved users in the test filled out diaries

and answered daily questions via an online platform to provide an overview of how their opinions and experiences evolved during the test time. This real life test started with a questionnaire aiming at providing background information and was concluded by an interview and questionnaire providing the same type of information that was gathered in the prototype test above.

Comparing the prototype test and the real life test gives some valuable insights of how a longer test in a real life setting provides a much richer picture. By following the user comments during the test, it became evident that the first impressions changed over time. This is one example showing that traditional tests conducted in a laboratory might provide a limited view compared to tests conducted in real life environments over a longer period of time. Our experience with the "real life test" is that it provided rich data regarding people's opinions, drivers and behaviors. This is the kind of information that seems truly important to gather before a market release.

In the market phase we have also conducted several surveys and questionnaires to explore aspects about adoption, business models and general validation of innovations planned to be launched on the market. Our experience in this phase is similar to what has been reported earlier about surveys and questionnaires. This technique have proven to be a valuable source of information and a rather resource efficient way of gathering information relevant before a market launch.

4.3 Different kinds of user contributions

In the four projects we have elaborated on three different kinds of user contributions; *decision*, *information* and *creation*. In several cases we have worked with the same methods and techniques but with different kinds of contribution. In idea generation activities we have for example used different types of triggers and used these to let users comment, relate or to generate new ideas. However, the methods and techniques can mainly be divided by the kinds of contribution. In our cases, surveys, questionnaires, tests, evaluation and validation have formed the base for the decision kind of contribution. However, all these methods and techniques have also served as means to gather information about user's wants, needs and preferences during the earlier innovation phases.

The methods and techniques that have been based on the information kind of contribution are primarily interviews, diaries and observations. Moreover, the first phase in the future workshops has also served as an information gathering activity.

Finally, the third kind of contribution (creation) has been used in the future workshop and prototyping methods used in our projects. These methods have been mainly based on users creating their future vision of an IT-innovation by creating scenarios, mock-ups and low-fi prototypes. Furthermore, users have created personas and image boards that have informed the innovation processes by creating detailed descriptions of target groups based on the user's domain knowledge. For example, seniors have created personas of elderly people by describing their background, the specific conditions and the wants, needs and preferences of the persona. In a similar way, image boards have been created by users as a way to communicate what a persona like design wise.

Our experiences regarding different kind of user contribution activities are that the decision kind is the easiest to apply to methods and techniques. Asking direct questions about preferences, use behavior or what design solution that is preferred is rather straight forward. These activities are also less resource dependant, both to conduct and to analyze. Online questionnaires for example, generate a huge amount of data, and if they are well designed, have proven to be a valuable source of information in the earlier phases of the innovation processes as well as in the market phase.

To work with the information kind of contriubtion is similar to the decision kind with the exception of a higher amount of resources needed to conduct for example interviews compared to questionnaires. The information is also harder to analyze, but generates a rich picture of for example the life situations of seniors with specific disabilities.

The creation kind of user contribution is from our experiences the most challenging and demanding way to incorporate in methods and techniques. The facilitator's ability to provide a creative environment for the users to work within as well as the group composition affects the outcome of the methods and techniques that we have worked with. Though, if successful, the material generated by for example mock-up activities can prove very valuable as guidance for design decisions in the prototype phase in innovation processes.

4.4 Different types of users

Users can be categorized in a lot of different ways and it is important to keep in mind that user groups can differ in more than how they put a specific product or service to use. In some scenarios they might even have conflicting values, for example a product that a primary user sees as a support tool to aid them in their daily activities might for secondary or tertiary have a different purpose, the product might instead be seen as a way to gather information about their next of kin's whereabouts and health. In a scenario like this it is easy to understand how different kinds of user groups can have quite diverse views on what the products value and purpose is.

From our experience, the categorization of primary, secondary and tertiary users provide valuable guidance for which user groups that should be involved in a Living Lab process. However, in some cases the context makes the categorization of users more complex. In the Secure at Home – Living Lab project we worked with a suggested information system that among other things provided information about when a care provider had visited a care taker (when they arrived and when they left), and what had be done, which was also confirmed by the care taker. The system also provided the care giving personnel about what to do at a care taker and where to go next after a visit. Our initial view and categorization of types of users were based on the care giving perspective. Four different types of user groups where identified. The care giving personnel was seen as primary users. The next of kin and the care giving managers were seen as secondary users and the seniors (care takers) were seen as tertiary users. However, it became quite evident in our first workshops that the categorization of users was more complex. The next of kin wanted information about visits from the care givers to ensure that their relatives got the care that was needed. The care giving managers wanted the same information but for different reasons, to be able to plan for the care and also assess the efficiency in the care. The seniors wanted information about when a care giver should arrive, but also to know what tasks that should be done at a specific day. Based on which perspective that was taken, the term primary, secondary and tertiary user changed. The conflicting interests between the different groups of users were also highlighted in our workshops. Aspects such as the integrity of the care giving personnel became evident as well as in some cases conflicting interests between other user groups.

While categorizing users might give guidance for selecting users to cooperate with and analyze the outcome of an activity, it is also important to keep in mind that a user's characteristic is very hard to pin down. Based on our experience it does not matter what kind of category of users you are dealing with; the group dynamic and consensus of a group of users is still very fragile and can easily be effected by individual members of the group, creative or dominant members have a tendency of getting their point through more often than their more quiet and conservative counterparts. This puts a lot of pressure on the facilitator of

the workshop who has to be able to balance this out in order to let everyone add to the discussion.

We have also noted the importance of having dedicated users taking part of the workshops. To get satisfying results from an activity the users have to be interested and dedicated to the cause. This might be even more important in a Living Lab approach since the users are supposed to be a part of the whole development process from the start until the end. This raises the question of how dedicated users can be identified during an early stage and how they can be supported during the innovation process to keep them dedicated. A task that can be quite a challenge; to keep users dedicated they have to be kept in the loop, but that also puts a lot of pressure on them and their already busy calendars.

5 Conclusion

Based on the above discussion we discern the following challenges with user involvement activities in a Living Lab setting.

a) Identifying a heterogeneous group of engaged and motivated users that complement each other. Since involvement by users is voluntary it can be hard to find ways of creating continuance within the user groups. We believe that it might be necessary to find some kind of reward system to ensure participation of the "right" mix of users.
b) Using the "right" mix of methods and techniques that delivers the data needed for a specific stage in the innovation process. Since the methods and techniques that are more time consuming often also generate a larger amount of data, they need to be mixed with others that generate more quickly results with less effort.
c) Working with different kinds of user contributions in different phases of the innovation process is essential to secure the development of usable products and services. Finding ways to do this in a way that motivates the users and at the same time is not too resource intensive is indeed a challenge.
d) To be able to involve more users in their home environments, there is a need to translate methods and techniques to work in a distributed way over the internet. The biggest challenge lies within finding ways to facilitate these activities.

The limitations of this study are that we have mostly used face to face activities that is rather time consuming. The Living Lab approach implies that we should meet the users in a real life setting, e.g. in their homes. Involving users in the innovation process is very rewarding, but puts pressure on the facilitators and the users when it comes to time and dedication. The facilitator has to maintain a healthy balance between the different kinds of users, while trying to enable and trigger creativity. The users have to be prepared to dedicate themselves to the project and contribute for a period of time.

The ability to carry out some of the innovation process activities aided by distributed tools in an online setting where a facilitator can administer and setup online workshops, might decrease both some of the facilitators workload and also give the participants a bit more flexibility. Future research will focus on the translation of methods and tools for distributed activities.

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