Publisher: IISI - International Institute for Socio-Informatics
ISSN 1861-4280

international reports on socio-informatics

volume 15 issue 1
2018

# *Managing Viewpoints: Maintenance Work in Sustainable Living Lab Research*

**Authors:**

Corinna Ogonowski, Gunnar Stevens,
Jan Hess, David Randall, Volker Wulf

*The 'international reports on socio-informatics' are an online report series of the International Institute for Socio-Informatics, Bonn, Germany. They aim to contribute to current research discourses in the fields of 'Human-Computer-Interaction' and 'Computers and Society'. The 'international reports on socio-informatics' appear at least two times per year and are exclusively published on the website of the IISI.*

# Impressum


IISI - International Institute for Socio-Informatics
Stiftsgasse 25
53111 Bonn
Germany

fon: +49 228 6910-43
fax: +49 228 6910-53
mail: contact@iisi.de
web: http://www.iisi.de

# Managing Viewpoints: Maintenance Work in Sustainable Living Lab Research

Corinna Ogonowski, Gunnar Stevens, Jan Hess, David Randall, Volker Wulf
Institute for Information Systems, Siegen, Germany,
*firstname.lastname@uni-siegen.de*

**Abstract.** Living Labs are dynamic networks in which several stakeholders participate for various reasons and in which technical-oriented innovation emerges by bringing together these diverse perspectives. In this paper, we present a case study of a Living Lab that was set up in a publicly funded project to design home IT-solutions. In this context, we investigate practical management fostering cross-stakeholder interactions and relationships that facilitate consistent and continued collaboration in a Living Lab We analyzed the project documentation, emails, etc. and conducted semi-structured interviews with all participating stakeholders including industry, academia and involved users. Based on the generated data corpus we reconstructed the formation process of the Living Lab project as well as the diverse perspectives of the stakeholders and subsequently analyzed how they are connected with each other, which communication practices has been established and how long-term collaboration processes are managed and maintained to local needs and constraints of several actors. The analysis of the different viewpoints, nevertheless, uncovers asymmetries and some difficulties in achieving these aims. These are seldom discussed in literature and are negatively associated with strong user engagement. Our results suggest that a shift in traditional user perspectives is needed to realize the full potential of the Living Lab approach. In addition, our study reveals the emergence of an essential role that we define as Living Lab agents. Agents serve as facilitators within a Living Lab and undertake necessary (but often unrecognized) maintenance work for all stakeholders. The paper further discusses the possibility of systematizing this role and the opportunity to provide a Living Lab infrastructure as professional service for external clients.

## 1 Introduction

The development of innovative technology and products is a risky endeavor, as is well-attested in the literature. The risk of market failure for consumer goods for example, is estimated by Haber (2008) to be in the region of 80%-90%. More recent studies show decreasing numbers. Dijksterhuis (2016) references a failure rate of 50%-75% in that domain. It has been suggested that this has to do with the fact that the routine social practices and rhythms of everyday life are inadequately considered in design processes (Frissen and Lieshout, 2006). Allied to this, there is the obvious fact that ordinary users may not be knowledgeable or motivated

enough to express their needs and desires with regard to these new technological opportunities. Innovation development therefore faces a "symmetry of ignorance" (mutual incomprehension between designers and users) (Fischer, 2000). Moreover, new needs often emerge only in reaction to technology appropriation (Orlikowski and Hofman, 1997; Swiderski, 2008). Because of this, it is sometimes suggested that new technologies or products need to be developed in an iterative and evolutionary manner, such that their appropriation by users 'in the wild' is recognized as an integral part of the process (Rohde *et al.*, 2009; Stevens, 2009; Wulf *et al.*, 2011; Wulf, Schmidt and Randall, 2015). Whatever the specific solutions envisaged for dealing with these issues, it is clear that there remain a series of methodological challenges. Although the role of ethnography, or fieldwork (see (Randall, Harper and Rouncefield, 2007), is by now established and has been put to the service of design in many different contexts (see e.g. (O'Brien *et al.*, 1999; Crabtree and Rodden, 2004; Grinter *et al.*, 2009), it is by no means clear how this is to be adopted in domestic usage contexts (there is extensive debate about whether methods which have proven adequate for the understanding of work settings are equally useful in the context of non-work settings, for practical and/or analytic reasons. We do not propose to engage in this debate for reasons of space but see Brown and Bell, 2004; Crabtree et al., 2009; Laurier et al., 2001; Schmidt, 2011). Specifically, however, there may be issues for immersive forms of enquiry like ethnography in situations where technological innovation is rapid, where it may potentially change behaviors quite radically, where domestic environments are implicated, and where users have, at best, only rudimentary understandings of what is possible. A related, but distinct, approach is associated with Participatory Design (PD), which originates with concerns for workplace democracy, but has been further elaborated in recent years to integrate people and their context into more generic design processes (Ehn, 2008), transforming the "symmetry of ignorance" into a complementary "symmetry of knowledge" through symmetries of participation and symmetries of learning (Fowles, 2000). People thus become 'co-creators' into the design process.

In the HCI community, for instance, diary studies (Bolger, Davis and Rafaeli, 2003; Carter and Mankoff, 2005; Sohn *et al.*, 2008) and probes (Gaver, Dunne and Pacenti, 1999; Crabtree *et al.*, 2003; Hutchinson, Mackay and Westerlund, 2003; Boehner *et al.*, 2007) were developed as approaches to give designers access to people, contexts and peoples' individual experience to foster their reflections about possible futures and to inspire design for and with ordinary users. For product development in and with online communities, for instance, standard web technologies and collaboration tools were applied that link usage situations and an actual development environment to support communication and collaboration processes between members of established online communities (Hess *et al.*, 2013). Other methods have also been adopted in a broadly PD context which - to some extent - address these issues.

Nevertheless, challenges remain when multidisciplinary actors come together. One of the main challenges is to create a basis for mutual understanding as a starting point. Soini and Pirinen (2005), for instance, examined workshops as a means to generate infrastructure for collaboration and idea or knowledge sharing by various actors. Based on these insights, they derived three distinct modes of collaboration within workshops: creating shared insights, discovering common denominators and clustering competencies. Soini (2006) further focused on the role of industrial designers as facilitators. She found that facilitation requires specific skills such as ideation, visualization, social and research skills if participants were to fully realize their potential. In a slightly different vein, Vines et al. (2013) scrutinized conditions of collaboration with respect to the configuration of participation in HCI research – including different forms of user participation, real benefits for users and initiators, and the degree of sharing the control with users. They emphasized critical issues of a conceptual, ethical and pragmatic nature that arise when involving users in such processes. In addition to designer-user-interactions Dachtera et al. (2014) approached cooperation processes in joint research projects by focusing on conflicts between academic and industry partners. They identified three aspects: the mismatch between companies' internal and the projects design approach; the rhetorical framing of research interests based on the political point of view (funder); and the view on each other's work and the outcomes associated with it.

While all of these approaches can be shown to support an understanding of the dynamics of innovation in context, they arguably do not wholly encompass the organizational realities of rapid product development, nor those of building and maintaining long-term relationships with users in domestic environments so as to support *sustainable* participation, collaboration and mutual learning. Further, domestic contexts pose a specific challenge in the design of new artifacts, because accessibility for researchers and designers to private spaces remains something of a problem, which requires special sensibility in dealing with the user. Tolmie and Crabtree (2008), for instance, point to practical and methodological challenges when deploying research technology to private households. Users often did not see any need for taking ownership or responsibility for keeping technical systems running. They rather expect this as a practical service from researchers (Ley *et al.*, 2015). Moreover, prototype technology is seen as a kind of 'foreign object' that disrupt domestic routines and has somehow to be 'made at home' in these circumstances. This requires a certain open-mindedness on the part of users and, equally, of researchers, one which, it turns out, is not always easily arrived at and might require a degree of sophistication in relation to understanding the possible consequences of deployment (Tolmie and Crabtree, 2008).

In recent years, Living Labs (Eriksson, Niitamo and Kulkki, 2005; Niitamo *et al.*, 2006; Almirall, 2008; Folstad, 2008) have become a more popular approach, aimed at addressing the issue of bridging the interests of divergent stakeholders;

for instance academia, public institutions, industry and users. They have been deployed in various contexts, but were specifically designed as an approach, which would work in relation to co-creative product innovation, notably in the domestic arena. They include, for brief mention, Orange At Home (Randall, 2003); the Philips HomeLab (de Ruyter and Aarts, 2004); Placelab (Intille *et al.*, 2005); and the Helsinki Virtual Village (Eriksson, Niitamo and Kulkki, 2005). As Eriksson et al. (2005) suggest:

> "The Living Labs concept refers to an R&D methodology where innovations, such as services, products or application enhancements, are **created** and **validated** in collaborative multi-contextual empirical real-world environments. (…) The user experience focus involves areas of user interface design and ergonomics as well as user acceptance, extending to user co-design process, finally leading to service or product creation. The human-centric approach in Living Labs conceives of human beings, citizens and the civic society as a source of innovation and not just as users or consumers in a narrow sense being an object for R&D activities. (…) the Living Lab approach then strives to break the trial and error process of product development previously described, and change that into a co-design process where users and developers actively work together (…)".

Living Labs have been adopted widely for a number of reasons, which include that they involve the user; get relatively quick and low-cost results; may constitute a permanent test bed; allow for 'mixed method' approaches to data, and of course, put the user at the center of an iterative design process. As Schuurman et al. (2009) point out there are at least two ways in which the Living Lab can be constituted. Firstly, they can 'make the technology or product available in the home of the users' and secondly one can develop, 'a home where the technology or product is available and where users come to stay for a certain period'. Schuurman et al. (2010) specifically discuss 'mobile TV' research through a Living Lab perspective. They suggest, "(w)hen a product is designed for users, data and theories regarding the users are used as a knowledge base for design. A design with users denotes an approach where user studies are included, together with feedback from the users on different solutions or concepts."

In principle, then, Living Labs are a promising candidate to provide a considerable framework supporting innovation processes and collaboration among the stakeholders involved. However, currently we have relatively little information about the processes of knowledge transfer that would have to take place between 'users', professionals, and researchers if Living Labs are to prove a useful and sustainable addition to our methodological armory. Not least, and as we discuss below, there are management issues of a quite practical nature that are under-described. There is, then, a good case for examining a long-term case of Living Lab participation in order to enrich our understanding of how processes might be arranged, changed and negotiated over time to provide maximum benefit

for all stakeholders. We will argue that the inter-linked dimensions of knowledge, expectation, practice and time are critical to this understanding.

The paper contributes to these issues by presenting a case study of a Living Lab where participants had the use of a new cross-platform entertainment infrastructure for interactive television and social media applications on mobile devices. Our focus here is, however, less on the technology than on the way in how 'interests' and 'expectations' are managed. In doing so, we draw on the notion of 'Community of Interest' (CoI) (Wenger, 2000; Carlile, 2002). The concept has the analytical advantage of not presupposing that a shared goal and understanding among participants of a Living Lab must exist, but rather investigates empirically how varying viewpoints and interests are negotiated over time to produce such a community.

The paper is organized as follows: Section 2 presents a review of the existing literature on Living Labs and examines the concept of CoI to study processes of change within such a community. Section 3 describes the partners to this research and outlines some methodological concerns. Section 4 outlines the way in which our Living Lab was conceived. In Section 5, we emphasize the perspectives of the various stakeholders in the work and reflect on the issues that arose. Finally, section 6 discusses the findings with regard to the relevance of practical management of maintenance work in long-term collaboration projects and the importance of specific roles in such a complex innovation environment. Furthermore, based on our results, we will make suggestions as to how innovation processes and collaboration within a Living Lab can be fostered and sustained.

# 2 Related Work

## 2.1 The Living Lab Approach

In recent years the term, 'Living Lab' (and its methodological possibilities) has attracted increasing attention within the research field of ICT. According to Eriksson et al. (2005), the term was created by Mitchell at the MIT Media Lab and was considered as an instrument to carefully study users and their interaction with new IT-artifacts in real life environments and for longer periods of time. As such, it drew on early insights from product design where, for instance, von Hippel (1978; 1986) focused very much on applying a quasi-naturalistic, but nevertheless controlled environment for product testing. Since then, and depending on the context, the research goal and the stakeholders involved, the term has been used with varying emphasis. Underpinning all approaches, however, is a common understanding of the concept as an infrastructure with a strong focus on user-centric research methods, i.e. methods that can be applied in multiple real life environments for "sensing, prototyping, validating and refining complex solutions" (Eriksson, Niitamo and Kulkki, 2005). According to this,

Living Labs basically can be understood as an infrastructure where different stakeholders from several sectors – public institutions, academia, industry and citizens – may interact in an open innovative process that takes real use contexts (domestic and working environments, public and urban spaces etc.) into account (Niitamo *et al.*, 2006; Almirall, 2008).

These characteristics of a Living Lab were additionally influenced by the research and development funding of the EU Commission for piloting the 'European Network of Living Labs (ENoLL)'. ENoLL was founded in 2006 to build a sustainable strategy for innovation processes in Europe, and established the principle that a Living Lab is qualified for four main activities:

(1) the exploration of user behavior in context, and of market conditions;
(2) the co-creation process between users and designers;
(3) experiments within scenarios and
(4) the evaluation of products and services within real life environments (OpenLivingLabs).

Følstad (2008) also emphasized similar characteristics in his comprehensive literature review. He identified nine characteristics, and four that are valid for all the labs that were analyzed, namely: gaining insights in unexpected ICT-uses and new service opportunities; evaluating or validating new IT artifacts with users; experiencing and experimenting with such solutions in contexts familiar to the users; and enabling middle- or long-term evaluations with users. In particular, the early and constant involvement of the users into the co-creation processes of IT artifacts is seen as an important characteristic of the approach (Schaffers *et al.*, 2007). Long-term and sustained collaboration thus enables, in principle, the capturing of both the ideas and the experiences of users in real usage contexts. Whether this is always achieved in practice is another matter.

Quantitative empirical investigations of TRAIL (Translating Research and Innovation Lab) has indicated that Living Lab operations do not always result in the successful transference of knowledge about empirically observable usage patterns and social behavior as well as direct user feedback and ideas into new services and IT artifacts (Mulvenna *et al.*, 2011). They also indicate uncertainties about collaboration strategies and over best practice in engaging with users. Therefore, based on study results, TRAIL has published a toolkit with practical advice (Beamish *et al.*, 2012). Here, it is shown again that there is no common understanding of the concept as a research framework, something that Schuurman and De Marez (2009) had pointed out earlier. That is, there is a need to deconstruct the concept in such a way that a practical and nuanced understanding of the negotiated relationship between different stakeholders and the consequent barriers to useful collaboration is possible. The stakeholder problem, as Ponce de Leon et al. (2008) have emphasized in this context, is a critical challenge to the Living Lab concept.

The Living Lab approach and its putative qualities are discussed from a range of different theoretical perspectives. Schuurman et al. (2010; 2009) adopted SWOT analysis (a strategic planning method that focus on strengths, weakness, opportunities and threats of business ventures and projects) in order to identify advantages and disadvantages with regard to research on Mobile TV, and specifically in relation to the qualities of participants and their roles at different stages in the Living Lab process. Again, Kusiak (2007) investigated empirical approaches to fostering the innovation process and ascertaining user requirements. With a slightly different emphasis, Almirall and Wareham (2009) analyzed applied research methodologies associated with the Living Lab concept in order to explore how users could be involved into a more user-centered design process to expose the potential for innovation and co-creation. Følstad (2008) also focused on the perspectives of multiple stakeholders and, again, identified a strong focus on user-participation in design processes. Nevertheless, and with few exceptions, little has been written about how co-creation and collaboration of the disparate groups involved are actually managed - successfully or otherwise - and what kinds of problem have to be surmounted if knowledge transfer across these groups is to be successfully coordinated in a continuous and sustain way.

One of the few examples studying cross-organizational collaboration within Living Labs is the work done in the ITAIDE project (Baida *et al.*, 2007; Frößler *et al.*, 2007; Tan *et al.*, 2010; Klein, Higgins and Rukanova, 2011). Frößler et al. (2007) applied a practice-theoretical lens to study the network relationships in the case of the Beer Living Lab (BeerLL) – a pilot project where four Living Labs were set up as real-life experimentation platforms for handling the export of excise goods and their movement in supply networks. They concluded that Living Labs are dynamic, open-ended environments in which the lack of clearly defined goals requires a willingness for continuous sense making and negotiation from participants. Collaboration could only be partially specified by fixed contracts, so that social capital was crucial for the actors to deal with the inherent uncertainties of innovation development (Klein, Higgins and Rukanova, 2011). In another four year Living Lab project Hakkarainen and Hyysalo (2013) reflected on mutual beneficial learning, rating it as one of the key values of the approach. They specifically examined power issues between different stakeholders and end-user reluctance in the co-design process. Based on that, successful mutual learning is at the mercy of so called ‘innovation intermediaries’. Such key persons can help actively to chart different priorities and to find compromises in situations of conflict. Johansson et al. (2011) approaching Living Lab processes as innovation boundary contexts and describe Living Labs as an interaction of different ‘Communities of Practice’ (CoP). From this perspective, they analyzed the dynamics of boundary situations, their influence on the innovation process and their facilitation by different support mechanism. Based on the analysis, they derived a process model that distinguishes between ‘boundary objects-in-use’,

‘process brokering’ and ‘product/service brokering’ in innovation processes. ‘Boundary objects-in-use’ provide a basis for ‘brokering processes’, which do not just arise between objects and individuals, but rather between members of several CoPs and can be described as constant iterative feedback and reflection processes enabling mutual understanding. ‘Product/service brokering’, however, focuses on processes of perspective making and perspective taking between CoPs with respect to innovation and design processes, e.g. idea creation, concept development, evaluation. In contrast, ‘process brokering’ focuses on maintaining basic communication and interaction processes.

As previous research indicates, in order to understand sustain and successful collaboration processes within a Living Lab in more detail, therefore, it is essential to understand how Living Labs work in practice as a dynamic, multi-contextual and long-term existing infrastructure for innovation development and with different stakeholders following diverging practices, interests and expectations. The work we detail below is a contribution to this recently emergent research concern. In particular, we will investigate the practices of participating groups in making sense of the available infrastructure and how these practices support inter-organizational knowledge transfer and how it may change over longer periods of time, affect collaboration processes between the different stakeholder groups and lead to negotiation of specific role takings that provide the basis for the Living Lab approach.

## 2.2 Learning through Interactions of Communities of Interest

Conventionally, organizations can be thought of as having both formal (rules, procedures, structures) and informal (conventions, habits, cultures, practices) elements. At the risk of simplifying complex arguments about the conceptualization of the ‘formal’ and the ‘informal’, we will simply suggest that formal structures are typically held to ensure stability and continuity and to be efficient for the structuring of repetitive tasks. Informal elements ensure flexibility when dealing with the contingencies of situated work. These informal elements, of course, are not randomly enacted. They orient towards some kind of skillful, knowledgeable work and provide a base for the building of social capital within organizations (Putnam, 2001; Huysman and Wulf, 2004). Living Labs, then, are - in significant ways - distinct from classic conceptions of the organization. While there may be elements of the ‘formal’ to be found - some common procedures, rules, etc. - they will nevertheless not be mature and neither will there be any of the normal organizational sanctions, which underpin their existence. Similarly, although from the outset we might identify informal practices, they will not be mutually constituted in any stable way. It is only when they result in the building of affiliations, trust, and motivation that they can be thought of as entailing social capital. Overall, Living Labs are better conceived of as networks and, moreover, specific types of organizational network whose characteristics decisively differ on

several dimensions from classical networks (Frößler *et al.*, 2007). They are dynamic, fragile and complex collaboration networks in which multiple actors with different interests, expectations, cultures, practices and languages etc. come together to participate in interdisciplinary projects for a limited period of time. In order to deal with the uncertainties of innovation development, the elements of trust etc. that define social capital need to be fostered (Klein, Higgins and Rukanova, 2011). How this is to be done within the fragile conditions of a Living Lab in a reliable and sustainable way remains an open question.

From a practice-oriented point of view, then, the concept of CoI seems to be appropriate for the investigation of Living Lab processes. A CoI commonly represents a network in which members from different CoPs come together temporarily in order to solve a common problem or to share a common interest in a certain domain (Fischer, 2001). In a CoP, learning mainly takes place through legitimate peripheral participation and is predicated on shared assumptions about the nature of expertise. In contrast, learning in a CoI is rather a complex process across the boundaries of diverse knowledges and experiences. The diversity provides a high potential for innovation and collective creativity through the interaction of different CoPs (Fischer, 2001). In order to realize the innovative potential, knowledge has to be managed, translated and transformed from one context to another and artifacts adapted for these tasks (Stevens, Schwartz and Meurer, 2009). Common understandings evolve incrementally over time in people's minds, by the help of external artifacts (Fischer, 2001) and through persons with key roles shaping practices between different CoPs (Lee, 2007). Accordingly, externalization is key for collaboration in CoIs (Bruner, 1996).

Applying these considerations to the case of Living Labs, we suggest that Living Labs present a kind of a project-oriented CoI, in which 'boundary negotiating artifacts' (Lee, 2007) emerge and become more stable over time. That is, processes of collaboration, which constitute the founding purpose of the CoI are mediated by negotiating artifacts which, in turn, become more stable and predictable in their use as more stable collaborative forms take shape. These iterations are, however, not smooth. Taking this evolutionary character into account, the concept will further prepare us for taking a closer look at the formation of the Living Lab and how artefacts and roles appear and become stabilized.

## 2.3 Research Gap

As previously described, bringing together heterogeneous stakeholder groups and applying collaboration infrastructures like Living Labs, require for mediation and negotiation activities especially in long-term projects in order to perform successfully and provide valuable and sustain output where every single stakeholder can be satisfied. However, relatively little is known how Living Labs operate successfully in long-term perspectives. This leads to two main questions,

which we investigated in our research by analyzing qualitative data from the overall project with a practice-oriented analytical lens to study the overlapping boundaries as well as management and negotiation processes among diverse stakeholders. How do inter-relationships between several stakeholder groups need to be managed and maintained? What importance attaches to specific roles or artefacts, how can they be defined and in which way they will be applied?

# 3 Method

This case study presents the Living Lab called 'SocialMedia Experience and Design Lab' (SMEDL). The Living Lab was set up within a publicly funded, four year research project that aimed to develop a cross-platform framework including TV, PC and smartphone to support more flexible and integrated media consumption and use of social media applications (Hess *et al.*, 2012). The project consisted of three academic partners, two from different departments at the University of Siegen, Germany (one from the information systems department and one from the media research institute), and one external research partner with focus on user-centered design; two industry partners (media agencies); and a regional user sample of 16 households representing future users. The users are not core members of the project consortium, but are an essential part of the Living Lab. Additionally, there are some associate partners (like a private TV broadcaster) that are interested in the results of the project, but do not actively participate in the Living Lab. The academic partners are fully funded, while the industry partners are co-financed on a matched-funding basis. The participating users do not receive any direct payment. As incentive, they were equipped with current marketable technologies they could use individually over the whole project time.

The work we report here can be thought of broadly as action research and as such confronts the same dilemmas known from action research and from ethnographic practice: On the one hand researchers should being a member of the setting in question allows a privileged access to the setting and the detailed interactions it contains, providing first hand data and in-depth insight. At the same time, this involvement threatens the neutral, 'critical realist' stance on research that outsiders can more easily take (Mathiassen, 2002). Our response is pragmatic. We take the view of participant observation associated with the likes of Clifford and Marcus (2010), which accept the inevitability of partiality and recommends a reflexive process in which researchers consider their role in the production of the ethnographic narrative. Having said that, although two of the authors have been directly involved in the project from the beginning, three others have no direct involvement. Their critical external view supplements insider knowledge and acts as a 'sanity' or 'reality' test of claims.

In our study, we applied the (loose) method of focused ethnography (Knoblauch, 2005), where the focus is typically given by a particular research interest and/or by a theoretical perspective. In our case, the focus was given by our interest in the multiple perspectives on Living Labs, and the way in which different stakeholder groups collaborate in long term. The data corpus we collected includes documents like the project proposal, the consortium agreement, project deliverables and minutes of project meetings as well as the email exchange between the directly involved representatives. Since the users' perspective is only marginally expressed by these documents, excerpts of email exchanges between households and responsible Living Lab staff members, and interviews with all participants formed the main basis for data collection. We also conducted semi-structured interviews with two of the industry partners and two of the representatives from the university. The other academic partner from the media research institute as well as the external research partner have no active involvement within the Living Lab and therefore were not interviewed. Table 1 lists the interviews we conducted.

| Stakeholder | Institution | Function/Characteristics |
|---|---|---|
| Academia | Institute for information systems (university) | Research associate *(overall project coordinator)* |
| | Institute for information systems (university) | Research associate *(project assistant)* |
| Industry | Media agency A | Manager for innovation projects *(sub-project coordinator A)* |
| | Media agency B | Chief executive assistant and manager for special projects *(sub-project coordinator B)* |
| Users | SMEDL - regional test bed | 27 participants out of 16 households |

**Table 1: Sample of interviewed persons involved in the Living Lab project**

Both members from industry are sub-project coordinators and are responsible for the work in the project and for innovation and funding projects within the companies. One representative from the university - author and overall coordinator of this project - was directly involved in acquisition, planning, organization and coordination. The other representative from the project staff is responsible for the technical development and technical support of the participating households.

The four interviews with academic and industry partners were conducted in person and lasted up to 90 minutes. We asked questions about the Living Lab

setup process, personal views of the project and collaboration issues. Of particular interest was the degree of mismatch between individual and professional practice as against the demands of collaboration. As part of the project, several empirical studies were conducted to explore IT practices, domestic media usage and social interactions of the participating users. In addition, we conducted 64 semi-structured interviews at participant's homes – four in each household: one before the technical intervention and one every year with respect to long-term phenomena. Interviews were also conducted in person and lasted up to 60 minutes each. The interviews included questions about individual motivation, the personal understanding of the Living Lab concept, their own role in the Living Lab process and collaboration with others.

All interviews with participating household members, industry and academic partners were recorded and transcribed afterwards. The analysis of the whole data corpus was conducted by qualitative techniques. In a first analytic step, we structured the data by its content (Mayring, 2000) to provide an overview and to identify interesting extracts for a subsequent detailed analysis. We derived categories from the interview guides (motivation, definition of Living Lab, understanding of one's role, conflicts of collaboration etc.) and the concept of CoIs (expectation, communication, established practices, artifacts, common intersections within Living Lab work etc.). After that, we analyzed identified excerpts in detail by following an inductive coding method (Corbin and Strauss, 2008) and triangulated identified phenomena of several stakeholder groups (work and life practices; and mediating roles) with contrasting examples from others. Both phenomena are interrelated with each other and reveal which negotiating and maintaining activities seemed prominent for long-term collaboration in Living Labs. We further analyzed the stakeholders' deals with the heterogeneity of interest and worldviews and how they manage the dynamics of the innovation development process. In particular, we were interested in how the perspectives are mediated across the local sites and coordination is reached within the Living Lab.

# 4 The Formation of the Living Lab

Understanding the formation process helps to understand how subsequent activities in this kind of CoI emerge and how interactions can be coordinated in order to achieve an agreeable outcome. Hence, based on the data corpus, we will reconstruct this process in the following sections, starting with the setup of the Living Lab and finishing with collaborations between the participating stakeholders.

## 4.1 Formation and Setup

Before the actual start of the research project, representatives from academia and industry discussed the goals they wanted to reach, and identified their own interests in relation to project outcomes. These stated aims fed into work packages by the overall project coordinator who summarized feedback to project members and used that to structure the division of labor. The main goal - as stated in the proposal - was the common development of an integrated home IT platform. The basic framework of the platform was to be developed by the university. The main duty of the industry partners, in turn, was the development of client-side applications using the framework, for instance, by developing adequate interfaces for smartphone and TV.

To benefit from real use contexts in the design and evaluation processes, the project adopted the concept of Living Labs as infrastructural and methodological framework. In the planning phase, it already became clear that a well-designed infrastructure would be necessary to facilitate collaboration with all stakeholders over a time period of four years. As a crucial document, the project plan served as a basic guide to structuring the entire process and for the establishment of the required infrastructure. The project plan was elaborated together by involved partners and contained descriptions about tasks and work packages, internal milestones for each partner and external milestones for the whole consortium as well as the planning of events like creative workshops where all stakeholders including users came together for review.

The first stages of the project itself had to do with the setup process of a regional test bed for involving users from the earliest possible stage. The test bed was intended to enable the co-creation of new ideas, the discussion of concepts and the evaluation of prototypes in a continuous manner. The project consortium decided at a workshop that the university should primarily take on this task along with the hosting itself, because of its acknowledged expertise in and experience of fieldwork. In this context, it was also decided to identify and build a regional user sample near the university to ensure technical support and close collaboration with participants in order to foster the user-centered research strategy. Even though the setup, hosting and basic user involvement was planned to be managed by the university, it was also agreed that other Living Lab partners, notably industry partners, should become involved in further processes, for instance, by discussing ideas in workshops or reflecting on early mockups with participating households.

Hence, the university took responsibility for the application and selection process of the household sample, based on criteria that were collectively identified by project partners. The sample, in other words, was in no way random. As well as being situated in the local area, household members were expected to demonstrate high personal interest in new media, home entertainment technology and services, high frequency media usage as well as an ability to reflect on their

own experiences both as media consumers and as project members. Households also needed to have the appropriate technical infrastructure within their homes. Additionally, the sample, if at all possible, needed to reflect certain typical family characteristics. Thus, couples with and without children, and singles with and without children had to be found. Concerning the users' experience with new marketable technologies, an agreement was achieved about the selection of participants with different levels of expertise, for instance, ranging between more experienced participants, who already had used specific technical systems or devices (media center system and/or a smartphone) before and others who had not. The consortium stressed that feedback from a broad range of heterogeneous users was needed in order to design for a broader user community. Thus, 27 participants (14 male, 13 female) out of 16 households (5 couples with children, 5 couples without children, 2 singles with children and 4 singles without children) were selected according to the described characteristics. The multistage setup process of the local user sample is described in detail in Hess and Ogonowski (2010) and Ogonowski et al. (2013).

## 4.2 Establishing Collaboration Between Stakeholders

The project plan required university partners to take responsibility for the development of a suitable protocol for user participation, defined by one of the work packages. It was decided that this should be done through a mixture of methods, reflecting both practical issues such as available time (for researchers and households); the need to establish and maintain a more personal level of contact; the need for 'rich' data about usage and the need to reach some comparative conclusions. Above all, from the researchers' point of view, there was a desire to understand how media usage was mediated by the structures and rhythms of household life. Initial user studies were predicated on the use of media diaries and semi-structured interviews, in order to obtain an early understanding of the users, their current media usage and related social activities in domestic environments (Hess *et al.*, 2011). This work package also included the identification of initial requirements to be established before further work was undertaken. A part of the project plan was to equip participating households with new, marketable, technologies. The technologies (a media center system, a smartphone with Android OS and a high definition television) were selected in accord with a common decision made by members from the university and industry, but without involving participants of different households. The university carried out the installation of all necessary additional equipment in the households, and was responsible for the technical support of deployed technology as well as for the installation of software updates.

In line with the project plan, project assistants at the university organized creative workshops simultaneously. In the first instance, workshops with users with a relatively high degree of technical knowledge were conducted at the

university. The aim was to discuss current media usage and to examining possible new ideas (Hess *et al.*, 2011). Representatives from industry also joined the discussions in order to gain a first-hand understanding of the needs and demands being expressed at this point in time. For this, the industry partners had developed initial mock-up concepts on paper and with PowerPoint, which were discussed in several test sessions afterwards. Later on, participants from the regional user sample were invited again to test an early prototype on a mobile device provided by one of the industry partners. The tests were conducted by the university staff who also subsequently edited the data (which had been recorded and analyzed) with respect to usability aspects and fed back information to the respective partners. In a second step, the improved and fixed prototypes for smartphone, TV and PC were tested again in an artificial domestic lab environment at the university, before the entire home IT concept (with its initial functions already defined) was rolled out in the Living Lab households. Responses to these functionalities which were obtained from these tests, were again fed back to the industry partners in a structured manner, including a rating of the significance of mentioned usability issues. A suggestion for the design was provided as well.

As stated in the project plan, the university was responsible for establishing a collaboration between the future users, for exploring the context of use and finally for conducting more focused user studies. In addition, they were also asked to mediate between users and industry partners. To foster the information transfer between stakeholders, the university presented summaries of empirical results in consortium meetings. Additionally, empirical findings were fed back to the participating households. Again, the industry's part was more confined to technical development. They were required to deliver corresponding sub-goals such as mock-ups or prototypes for evaluation by the university with its regional Living Lab user sample. The results from the empirical studies concerning user requirements or their individual feedback were taken into account for further development steps. In comparison with the researcher's side, industry partners had relatively little in the nature of contact points with the regional user sample. As already indicated, users had no formal role in the project structure but were nevertheless seen as a key part in the co-creation process. As we will discuss, their pivotal role in the process measured against their lack of a formal status had consequences.

Hence, the Living Lab embodied the interests of several stakeholder groups from academia, industry and users. As above, we refer to this constellation of practical purposes as a CoI. Altogether, while they collaborated in order to reach a common project goal, developing an integrated home IT platform, each single group or even single members aspired to follow their individual interests and purposes.

# 5 Perspectives and Reflections of Stakeholders

In this section we will describe the individual perspectives of the three stakeholders - academia, industry and users - uncovering their motivation, individual interests, expectations and their experience with the Living Lab as a complex infrastructural and methodological toolkit. Further, we will describe the way in which the various methodological choices imposed a variety of challenges on the consortium, challenges, which altered in character over time.

## 5.1 Academic Perspective

The academic partners, and especially the university already had a strong expertise in the field of home IT and were therefore already familiar with the state of play in technical and market terms. Besides the common project focus, one of the researcher's motivations was to understand how technical systems and devices work in practice in order to use this information for further design processes.

> "The point is to identify a gap and therefore develop specific functionalities (…) to implement things and evaluate them in practice. Later on, writing a nice paper, to make a contribution to the research field. Therefore applied computer science, but also with a strong research focus." *(project coordinator)*

Further, they had a familiarity with methodological traditions, which emphasized the analysis of 'practice' – the so-called 'turn to the social'. In previous work, members of the team had undertaken more orthodox ethnographic work, entailing the study of users in 'naturalistic' environments. Nevertheless, they recognized that the study of users in household contexts presented particular difficulties. Not least, the study in question lasted four years, and entailed the progressive installation of different versions of the technology in that time. The orthodox ethnographic route did not seem especially promising as a methodological vehicle in these circumstances. There were other issues which also framed the progress of the work, and which need to be understood in respect of a collaboration, which was predicated on different interests. One of them is the need for clear documentation of processes. Industry partners were not minded to investigate user behaviors themselves in any great detail, but nevertheless oriented to some form of 'requirements' which might emanate from the study. The project plan was framed in a way that enabled academic partners to explore the users' current media usage in domestic environments and their related social activities before and after technical interventions. Such a process enabled academic partners to understand appropriation processes and technology use in daily life over a longer period of time:

> "You get other data then by a usability test. If you frame it as usability evaluation you quickly can check how to modify the interface. With a Living Lab it is rather the case that one can explore with long-term perspective. There are rather fundamental facts if technical artifacts

were accepted or that households accept them in a way other than intended. (…) We had seen the potential long time before. Therefore, we had pushed it." *(project coordinator)*

Conducting long-term empirical work in the context of emerging technological development, and in a context where methodological issues need to be identified before they can be resolved turned out to be appreciably more difficult than originally envisaged. The approximate model that the university researchers were working to, and embodied in project plans, was that there would be early 'pre-studies' which would furnish initial insights into the context of use, would involve design exercises with users to identify interesting technological concepts and which would allow observations of changes in media usage. These would in turn generate prototypes, which could be further evaluated and appropriation processes investigated. What researcher not anticipated was the sheer expenditure of time, effort and resources that resulted.

"It is a lot of work, not expected in this domain. For example, the introduction of new technology, a lot of things happened that no one could have imagined before. On paper you plan a study, conduct an interview, put technology in place, make a study again and that's it. In practice many wiked things happen. (…) Participants have different [technical] problems; appointments have to be planned. The effort is much higher than expected." *(project coordinator)*

One of the unexpected elements of this had to do with mismatched expectations concerning the nature of the university's role and the status of a prototype technology. University staff was responsible for rolling-out and maintaining these technologies, but understandably did not see themselves as a service hotline for any and all types of technical support. Users called them on numerous occasions for a quick rectification of a problem, which sometimes had little or nothing to do with the prototype technology, instead of solving the problem on their own.

"One example was the TV-signal within a household that did not work correctly. We started to solve the problem via telephone and remote servicing, then made a home visit and identified a defect signal cable. (...) The problem was the cable, not our technique. In such a situation, one does not call a technician, because of the cost thereby incurred. (...) Calling the university is for free and they can solve the problem. Instead of using another cable, they call us." *(project assistant)*

The point here is that the maintenance of relationships with users is such that simply refusing to conduct minor service work has consequences for the relationship. Academics, although they do not see routine maintenance work as part of their daily duties, still have to factor in judgments about how to deal with requests of this kind given that they are entirely dependent on the goodwill of participants. This is particularly important given that research involved not only the observation of people in their homes but also the conduct of workshops in the university to which participants were to be invited. Their input was a central aspect of these methodological choices.

Similar ambiguities in the nature of the relationship were evident between academic and industry partners. Academic members were responsible for the

transfer of design understandings to a common development strategy with industry partners in what, as they had been at pains to point out, was a dynamic and fragile environment. As the project coordinator explained, at this time, companies do not necessarily have expertise in such dynamic, cyclical and experimental exploration and user-centered design strategies. As a solution, he stated that it was a quite fundamental and important principle that the university performed the moderation:

> "What became visible for example at those creative workshops was the necessity to moderate certain things. For them [industry partners] it is the first time that they worked with mockups, with PowerPoint and paper to build mockups quickly and test them in workshops together with users." *(project coordinator)*

This also had consequences in relation to feedback processes. Academic interests concerned more than simply the production of requirements for technical innovation. Unsurprisingly, they had an interest in the social interactions that underpin media use and in the way in which empirical methods were to be deployed and managed. Nevertheless, in a project with partners from industry, these interests have to be negotiated, particularly when it comes to the reporting process. For industry partners, specific results, which center on innovation strategies and evidence that they are worth pursuing, are the main - almost the exclusive - point of interest. This again has certain consequences for researchers. They had to learn how to select and translate often complex and subtle information into a form that was relevant to the companies' individual needs and in a language, they understood. That is, and put simply, there were problems of relevance for all partners. What were relevant matters for users, for academic and industry partners were not always mutual, nor adequately shared. This can be expressed as a heterogeneous and not always well-understood set of priorities on the part of different interests. Not least, there was a divergence between interests of project members who saw ideas as 'cool' or 'exciting' and those, which were concerned with mundane matters such as what was doable and at what cost. As a solution, a priority list was established, and divided into 'basic functionalities' and 'advanced concepts' in order to build a common ground for further work. Thus:

> "What is even of importance is the feeling for an innovation, what are interesting functionalities and even to rate them with priorities. (…) An idea, even if really cool, may not be implemented, because less technical affine persons do not understand them or are not interested in them. We should rather give ok to other ideas, even if this function is not highly innovative, we should rather do basics, because most are interested in them. (…) We tried this for the first version … and then later on, we will try to explore more interesting and innovative things." *(project coordinator)*

## 5.2 Industry Perspective

As described above, industry partners in this project had very little experience in methods which implicated some kind of 'co-creation'. In neither of the media companies who were partners to the project was any history of working with users

on design, although they did have evaluative mechanisms in place, which sometimes (though not always) involved users as test subjects. Moreover, such evaluative strategies were typically conducted in-house and had no naturalistic elements. Media agency B thereby described the process as follows:

> "We have our internal test groups. We have the quality management group, some testers from the administration department, who are not necessarily technical forerunners and our programmers (...) when we use third party providers than we always have testers on their side. So we get the results of the test or we test everything on our own and we also write the cold review, when we have the third party provider."
> *(sub-project coordinator B)*

If requested by the companies' customers, extensive testing was normally outsourced to external providers, because of limited internal resources. Oddly, the involvement of users in the design process ran counter to company philosophy in at least one important respect. Since, it was argued, these companies represented themselves to clients as already being expert in their understanding of user needs, it would sit oddly if clients saw that they needed to have users involved in the design process. The sub-project coordinator A explained that the companies' philosophy would be negatively affected.

> "We have a long experience in business and our customers expect that we know what users want and respectively what we are doing. It would turn out badly for us to say that we let users participate in design." *(sub-project coordinator A)*

Despite these difficulties and barriers, the Living Lab was seen from both agencies as an interesting option to learn about new user-centered methodologies and to enlarge their expertise in receiving aggregated knowledge about relevant user demands. This was not the case at the outset, but rather was an emerging realization following some of the early workshop discussions with relatively experienced users. As underlined in the following quote, the sub-project coordinator of media agency B was rather surprised by the value of such group-based brainstorming sessions. Ideas from the participants were considered to be really innovative.

> "I liked it very much to brainstorm with the participants; it was a lot of fun. They already used new techniques in their homes and were creative in brainstorming processes. I was really surprised. For me, it was interesting to pick up on given ideas, some of them were equivalent to our visions and some were really innovative. For me, I picked up one brilliant idea!" *(sub-project coordinator B)*

At the same time, industry partners did not want to bear the cost of setup and management processes in relation to the Living Lab on their own, because they realized that moderating, coordinating and maintaining the whole process would be burdensome. Instead, industry partners viewed the Living Lab with respect to user involvement as a kind of service provided by the university:

> "I realized that it is a lot of work to do [at first]. Within the workshop you must coordinate the discussion, but also you have to make sure not infantilize people (…) and afterwards the analysis of the amount of data (…) I'm happy that you [university staff] handle this and give

the results to us."
*(sub-project coordinator B after a creative workshop)*

While both industry partners expressed a high degree of interest in evaluating their prototypes over a longer period of time, they were appreciably less interested in research questions to do with the way in which technologies change standardized practices of media usage over time. For them, the chance to check and improve innovative concepts, to understand their usability in everyday life in order to better design user-oriented and more marketable products and services were valuable. They tended to accentuate the direct acceptance of new technical solutions. Here, for example, one of the partners requested options and techniques to gather feedback in-situ in order to simply analyze it afterwards. From their point of view, user feedback needed to reach developers and designers immediately and with a degree of 'objectivity' and simplicity of information to keep usage processes and occurring problems comprehensible.

"We will support the users' feedback process on a short and easy way so that it is ensured in-situ feedback will be actually produced. Instead of participating households taking paper and pen, it would be much easier to track their navigation given that users agree to usage tracking at home. Additionally, screenshots and voice records would perfectly match their input. For us, problems or bugs will be much more easily comprehensible. All of that in combination would be the optimal." *(sub-project coordinator B)*

## 5.3 Users' Perspectives

It is almost a truism to say that selected participants were motivated and excited to become involved in the project. They were, after all, volunteers. The opportunity of being equipped with new 'state of the art' technology was a strong extrinsic motivation. Nevertheless, more intrinsic satisfactions became apparent. As one participant said:

"[I]t is very interesting and exciting to be part of this Living Lab. I can express myself and discuss novel concepts together with other households in the hope that some of my ideas will be implemented. If not, it does not matter. Anyway, if the product or system is available on the market, I can tell my friends that I contributed to it in the Living Lab." *(m 31, couple without children, high technical experience)*

In summary, the diverse motivations of the users included curiosity (the interest to explore new things), self-reflection (to understand and reflect on their own media usage), socializing (to get in contact with others), participation (to express own ideas), learning (to update personal expertise) and the support of research in general in order to influence the design of new products or services with respect to functionality or usability aspects (to act as co-creator) (Hess and Ogonowski, 2010).

In general, the users had shown strong involvement and interest in events where new ideas were brainstormed, first mockups discussed, or the usability of workable prototypes tested. For example, within small groups of creative

workshops, users also started to sketch their ideas on paper and liked discussing them with partners from the industry and university. In order to make their contribution to the technology development, users further remarked that it was necessary for them to make real experience by testing new functionalities in their everyday life.

> "Yes, if I tested it [in practice], I would have further ideas that I can provide. Actually, we did not test it but it was only shown to us. If one can test it, we can experience how functions are integrated in our daily lives and then we can evaluate aspects that are exciting or if settings are too difficult and have to be simplified." *(m 43, couple with children, high technical experience)*

The motivation to explore technology and to try out new functionalities was also expressed by the users with regard to marketable solutions. Nevertheless, the study has shown that the concrete level of engagement differs substantially from household to household: While some started to experiment with the technical equipment on their own, others wanted to be guided step by step. Users with low technical experience in particular were troubled when, for instance a problem with a device, smartphone or TV remote control, occurred. High technical experienced users were more likely to search for a solution on their own and subsequently confide their results to the academic staff. To begin with, there were high expectations when it came to getting into contact with the university staff when problems occurred or simply in relation to information seeking about possible uses of the new technologies.

> "Partly I was frustrated, because I thought there are so many functionalities and I do not get them at all and I wanted to have a small event with introductions, so that I knew what was possible. That would be nice. (…) Maybe this only affects me (…) because there are many new things at once."
> *(f 37, single with children, low technical experience)*

Participating households were also interested in the current state of the project's progress and normally wanted a more or less regular update from their contact person, who is a project member at the university. Minutes of casual meetings or telephone calls about technical problems indicated that, for users, it is important to get clear feedback about project status and, especially, about the way their contributions feed into the design process. Co-creation here means more than asking users to feed ideas into the process – it also involves giving non-experts a clear sense of what their contribution is, not least because their continued motivation to participate in the Living Lab depends on it. Most of the participants also expressed the wish to get in contact with other participating households and to be given the possibility to exchange experiences:

> "Probably there were several households that had problems with the television reception and with the remote control. There it would have been calming if others had confirmed same problems and I would not have believed that I was the only fool not to get it running. Even to discuss solutions for problems directly would be helpful." *(m 37, couple with children, high technical experience)*

Furthermore, while participants opened up to the researchers, they also wanted to know more about the persons behind the project. They expected more details

from the project members such as their work tasks, interests and some personal information, thereby demanding a higher degree of transparency:

> "That would be great, if for example the homepage [of the research project] would be enriched. (…) I wanted to show it to my mom, but then you only can read 'we do it in that and this way', but this is (…) that sounds as if it is written for specialists only. That is incompatible to normal households that have no clue. Or to introduce oneself with a photo [would be fine]." *(f 23, couple without children, low technical experience)*

The university responded to this by including users' suggestions and providing general feedback via a digital newsletter where results from empirical studies were summarized. In a more informal way, participating households were also invited to join a barbecue and annual get-togethers at the Christmas market, which were organized by the university staff. The social events helped to generate a better sense of the roles of university staff, the project's progression and provide 'faces' to names, and further helped households get some sense of other participants and their interests. Additionally, the university set up an online social community as a common reference point so that all participating households and project members (from academic and industry side) became part of it by completing their own profiles and in principle getting connected to each other. Such a common platform also helped to provide a shared understanding of the current stage of development as well as to share formal and informal news and information between all Living Lab members.

# 6 Discussion

Above, we have outlined the structure of the Living Lab, showing how it served both as R&D methodology and as infrastructure where various expectations, interests, working practices and learning experiences were brought together in order to deliver results on the topic of interactive television and social media. In this section, we will discuss the case by using the outlined CoI concept as a practice-oriented lens for understanding viewpoints and collaboration processes within Living Labs by taking a closer look at the emerging practical management of maintenance work and its corresponding roles.

## 6.1 A Living Lab Project as CoI

There is no doubt that, from the outset, all partners and involved households to the project had a clear sense of objectives beyond their immediate interests – they understood that it was a common project, developing and evaluating new entertainment concepts within a Living Lab setting. This common project interest was anchored in the project proposal and framed the consortium, and all partners contributed to the common development. However, this recognition did not preclude an emergent negotiation of roles predicated on more specific and

situational objectives. These distinct forms meant that nothing like a CoP could ever be discerned. Instead, the common Living Lab project was structured weakly enough to accomplish individual interests and to allow the partners to remain rooted in their own expectations and practices. Rather, we feel, the idea of a CoI fits this dynamic and emergent situation better. The Living Lab therefore provides a specific framework that brings together these different practices to foster interactions, allow for the negotiation of common values and space for innovation and learning. Referring to Johansson's et al. (2011) investigations, a Living Lab can be characterized as an emergent CoI, comprising several stakeholder groups (researchers, ICT developers and users), which share experiences and work together in order to solve a problem. We agree more or less with the assumption that Living Labs consist of several heterogeneous CoPs. Nevertheless, that heterogeneity is also present to some degree within single groups. Our experiences have shown that companies can be very heterogeneous concerning their worldviews of user empowerment and they can be competitive in their interactions. The same can be applied to users with varying motivation for participation, technical expertise and practices to handle technical issues. This group could not be considered as a 'naturally grown' CoP right from the beginning of the project. It evolved over time and throughout the project's progression but did not happen without external mediation work. Participating households were selected by academic staff members after consultation with industry partners. Community building was, in this specific case, artificially arranged and required practical management for bringing participants together. A lot of so called 'invisible work' was done by academic staff members, for instance informal meetings were organized to setup trust and get to know each other in person in order to also trigger the virtual exchange via messenger and social media communities at a later stage. Bringing participating users together was not easy as thought and was time consuming. This extra work was not anticipated, being independent from research work as such, but it was crucial for building the ground for further investigations. To paraphrase, it can be thought of as 'the work to make the project work'.

The same extends to the formation of the project consortium as a CoI. From a theoretical point of view, we argued the concept fits for emerging constellations like Living Labs. Having said this, it is clear that a Living Lab project is not really a CoI in its original understanding (Frößler *et al.*, 2007) either, at least at the outset. It rather needs a lot of maintenance work in several areas to become a CoI. For instance, academic partners provided the user with possibilities for face-to-face exchange and a further social media platform. The 'getting to know each other in person' was important but time consuming to manage. A mix of physical and virtual exchange possibilities turned out to be a good use of available resources but could not have been assumed at the outset. Without the practical work of determining how interactions and project outcomes might be successfully

managed, we argue there would have been no success. Such efforts were not basically considered in the project proposal but, with the benefit of hindsight, need to be recognized as a necessary part of coordination work packages and should be calculated in staff costs. Hence, there is an evident need to understand the extent to which negotiation and the management of processes produces the appearance of a CoI - come to constitute it - over time.

## 6.2 Negotiating Asymmetries in Stakeholder's Engagement

We further observed that the engagement and collaborative activities of the diverse Living Lab members constituted an asymmetrical structure. The Living Lab infrastructure provided for specific roles and responsibilities, which nevertheless had to be delivered (and negotiated) in practice. Exactly how was determined over time as all members learned what the costs (in terms of effort, time and resources) might turn out to be; what expertise were required; what challenges had to be handled; and what possible rewards might result.

One result of this was that by far the most active roles were those of the academic partners, especially those of the university. In the pre-project phase, it was mainly the subsequent project coordinator who formed the consortium. Academic staff members were responsible for the user acquisition and selection. In the initial project phase, the criteria for the selection of households were developed together with industry partners but academic staff were then responsible for finding appropriate candidates. Furthermore, due to the common agreement between academic and industrial stakeholders, the university served as the operator of the local test bed and became the de facto service provider for industry. Figure 1 provides an illustration of the resulting asymmetric structure of the Living Lab, where the university mediated between users and researchers and moderated their interaction. This role of the academic partner is expressed by the large intersection of the users and industry sides. In contrast to this, there was no direct intersection between industry and users regarding long term interactions. Industry had direct contact only within creative workshops and the first testing of mock-up concepts, and did not seek further possibilities for collaboration.

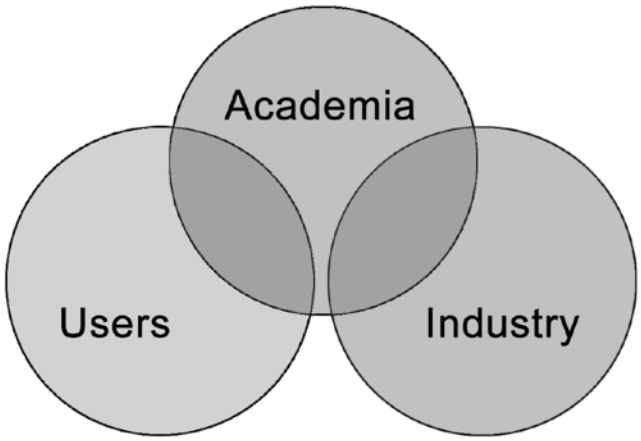


**Figure 1: Asymmetrical structure of the interaction where the academic partner functions as a mediator and moderator between users and industry**

The asymmetry is also expressed by the different interests evident. For industry, households mainly function as a test bed for the developed prototypes and were seen as having a very minor function as co-creators in the ideation process. Researchers were more interested in understanding media usage practices on a socio-technical level, and in how long-term technology appropriation happens. In addition, researchers had and have an abiding interest in the research process itself, its methodologies, and in the way in which the principle of co-creation turns out in practice. Users, for the most part, while they express some interest in these matters at the outset show themselves over time to have a much narrower set of interests. Their understanding of the research process, always secondary, became more subsumed by practical interests as time went by. Above all, they wanted the technology to work. They tended to perceive researchers, who had a motive to be in regular contact with them, as a help desk, responsible for any issue that might arise in the context of the deployed technology. The delicacy of this situation became apparent when, for instance, researchers had to make explicit statements to the effect that they would not respond to requests for help at weekends.

This underlines again the evidence of an emerging role of Living Lab members who are sensitized to the need to be aware of different point of views and to the necessity of being in charge of negotiating the diverging expectations of stakeholders, transferring information from one group to another and being a locus for communication. Johansson et al. (2011) briefly thematized this kind of emerging role in the context of process brokering activities based on boundary objects. Maintaining interactive dialogues between several group activities requires boundary-spanning competences. Those competences were attributable to experts in process brokering and they observed that researchers as operators of the Living Lab took them over spontaneously (Johansson, Lundh Snis and Svensson,

2011). Hakkarainen and Hyysalo (2013) described such key persons as ‘innovation intermediaries’. Ley et al. (2015), with regard to researcher-user relationships, see these ‘brokers’ as mediators with a function as point of contact and troubleshooter. In this case, this role was identified for one academic staff member. In their studies, Ley et al. (2015) showed such roles can be situated both within the community of participating users and as a part of a research team. In any case, it is relevant to ensure responsibility for heterogeneous stakeholders’ concerns and to become a trustable person. In this case and it is even observable in other constellations, this work is typically dependent on one single person who does practical management between stakeholder groups. However, there is an obvious need to reflect more precisely on the expert’s role, possible associated obstacles and necessary attributes in order to understand how mutual understanding between several Living Lab members will be established and maintained.

The challenge in this context is that we are dealing with subjects that have their own perspectives, attitudes and distinctive behaviors. With regard to boundary spanners, the characteristic feature is that they mediate between two communities of practices to which they belong (for instance, a boundary spanner would be a designer that works in the media agency, and at the same time, a participant of (for instance) a focus group. Therefore, Soini (2006) argues for the role of industrial designers as facilitators because of their knowledge of both design and of user groups. Even so, there is little discussion of the possible barriers to this mediating role – the nature of language used, of background assumptions, of heterogeneous and sometimes disguised interests, and so on. Mediation, put simply, is challenging. This task implies both specific social (sympathy, empathy etc.) and research skills (visualization, ideation etc.).

For want of a better word, we name this emerging role, a *Living Lab agent*. With the boundary spanner, the role requires that s/he understands each stakeholder’s perspective in order to successfully coordinate and mediate between them. In contrast to a boundary spanner, this understanding is not naturally given but has to be developed over time and is directly connected with a lot of invisible work which depends on basic social competencies, as well as an information strategy for developing and maintaining appropriate channels and materials, e.g. digital newsletter, social media community and further documents. The case study showed that these maintaining and mediating activities were essential for bringing together users, researchers and representatives of the industry in order to create spaces for common collaborations and for the transmission of bundled information to the industry partners, to the users, as well as to others in the research group. Users should be able to directly address the boundary agent for any questions or support, which strengthen the trustful relationship between him/her and the individual user. In addition, as a moderator and network manager, a Living Lab agent functions not only as an inter-organizational actor mediating

and maintaining between the different partners, but also as a reflexive participant, handling of their own, intra-organizational perspective, taking into account their own value system, personal interests and organizational demands.

## 6.3 Physical and Digital Artifacts in Use

The case study further shows that pre-defined work packages and milestones are important artifacts for the basic orientation of management and cooperation and the alignment of perspectives. Having said that, the project plan, by definition, underspecified the realities of practice. It is possible to see this as a 'failure' of planning certainty, but we do not take this view. We see this, not as a deficit, but as a necessary feature of the plasticity required for evolving projects to function fairly smoothly. This plasticity functions in two dimensions: structurally and temporally. Structural plasticity helps to shape activities such as workshops or milestone deliverables, so that each representative knows what he/she has to do, and is weak enough that individual interests, flexibility and work processes can be negotiated and managed. If those activities are structured too weakly or too rigidly, collaboration becomes more difficult as different work practices, languages and general interests or the limitations that are determined by brand identities and companies' philosophies within the customer market, create frictions. Temporal plasticity (typically neglected in the literature on boundary objects (Star and Griesemer (1989), Carlile (2002) or Stevens (2009)) is especially important in the case of distributed innovation development where diverse processes have to be coordinated. Representatives with diverging temporal requirements, predicated on the radically different routines and rhythms of academic, domestic and business life, need to accommodate. In this case, the work packages were designed with temporal plasticity in mind, e.g. partially decoupling technology development through a component approach as well as decoupling the development thread from the empirical thread, using a probing approach (Gaver, Dunne and Pacenti, 1999).

In particular, the design of work packages shows that structural and temporal dimensions are not independent from each other and therefore they have to be planned together. While the project plan serves as a basic orientation, essential elements of innovation cannot be planned, but are informal in nature. Good examples are the creative workshops that serve as negotiating artifacts. As a place where all representatives come together, it allows them to acquire a feeling of what may be of relevance for future developments and to re-prioritize work. The process of compiling a technical prioritized feature-list was a valuable process for participation, discussion, reflection, analysis and learning. This was stressed for instance by the industry partners, who admitted to being inspired by early brainstorming activities with users.

These negotiating artifacts became an object of shared interest, but were not adapted to local needs and constraints. In the observed case, the official project

website developed into such an object. The intention of the providers (project coordinator and academic research group) of the site was to create a common representation for all partners. Nevertheless, while users recognized that the website was intended as a common object containing information about project status etc., they could not identify themselves with the design, content or language. The university considered criticisms and suggestions from the users, so that a social community supplemented the object. It was set up in order to moderate online discussions and to support the exchange between households and project.

This example demonstrates that the processes of mediation are critical to the role of negotiating artifacts. At various points in their development, such artifacts function only because of the mediating work done - in this case - largely by university partners who played a major role not only in knowledge transfer but also in maintaining motivational levels, 'taking care' of users, providing technical support, translating into more functional language for industry partners, and so on.

## 6.4 Cognitive Shifts as a Basis for Co-Creation

A general issue of the Living Lab approach is that "members of each organization have to perform a cognitive shift away from the traditional perspectives of their own institutions (…) towards the formation of a new perspective in which each institution played a crucial role in the overall network" (Frößler *et al.*, 2007). In the literature (Folstad, 2008; Schuurman, De Marez and Berte, 2010; Mulvenna *et al.*, 2011), the users' role within that network is also typically diffuse. This is not just a theoretical, but also a practical problem. Vines et al. (2013) described this phenomenon of gloss in respect of 'how to involve users into design' from a general HCI perspective, but it is transferable to Living Lab research. 'Participation' is, unsurprisingly, a term which is extensively used in HCI literature but it is "rarely articulated how user participation in design occurs in different forms of interaction and engagement" (Vines *et al.*, 2013). We found in the Living Lab literature that users are typically treated as co-creators at a theoretical level and that degrees of user engagement are recognized to be diverse, but that there exists little work (e.g. Ogonowski et al. 2013; Schuurman et al. 2010) that actually describes different participation roles and how they emerge. Even less work concerns what kinds of user might be suitable for different design stages and how they can contribute to that. This gap in the literature has to do with a casual assumption about users as co-creators and is the result of too few attempts to examine the actual process and role expected of users. These under-investigated participation issues thus constitute barriers for the stakeholders involved, particularly with regard to their cognitive shifts in the design process and the degree of user engagement. This leads to uncertainty in conceptual research design, over sharing control with users, and ethical issues. There are undoubtedly pragmatic challenges associated with how one selects users and the

concomitant possibility that multiple design perspectives are not adequately reflected (Vines et al. 2013, Ley et al. 2015). It is, we argue, important to recognize the individuality of user perspectives and to see design choices which are ultimately predicated on heterogeneous user input as reflecting something more than an averaging process. This is related to the fact that users, as has often been asserted in the PD literature, should be treated as active agents in the design process and not merely as sources of information. The recognition of agency is critical, in our view, for an understanding of the Living Lab as being significantly more than a product testing ground. That agency is constituted precisely in the personal relationships we aimed to realize. They are constitutive of the social capital that the Living Lab should generate.

From this perspective, the Living Lab asks for a shift from the scientific or engineering perspective which otherwise seeks an objective solution to the problem of design. Action researchers, in contrast, do not consider neutrality and objectivity as the important qualitative criterion and hence can orient to a more nuanced understanding of user participation. In addition, the case study also shows that the problem of engaging users is also related to norms within specific expert roles like UI or industrial designers. Traditionally, the designers' competence is to know and to understand users, while the Living Lab asks for a new competence – being an expert in 'working with' the user as a co-creator especially for ideation and concept creation. Media agencies, their customers and industry are sometimes locked into a traditional view of users, which, at worst, treats them as irrelevant at this design stage and at best as a source of data. A core competence, we suggest, of the Living Lab is the ability to make use of the full potential by creating spaces in process models for integrating users as co-creators and fostering ideation, negotiation processes and experience sharing. This is anything but trivial. In this work, we do not give a final answer to whether the indicated cognitive shifts are ultimately achievable. The aim of this line of thought is rather to articulate the theoretical as well as practical difficulties of user engagement and the shortcomings of grounding the cross-boundary collaboration in social capital.

# 7 Conclusion

Living Labs present a promising innovation concept in which design is carried out in close interaction with real life environments (Eriksson, Niitamo and Kulkki, 2005). It serves as an infrastructure and as a research methodology in which multiple stakeholders including representative users can collaborate in the long term (Niitamo *et al.*, 2006; Almirall, 2008). The diversity of the people interacting in the Living Lab, it is argued, fertilizes innovation development through collective creativity (Fischer, 2001). However, by its very nature the emergence of innovative ideas is difficult to plan for, so that there is typically a lack of well-

specified goals and operational steps (Frößler *et al.*, 2007). This raises the question of how knowledge transfer and management activities across the sites works in practice and especially over a longer period (Folstad, 2008).

Within our work we provided insights into negotiating and maintenance work in Living Lab processes, their importance for emerging artifacts and the mediating role that has to be undertaken to bridge between divergent communities. By using a practice-oriented lens, we presented the case of SMEDL – a Living Lab that served as infrastructure for academia, users and industry to design a home IT platform and related applications. We especially focused on the formation process, the structuring of interactions, the practical management of maintenance work and the different perspectives of the stakeholders in that process. Our case study confirms the finding that the Living Lab presents a dynamic, fragile network, in which participating stakeholders have to react to new experiences and continuously changing conditions (Frößler *et al.*, 2007; Klein, Higgins and Rukanova, 2011).

We demonstrated how artifacts needs to be redefined so as to account for temporal dynamics. The case study reveals that in project-oriented Living Labs (Frößler *et al.*, 2007) the project plan as well as user workshops can and should be designed from this stance: plans should be well specified in order to give a basic orientation to the diverging stakeholders, but they should also provide enough temporal and structural plasticity to be adaptable to local needs and constraints as well as to deal with the contingencies of innovation development. It is the temporal plasticity that we feel has hitherto been under-examined. Generally, we argue that these artifacts help to shape collaborative activities between the diverging parties when, and only when, mediating work is done.

In addition, if mediation, as we assert, is crucial for emerging artifacts to function as such, this has consequences for the way in which we think of user participation in the context of Living Labs. Although in the literature (Folstad, 2008; Schuurman, De Marez and Berte, 2010; Vines *et al.*, 2013) there is a strong focus on user-participation, our study reveals that in practice the role of the user remains ambiguous and, to an extent, contradictory. In our study, there is clear evidence that there are a number of different views in play of what it is that users can be expected to do, not least on the part of users themselves. The Living Lab approach, our evidence indicates - and confirms earlier findings of Johansson et al. (2011) - requires a strong mediating role when commercial, academic and domestic interests are in play.

With regard to managing the complexity of setting up and maintaining Living Lab infrastructure and processes over long term, our case study further observed the emergence of a specific role that we have defined as *Living Lab agents*. In the described case, this new role was taken by the university to mediate between participating households, industry and researchers itself. For the users, they not only serve as a help desk that supports the appropriation of new technologies, they

also were responsible for conducting empirical studies and have to enforce the merging process of participating households to a community. For the industry as well as for academic partners, the university serves as a translator of the users' needs, they do a lot of persuading in user participation during the design process and facilitate the mutual learning between users, designers and researchers. In contrast to Frößler et al. (2007), who describe the Living Lab as a kind of a project-oriented CoP, the case we present is best described as a moderated and evolving CoI characterized by these specific roles. Referring to the statement of Ponce de Leon et al. (2008), our investigations contributed to the analysis and identification of a possible Living Lab key role, that of the agent, which is highly relevant for successful collaboration and knowledge transfer in practice as well as for non-research related maintenance work. These tasks are evident but not typically considered in the planning and setting up of Living Lab processes. Nevertheless, we suggest they are key for conducting successful projects and need to be taken into account.

Considering the efforts of setting up and keeping a Living Lab alive after single projects end, it gives pointers to the professionalization of the role of the Living Lab agents. In particular, hosting a local test bed can be considered as a service infrastructure for research and development where a key competence of the service provider is to adopt a Living Lab agent role. Central to this role is having skills to mediate between the different social worlds, to compensate asynchronous technology development and appropriation processes as well as to manage the diverging interests of the various parties within a Living Lab.

# 8 Acknowledgements

We warmly thank all the participants from our 16 Living Lab households for their attendance and endurance in this project. We also thank our academic colleagues and industry partners that they were willing to give interviews and to present experiences and opinions. The project 'SocialMedia' is funded by the MIWF, NRW, Germany, with resources from the European Union for regional developments (Ziel 2) (No. 280411902).

# References

Almirall, E. (2008) "Living Labs and Open Innovation: Roles and Applicability," *The Electronic Journal for Virtual Organizations and Networks*, 10(3), pp. 21–46.

Almirall, E. and Wareham, J. (2009) "Innovation: A question of Fit–The Living Labs approach," in *Proceedings of Mobile Living Labs '09: Methods and Tools for Evaluation in the Wild*, pp. 3–6.

Baida, Z., Rukanova, B., Liu, J. and Tan, Y.-H. (2007) "Rethinking EU Trade Procedures – The Beer Living Lab," in *Proceedings of Bled eConference*.

Beamish, E., McDade, D., Mulvenna, M., Martin, S. and Soilemezi, D. (2012) *Better together: the TRAIL user participation toolkit for Living Labs*. Ulster: University of Ulster.

Boehner, K., Vertesi, J., Sengers, P. and Dourish, P. (2007) "How HCI interprets the probes," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '07*. New York, USA: ACM, pp. 1077–1086. doi: 10.1145/1240624.1240789.

Bolger, N., Davis, A. and Rafaeli, E. (2003) "Diary methods: capturing life as it is lived.," *Annual review of psychology*, 54, pp. 579–616. doi: 10.1146/annurev.psych.54.101601.145030.

Brown, B. and Bell, M. (2004) "CSCW at play: 'there' as a collaborative virtual environment," in *Proceedings of the ACM Conference on Computer Supported Cooperative Work - CSCW' 04*. New York, USA: ACM, pp. 350–359. doi: 10.1145/1031607.1031666.

Bruner, J. S. (Jerome S. (1996) *The culture of education*. Harvard University Press.

Carlile, P. R. (2002) "A Pragmatic View of Knowledge and Boundaries," *Organization Science*. INFORMS, 13(4), pp. 442–455. doi: 10.1287/orsc.13.4.442.2953.

Carter, S. and Mankoff, J. (2005) "When Participants Do the Capturing : The Role of Media in Diary Studies," in *Proceeding of the SIGCHI Conference on Human Factors in Computing Systems - CHI'05*. New York, USA: ACM, pp. 899–908.

Clifford, J. and Marcus, G. E. (2010) *Writing Culture: The Poetics and Politics of Ethnography*. Berkely, Los Angeles, California: University of California Press.

Corbin, J. and Strauss, A. (2008) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, California: SAGE Publications, Inc.

Crabtree, A., Hemmings, T., Rodden, T., Cheverst, K., Clarke, K., Dewsbury, G., Hughes, J. and Rouncefield, M. (2003) "Designing with Care : Adapting Cultural Probes to Inform Design in Sensitive Settings," in *Proceedings of OzCHI '03*. Brisbane, Australia: Ergonomics Society of Australia, pp. 4–13.

Crabtree, A. and Rodden, T. (2004) "Domestic Routines and Design for the Home," *Computer Supported Cooperative Work (CSCW)*, 13(2), pp. 191–220. doi: 10.1023/B:COSU.0000045712.26840.a4.

Crabtree, A., Rodden, T., Tolmie, P. and Button, G. (2009) "Ethnography considered harmful," in *Proceedings of the International Conference on Human Factors in Computing Systems - CHI '09*. New York, USA: ACM, pp. 879–888. doi: 10.1145/1518701.1518835.

Dachtera, J., Randall, D. and Wulf, V. (2014) "Research on Research: Design Research at the Margins: Academia, Industry and End-Users," in *Proceedings of the ACM conference on Human factors in computing systems - CHI '14*. New York, New York, USA: ACM Press, pp. 713–722. doi: 10.1145/2556288.2557261.

Dijksterhuis, G. (2016) "New product failure: Five potential sources discussed," *Trends in Food Science & Technology*. Elsevier, 50, pp. 243–248. doi: 10.1016/J.TIFS.2016.01.016.

Ehn, P. (2008) "Participation in design things," in *Proceedings of the Conference on Participatory Design - PDC '08*. Indianapolis: Indiana University, pp. 92–101.

Eriksson, M., Niitamo, V. P. and Kulkki, S. (2005) *State-of-the-art in utilizing Living Labs approach to user-centric ICT innovation–a European approach, white paper*. Available at: http://www.vinnova.se/upload/dokument/verksamhet/tita/stateoftheart_livinglabs_eriksson2005.pdf (Accessed: August 28, 2013).

Fischer, G. (2000) "Symmetry of ignorance, social creativity, and meta-design," *Knowledge-Based Systems*. Elsevier, 13(7–8), pp. 527–537. doi: 10.1016/S0950-7051(00)00065-4.

Fischer, G. (2001) "Communities of Interest: Learning through the Interaction of Multiple Knowledge Systems," in *Proceedings of the 24th IRIS Conference*. Turku, Finnland: Turku Centre for Computer Science, pp. 1–13.

Folstad, A. (2008) "Living Labs for Innovation and Development of Information and Communicaton Technology: A Literature Review," *The Electronic Journal of Virtual Organizations and Networks*, 10(3), pp. 99–131.

Fowles, R. A. (2000) "Symmetry in Design Participation in the Built Environment: Experiences and Insights from Education and Practice," in Scrivener, S. R., Ball, L., and Woodcock, A. (eds.) *Collaborative Design*. London: Springer, pp. 59–70. doi: 10.1007/978-1-4471-0779-8_6.

Frissen, V. and Lieshout, M. (2006) "ICT in everyday life: The role of the user," in Verbeek, P.-P. and Slob, A. (eds.) *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technolgies*. Amsterdam, Netherlands: Springer, pp. 253–262. doi: 10.1007/978-1-4020-5196-8_25.

Frößler, F., Rukanova, B., Higgins, A. and Klein, S. (2007) "Inter-Organisational Network Formation and

Sense Making: Initiation and Management of Public Private Collaboration," in *Proceedings of Bled eConference*, pp. 354–371.

Gaver, B., Dunne, T. and Pacenti, E. (1999) "Design: Cultural Probes," *Interactions*, 6, pp. 21–29.

Grinter, R. E., Greenhalgh, C., Benford, S., Edwards, W. K., Chetty, M., Poole, E. S., Sung, J.-Y., Yang, J., Crabtree, A., Tolmie, P. and Rodden, T. (2009) "The ins and outs of home networking," *ACM Transactions on Computer-Human Interaction*. ACM, 16(2), p. article no. 8. doi: 10.1145/1534903.1534905.

Haber, T. (2008) *Resistenz gegenüber Innovationen (Innovation Resistance)*. Wiesbaden: Gabler.

Hakkarainen, L. and Hyysalo, S. (2013) "How Do We Keep the Living Laboratory Alive ? Learning and Conflicts in Living Lab Collaboration," *Technology Innovation Management Review*, 3(12), pp. 16–22.

Hess, J., Ley, B., Ogonowski, C., Wan, L. and Wulf, V. (2011) "Jumping between Devices and Services: Towards an Integrated Concept for Social TV," in *Proceedings of the International Conference on Interactive TV&Video - EuroITV '11*. New York, USA: ACM, pp. 11–20.

Hess, J., Ley, B., Ogonowski, C., Wan, L. and Wulf, V. (2012) "Understanding and supporting cross-platform usage in the living room," *Entertainment Computing*, 3(2), pp. 37–47.

Hess, J. and Ogonowski, C. (2010) "Steps toward a living lab for socialmedia concept evaluation and continuous user-involvement," in *Proceedings of the International Conference on Interactive TV&Video - EuroITV '10*. New York, USA: ACM, pp. 171–174. doi: 10.1145/1809777.1809812.

Hess, J., Randall, D., Pipek, V. and Wulf, V. (2013) "Involving users in the wild—Participatory product development in and with online communities," *International Journal of Human-Computer Studies*, 71(5), pp. 570–589. doi: 10.1016/j.ijhcs.2013.01.003.

von Hippel, E. (1978) "Successful Industrial Products from Customer Ideas," *Journal of Marketing*. American Marketing Association, 42(1), pp. 39–49. doi: 10.2307/1250327.

von Hippel, E. (1986) "Lead Users: A Source of Novel Product Concepts," *Management Science*. INFORMS, 32(7), pp. 791–805. doi: 10.1287/mnsc.32.7.791.

Hutchinson, H., Mackay, W. and Westerlund, B. (2003) "Technology probes: inspiring design for and with families," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '03*. New York, USA: ACM, pp. 17–24.

Huysman, M. and Wulf, V. (2004) *Social Capital and Information Technology*. Cambridge, USA: MIT Press.

Intille, S. S., Larson, K., Beaudin, J. S., Nawyn, J., Tapia, E. M. and Kaushik, P. (2005) "A living laboratory for the design and evaluation of ubiquitous computing technologies," in *Extended abstracts of the SIGCHI Conference on Human Factors in Computing Systems - CHI '05*. New York, USA: ACM, pp. 1941–1944. doi: 10.1145/1056808.1057062.

Johansson, L.-O., Lundh Snis, U. and Svensson, L. (2011) "Dynamics in an innovation boundary context: Exploring a living lab process from a community of practice perspective," in *Proceedings of Information Systems Research Seminar in Scandinavia - ICT of Culture - Culture of ICT, IRIS '11*, pp. 339–348.

Klein, S., Higgins, A. and Rukanova, B. (2011) "Network Collaboration Models," in Tan, Y.-H., Björn-Andersen, N., Klein, S., and Rukanova, B. (eds.) *Accelerating Global Supply Chains with IT-Innovation*. Berlin Heidelberg: Springer, pp. 255–269. doi: 10.1007/978-3-642-15669-4_14.

Knoblauch, H. (2005) "Focused Ethnography," *Forum: Qualitative Social Research*, 6(3).

Kusiak, A. (2007) "Innovation: The living laboratory perspective," *Computer-Aided Design and Applications*. Citeseer, 4(6), pp. 863–876.

Laurier, E., Whyte, A. and Buckner, K. (2001) "An ethnography of a neighbourhood café: informality, table arrangements and background noise," *Journal of Mundane Behaviour*, 2(2), pp. 195–232.

Lee, C. P. (2007) "Boundary Negotiating Artifacts: Unbinding the Routine of Boundary Objects and Embracing Chaos in Collaborative Work," *Computer Supported Cooperative Work (CSCW)*, 16(3), pp. 307–339. doi: 10.1007/s10606-007-9044-5.

Ley, B., Ogonowski, C., Mu, M., Hess, J., Race, N., Randall, D., Rouncefield, M. and Wulf, V. (2015) "At Home with Users: A Comparative View of Living Labs," *Interacting with Computers*, 27(1), pp. 21–35. doi: 10.1093/iwc/iwu025.

Mathiassen, L. (2002) "Collaborative practice research," *Information Technology & People*. MCB UP Ltd, 15(4), pp. 321–345. doi: 10.1108/09593840210453115.

Mayring, P. (2000) "Qualitative Content Analysis," *Forum: Qualitative Social Research*, 1(2).

Mulvenna, M., Martin, S., McDade, D., Beamish, E., Oliveira, Á. and Kivilehto, A. (2011) *TRAIL Living*

*Labs Survey 2011: A survey of the ENOLL living labs*. University of Ulster.

Niitamo, V. P., Kulkki, S., Eriksson, M. and Hribernik, K. A. (2006) "State-of-the-art and good practice in the field of living labs," in *Proceedings of the International Conference on Concurrent Enterprising*, pp. 349–357.

O'Brien, J., Rodden, T., Rouncefield, M. and Hughes, J. (1999) "At home with the technology: an ethnographic study of a set-top-box trial," *ACM Transactions on Computer-Human Interaction*. ACM, 6(3), pp. 282–308. doi: 10.1145/329693.329698.

Ogonowski, C., Ley, B., Hess, J., Wan, L. and Wulf, V. (2013) "Designing for the Living Room: Long-Term User Involvement in a Living Lab," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13*. New York, USA: ACM, pp. 1539–1548. doi: 10.1145/2470654.2466205.

OpenLivingLabs (no date) *European Network of Living Labs*. Available at: http://www.openlivinglabs.eu/aboutus.

Orlikowski, W. J. and Hofman, D. J. (1997) "An Improvisational Model for Change Management: The Case of Groupware Technologies," *Sloan Management Review*. MIT press, 38(2), pp. 11–21.

Ponce de Leon, M., Hribernik, K. A. and Eriksson, M. (2008) "The Living Labs Approach to a Virtual Lab Environment," in Putnik, G. D. and Cruz-Cunha, M. M. (eds.) *Encyclopedia of Networked and Virtual Organizations*, pp. 818–821. doi: 10.4018/978-1-59904-885-7.

Putnam, R. (2001) "Social Capital: Measurement and Consequences," *ISUMA (spring)*, pp. 41–51.

Randall, D. (2003) "Living Inside a Smart Home: A Case Study," in Harper, R. (ed.) *Inside the Smart Home*. London and Berlin: Springer, pp. 227–246. doi: 10.1007/1-85233-854-7_12.

Randall, D., Harper, R. and Rouncefield, M. (2007) *Fieldwork for Design. Theory and Practice*, *Vasa*. London: Springer.

Rohde, M., Stevens, G., Brödner, P. and Wulf, V. (2009) "Towards a paradigmatic shift in IS: designing for social practice," in *Proceedings of the International Conference on Design Science Research in Information Systems and Technology - DESRIST '09*. New York, USA: ACM, p. Article No. 15.

de Ruyter, B. and Aarts, E. (2004) "Ambient intelligence," in *Proceedings of the Working Conference on Advanced Visual Interfaces - AVI '04*. New York, USA: ACM, pp. 203–208. doi: 10.1145/989863.989897.

Schaffers, H., Cordoba, M., Hongisto, P., Kallai, T. and Merz, C. (2007) "Exploring business models for open innovation in rural living labs," in *Proceedings of the International Conference on Concurrent Enterprising (ICE)*.

Schmidt, K. (2011) "The Concept of 'Work' in CSCW," *Computer Supported Cooperative Work (CSCW)*. Kluwer Academic Publishers, 20(4–5), pp. 341–401. doi: 10.1007/s10606-011-9146-y.

Schuurman, D., Evens, T. and De Marez, L. (2009) "A living lab research approach for mobile TV," in *Proceedings of the International Conference on Interactive TV&Video - EuroITV '09*. New York, USA: ACM, pp. 189–196. doi: 10.1145/1542084.1542122.

Schuurman, D. and De Marez, L. (2009) "User-Centered Innovation: Towards a Conceptual Integration of Lead Users and Living Labs," in *Proceedings of COST 298: The Good, The Bad and The Challenging*. Copenhagen, Denmark: ABS-Center, pp. 114–123.

Schuurman, D., De Marez, L. and Berte, K. (2010) "Enriching living lab-approaches for ICT-innovation by introducing different user roles: the case of digital TV," in *Proceedings of the International Conference on Interactive TV&Video - EuroITV '10*. New York, USA: ACM, pp. 161–170.

Sohn, T., Li, K. A., Griswold, W. G. and Hollan, J. D. (2008) "A diary study of mobile information needs," in *Proceeding of the SIGCHI Conference on Human Factors in Computing Systems - CHI '08*. New York, USA: ACM, pp. 433–442. doi: 10.1145/1357054.1357125.

Soini, K. (2006) "Industrial Designers as Facilitators : How to Enable Collaboration in Multidisciplinary Workshops," in *Proceedings of Connecting - A Conference on the Multivocality of Design History & Design Studies*.

Soini, K. and Pirinen, A. (2005) "Workshops – Collaborative Arena for Generative Research," in *Proceedings of Designing Pleasurable Products and Interfaces*. Eindhoven, Netherlands, pp. 1–17.

Star, S. L. and Griesemer, J. R. (1989) "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science*. Sage Publications, Ltd., 19(3), pp. 387–420. doi: 10.2307/285080.

Stevens, G. (2009) *Understanding and designing appropriation infrastructures: artifacts as boundary objects in the continuous software development*. University of Siegen.

Stevens, G., Schwartz, T. and Meurer, J. (2009) “A dialectic view on Open Innovation,” in *AMCIS 2009, 15th Americas Conference on Information Systems. Online proceedings*, p. paper no. 668.

Swiderski, J. (2008) *Die Bildung der Bedürfnisse: Bildungstheoretische, sozialphilosophische und moralpädagogische Perspektiven (The development of needs)*. Paderborn, Germany: Schöningh.

Tan, Y.-H., Bjørn-Andersen, N., Klein, S. and Rukanova, B. (2010) *Accelerating Global Supply Chains with IT-Innovation: ITAIDE Tools and Methods*. Berlin Heidelberg: Springer.

Tolmie, P. and Crabtree, A. (2008) “Deploying research technology in the home,” in *Proceedings of the ACM 2008 conference on Computer supported cooperative work - CSCW ’08*. New York, New York, USA: ACM Press, pp. 639–648. doi: 10.1145/1460563.1460662.

Vines, J., Clarke, R., Wright, P., McCarthy, J. and Olivier, P. (2013) “Configuring participation: On How We Involve People In Design,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI ’13*. New York, USA: ACM, pp. 429–438. doi: 10.1145/2470654.2470716.

Wenger, E. (2000) “Communities of Practice and Social Learning Systems,” *Organization*, 7(2), pp. 225–246. doi: 10.1177/135050840072002.

Wulf, V., Rohde, M., Pipek, V. and Stevens, G. (2011) “Engaging with Practices: Design Case Studies as a Research Framework in CSCW,” in *Proceedings of the ACM Conference on Computer Supported Cooperative Work - CSCW ’11*. New York, USA: ACM, pp. 505–512. doi: 10.1145/1958824.1958902.

Wulf, V., Schmidt, K. and Randall, D. (2015) *Designing Socially Embedded Technologies in the Real-World*. Edited by V. Wulf, K. Schmidt, and D. Randall. Springer London.