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FACILITATING SOCIAL AND COGNITIVE TRANSLATION IN INNOVATION NETWORKS

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Abstract

In this paper we present a two year long interpretative case study based on a Living Lab project. The case study is used to in retrospect investigate cognitive and social translation in a doubly distributed innovation network. By identifying and empirically exemplify how translations occurred, we present insights of how to support cognitive and social translations in these kind of networks. Using the concepts from Yoo et al. (2009) we explore the research question: how can cognitive and social translation be supported in Living Labs? Based on the findings we conclude that Living Labs can support heterogeneous set of actors and knowledge resources by supporting cognitive translation with techniques such as scenarios, mock-ups and prototypes. By working with an iterative process the involved actors can be supported to materialize prior and new knowledge which can be translated between different communities of actors. By setting up and providing a common ground a trading zone can be established supporting the social translations within the network by offering a space where negotiation of interests and alignment of perspectives can be facilitated.

Keywords: IT Innovation, Innovation Networks, Living Lab.

1 INTRODUCTION

Research on IT innovation has traditionally been focused on IS in an organizational setting. Today the use of IT has extended outside the organizational sphere and more and more digital products and services are offered to a consumer market (Yoo, 2010). This shift has opened up new venues for research agendas (Yoo, 2010), but also presented challenges for how the IT industry can deal with the development and diffusion of IT innovations that meet the demand of the consumer market (Eriksson et al., 2005). These challenges have lead to a shift from a vertically aligned thinking where one organization can handle all research and development by itself to a horizontally aligned thinking where the firm looks outside their own organizational borders to acquire knowledge from other actors needed to stay innovative and competitive (Yoffie, 1995; Chesbrough et al., 2006). This phenomenon can be traced in both larger firms' inter-organizational collaborations and in initiatives like the emerging concept of Living Labs where academia, SMEs and consumers co-create (Svensson and Ihlström Eriksson, 2009). The concept of Living Labs can be seen as both a milieu (environment, arena) and an approach (methodology, innovation approach) and are defined by Bergvall-Kåreborn et al. (2009) as *"a user-centric innovation milieu built on every-day practice and research, with an approach that facilitates user influence in open and distributed innovation processes engaging all relevant partners in real-life contexts, aiming to create sustainable values."*. Living Labs as a concept can therefore be seen as a loosely coupled heterogeneous network. In loosely coupled heterogeneous innovation networks s actors with complementary assets work together to be able to reach a common goal relating to a specific innovation closure (Van De Ven, 2005).

The innovation networks that these actors form varies largely in degrees of heterogeneity of knowledge resources and distribution of control and coordination and can be classified by these criteria into four different classes of innovation networks: Singular innovation networks, Distributed innovation networks, Systemic innovation networks, and doubly distributed innovation networks (Yoo et al., 2009). Digital innovation in general shape future innovation networks by increasing the heterogeneity of the involved actors due to digitization of products and services while digital convergence and ICT reduce communication cost which amplifies the distribution of control and coordination among actors. In Living Labs, heterogeneous actors with a diverse set of knowledge resources and interests are involved and the often initially loosely coupled innovation networks lack a hierarchically integrated control structure. Therefore the distribution and control differs compared to e.g. a homogenous innovation network within a single firm (singular innovation networks) with a high degree of coordination and control. In doubly distributed innovation networks such as Living Labs, individual firms, innovators, or other actors seldom have the power, resources or legitimacy to innovate and produce changes by themselves.

In these innovation networks trading zones might occur that enable actors with different knowledge, agendas and innovation trajectories to negotiate, collaborate and learn from each other (Boland et al, 2007). Living Labs supports the interaction between industrial partners and other actor groups that includes, but is not limited to, consumer or user representatives, academia and organizations such as e.g. voluntary organisations and municipalities. Living Labs therefore enables actors to connect to an innovation network or extend their existing networks to include new actors. Therefore Living Labs have the potential to increase innovative capacity by offering new possible knowledge transfers between involved actors (Eriksson et al., 2005).

Current research highlights two specific challenges for doubly distributed innovation networks, the facilitation of cognitive and social translation (Yoo et al., 2009). Cognitive translation occurs when heterogeneous actors transform knowledge between each other. As the heterogeneity of the actors and their knowledge resources increases in a network, the more challenging the cognitive translation will be. However, the translation leading to a transformation of knowledge presents both a barrier to and an opportunity for innovation (Carlile, 2002). The social translations often occurs at the boundaries of communities where heterogeneous actors connect, negotiate and adjust to each other perspectives

which leads to a re-definement of the social space (Yoo et al., 2009). The more diverse the set of actors within an innovation network is, the less likely it is that they can connect into the network without friction. As the diversity between actors in the network grows the ongoing negotiation between actors while also protection the social order becomes highly difficult (Yoo et al., 2009).

In this paper we present an interpretative case study (Walsham, 1995) based on a Living Lab project. Our research involved a one year case study of Halmstad Living Lab. The data was gathered during a research project where researchers from HLL worked alongside 2 SMEs, users, and representatives from other organizations to facilitate and support the innovation process. The case study is used to in retrospect investigate cognitive and social translation in a doubly distributed innovation network. By identifying and empirically exemplify how these translations occurred, we present insights of how to support cognitive and social translations in doubly distributed innovation networks. Based on the concepts from Yoo et al. (2009) we will explore the research question: *how can cognitive and social translation be supported in Living Labs?*

The paper is structured as follows: In the theoretical framework we will give an introduction to IT innovation, innovation networks and how cognitive and social translation occurs in doubly distributed innovation networks. We will then proceed to present our research approach and the case setting where the data was collected. Findings will be used to illustrate the social translations between the actors in the innovation network and the outcomes from the activities carried out to facilitate cognitive translations and knowledge transfers within the network. The discussion will draw back upon the findings and highlight important observations and reflections in relation to the theoretical framework. Finally the conclusion will address the research question and present future research opportunities.

2 THEORETICAL BACKGROUND

The increased need of incorporating knowledge and skills found outside of organizational boundaries has lead scholars to new venues for further research. Scholars have begun to realize the messiness, ambiguity, multiplicity and volatility of innovation spawning from distributed and dynamic networks of heterogeneous actors (Lyytinen and Damsgaard, 2001). Accordingly, innovation scholars are paying increased attention to the cooperative and networked features of innovation and argues that increased network heterogeneity promotes new combinations, support learning and might enable faster diffusion (Yoo et al., 2009). On the other hand, heterogeneity creates learning boundaries, inhibiting the spread of ideas and innovations (Carlile, 2002). To better understand these bipolar impacts of heterogeneity, scholars have began to examine in more detail the types of interactions, the knowledge creation and communication, and the barriers in different classes of innovation networks (Carlile, 2002; Yoo et al., 2009).

2.1 Innovation Networks

Innovation network can be defined as a socio-technical network that produces and consumes knowledge necessary for innovation where innovation is enabled by the organizational actors, information and communication tools (Yoo et al., 2009). IT innovations that are created and driven by increased heterogeneity of knowledge in innovation networks are directly affecting the experience of consumers. These innovations are redefining products and services, changing business models, generating new business logics and re-organizing industries (Yoo et al., 2009).

The increasing power and penetration of ICT in organizations has significantly expanded ICTs roles in the innovation process (Zammuto et al., 2007). According to Yoo et al. (2009), two generative forces or drivers will shape future innovation networks; 1) “ICT reduce communication cost and increase speed and reach which amplifies the distribution of control and coordination among actors”, and 2) “digitization of products and services and resultant digital convergence increases heterogeneity (and conflict) of knowledge resources in innovation networks”. These two drivers can be used to organize innovation networks into for different classes based on two dimensions. The first dimension concerns

the *distribution of coordination and control over resources and knowledge* and the second concerns the level of *heterogeneity of knowledge resources* that need to be identified and mobilized within the innovation network. Based on this, the four following classes of innovation networks can be discerned (see Figure 1):

Heterogeneity of knowledge resources		Distribution of coordination & control	
		Centralized	**Distributed**
	Homogeneous	**Singular** innovation form	**Distributed** innovation form
	Heterogeneous	**Systemic** innovation form	**Doubly Distributed** innovation form

Figure 1. Four types of innovation networks (Yoo et al., 2009, p. 19).

- The *singular* innovation form is a homogeneous pool of actors and tools that can readily be identified, mobilized and engaged within a hierarchically integrated control structure, mostly within a single firm.
- The *distributed* innovation form is a homogeneous pool of actors and tools that can readily be identified, mobilized and engaged across a distributed set of actors in the absence of a strong centralized hierarchical control.
- The *systemic* innovation form is a heterogeneous pool of actors and tools that need to be identified and mobilized across a set of diverse actors organized into a hierarchically integrated control structure, mostly within a single firm.
- The *doubly distributed* innovation form is a heterogeneous pool of actors and tools that need to be identified and mobilized across a diverse set of actors in the absence of hierarchical control.

These four forms of innovation networks have implications for the nature and type of IT innovations that emerge. The first two forms mostly involve incremental product and service innovations, while the *systemic* and *doubly distributed* forms can involve and support radical product and service innovations that are transformative, original and will break existing product or service architectures (Yoo et al, 2009).

In a *doubly distributed* innovation networks, the structure and dynamics is the most complex of the four classes. The control of the process, structure and outcomes is distributed throughout the network and at the same time, the networks have highly heterogeneous knowledge resources. To make it even more complex, the different types of knowledge resources needed for innovation are not known before a process is started (Yoo et al., 2009). Many radical products or service processes that have gone beyond traditional industry boundaries operate in d*oubly distributed* innovation networks. Examples of doubly distributed innovation networks can be found in new and turbulent markets such as mobile services (Tilson et al., 2006; Yoo et al., 2005). In these markets, several previously unconnected actors (phone operators, software companies, content providers, hardware device manufacturers, advertising companies, etc) must intertwine their perspectives, business models and technological frames to establish new services and build up arrangements (Hargrave and Van De Ven, 2006; Yoo et al., 2009).

The key challenge in *doubly distributed* innovation networks concerns "how to mobilize a range of potential innovators who have different and conflicting interests and widely heterogeneous knowledge bases, where no one has control over the final product architecture, the digital infrastructure that supports the innovation, or the rules of engagement" (Yoo et al., 2009).

Innovating in an innovation network is both a cognitive and a social process (Yoo et al., 2009). Innovation can be seen as cognitive since it involves the creation of new knowledge that is captured and translated through a series of representations before it can be materialized in new products and services. Innovation is social since "obtaining, transforming and sharing knowledge is a negotiation and sense-making process, through which an actor's identity and relationships to others are negotiated

and re-defined" (Yoo et al., 2009). An innovation fostered in a doubly distributed innovation network that involves multiple heterogeneous actors, including user and consumer groups, will differ from other forms of innovation due to the complexities within and the interactions between the actors' cognitive and social translations. The complexity becomes even more evident whilst working with digitization of product and services (Yoo et al., 2009).

2.2 Cognitive Translation

The term cognitive translation can be defined as a "*generative process* whereby knowledge is produced, refined, integrated, evaluated and materialized at least partially by digital means to reach an innovation closure, i.e. when the innovation is stabilized as a new product or service" (Yoo et al., 2009). The knowledge work in regard of new product development is not just a matter of processing more knowledge, but rather a process of transforming knowledge, the transformation of knowledge also presents both a barrier to and an opportunity for innovation (Carlile, 2002). Meanwhile, the knowledge work across the service, industrial and governmental sectors are becoming more and more knowledge intensive with knowledge domains and resources dispersed into communities (Boland and Tenkasi, 1995). In a doubly distributed innovation network this is seen in the shape of a set of *heterogeneous* actors with different *knowledge resources* that needs to work together towards an innovation closure (Yoo et al., 2009). The importance of knowledge work between dispersed communities of knowledge is easiest to see in firms involved with new product development in leading edge technologies where firms strive to find creative ways to representing and integrating knowledge (Boland and Tenkasi, 1995). Narratives that represent and integrate knowledge can therefore be seen as boundary objects that acts as a mediator between different communities of knowledge, an example of this can be seen in the case of three-dimensional representations being used to bridge communities of knowledge in architecture, engineering and construction (Boland et al., 2007). By increasing the variety of objects used for translations between communities and by doing that also bridging the gaps between actors an organization can increase the accuracy, range and nature of the translation in the innovation process (Carlile, 2002). This diversity and heterogeneity as well as a broader scope that actors bring with them into a doubly distributed innovation network create new challenges. Primarily concerning negotiating and making sense of unique knowledge brought in by diverse actors. Cognitive translations leading toward a final innovation outcome rarely form a linear process (Yoo et al., 2009). In contrast, *the process is iterative*, fractal and messy, filled with the ebb and flow of knowledge and peppered with actor's surprises and disappointments (Boland et al., 2007). Even so, in most cases cognitive translations evolves with a sense of progress, moving forward and reaching a closure. However, if one can find new ways of connecting and translating knowledge between heterogeneous actors during innovation processes, radical innovation might occur (Yoo et al., 2009).

The main aspects of cognitive translations have been summarized in table 1.

Aspect	References
1) Heterogeneous knowledge resources	Yoo et al. (2009); Boland and Tenkasi (1995)
2) Generative knowledge process	Yoo et al. (2009); Boland et al. (2007); Carlile (2002)
3) Iterative process	Yoo et al. (2009); Boland et al. (2007)

Table 1. Aspects of cognitive translation

2.3 Social Translation

An innovation always takes place within a web of social interactions that shape and are shaped by the innovation, thus, the innovation transforms the social space inhabited by the innovation actors (Yoo et al., 2009). The social translations often occurs at the boundaries of communities where *heterogeneous*

actors connect, negotiate and adjust to each others perceptive which leads to a re-definement of the social space (Yoo et al., 2009). In doubly distributed innovation networks such as Living Labs these heterogeneous actors may consist of academia, firms, consumers, non-profit organizations, governmental representatives and so forth with widely different agendas for working towards innovation closure (Eriksson et al., 2005). The more diverse the set of actors within an innovation network is, the less likely it is that they can connect into the network without friction. As the diversity between actors in the network grows the ongoing negotiation between actors while also protection the social order becomes highly difficult (Yoo et al., 2009).

Similar ideas are presented by Simard and West (2006) that discuss how two dimensions of network ties differentiate networks. The first dimension concerns deep versus wide ties where deep ties relate to homogenous knowledge and wide ties relate to heterogeneous which is and more difficult to capture. The second dimension, formal versus informal ties, concerns formal and contracted ties from ties characterized by informal personal and social contacts. According to Simard and West (2006) wide ties have greater potential to reach radical innovation and deep ties seem to lead to incremental innovation. In informal networks it is more difficult to control and manage knowledge exchanges compared to formal networks (see Figure 2). Adding to this complexity, innovation networks reaching outside the boundaries of the firm (such as in Living Labs) connects actors without any previous history into new networks (Yoo et al., 2009).

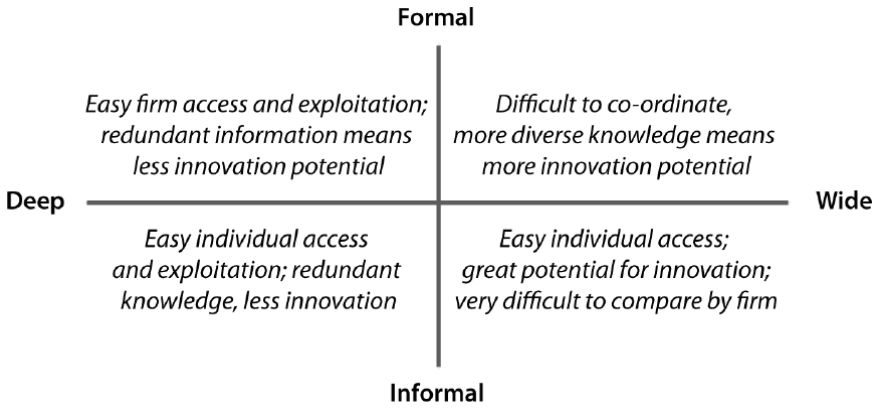

Figure 2. Dimensions of interfirm ties (Simard and West, 2006, p. 235)

In contrast to the cognitive translations that are viewed as a progression or generative process the social translation is instead a series of *negotiations of interest* within the socials space where the actors iteratively influence each other's behaviour (Yoo et al., 2009). The cognitive translation and the objects used during this process is an important part of the social translation by enabling the shaping and re-shaping of the actors role and social relationship with other actors in the network (Yoo et al., 2009). In these networks trading zones between different stakeholders might occur that enable actors with different knowledge and agendas to negotiate, collaborate, and learn from each other (Boland et al, 2007). The constant negotiation of interests and the interplay between the actors help them find ways to *align their perspectives* while striving for innovation closure (Yoo et al., 2009).

The main aspects of social translation have been summarized in table 2.

Aspect	References
1) Heterogeneous actors	Yoo et al. (2009); Simard and West (2006)
2) Negotiation of Interest	Boland et al. (2007); Yoo et al. (2009)
3) Alignment of perspectives	Boland et al. (2007); Yoo et al. (2009); Simard and West (2006)

Table 2. Aspects of social translation

3 RESEARCH APPROACH

Our research objective with this paper was to examine how cognitive and social translations can be supported in Living Labs. To do this we studied events involving multiple stakeholders that took place during a research and development project hereafter referred to as the smart lock (SML) project from a retrospective view. The theoretical basis for our studies of the Living Lab connected to an innovation network has evolved over time, due to firsthand experience by collecting the field data while also getting more and more familiar with past research in related fields. For the purpose of this paper the aspects of cognitive and social translations has been chosen as an analytical lens to find and highlight episodes of our gathered data to better help us understand the research area and address our research question.

The interactions in an innovation network are highly social in nature and consist of ongoing negotiations and transfers of knowledge between the actors. Empirical studies based on the collection of such data can be classified as interpretative case studies (Walsham, 1995). The data concerning the case used for the retrospective analysis were collected over a period of two years by the researchers, although the development project only ran for 13 months. The reason for this was to provide data covering both the stakeholders' everyday practice regarding their efforts to innovate IT products and their practice after being involved within the innovation network.

The data collection process cover 6 formal interviews performed with SME representatives, 3 group interviews with the focus group participants and 3 interviews with representatives for user groups in the network. The interviews were conducted before, during and after the development project were finalized. Interviews took place both at Halmstad University and at the companies' facilities, and were all recorded on digital media for later transcription. Additional interviews were performed over the phone to enable the researchers to ask follow up questions to related activities such as focus group meetings, these interviews were also recorded on digital media.

Furthermore, transcripts of meetings between actors in the network, 21 field notes covering observations and reflections by researchers involved in the ongoing activities within the Living Lab network and archival documents such as project diaries were used to collect data. We also chose to include informal conversations and e-mail correspondence between the project leader and representatives from other stakeholders since this data offered complementary explanations to phenomena that occurred during the interactions between the actors in the innovation network.

Interviews: SME representatives, Focus group participants, User representatives
Transcripts from meetings
E-mail correspondence
Project diaries
Researcher Field Notes

Table 3. Data sources used during case study.

In order to categorize the data collected, patterns were identified in the gathered material (Miles & Huberman, 1994). Excerpts in the data sources were marked with assigned colors, facilitating data categorization according to corresponding aspects of cognitive and social translations. Within these marked excerpts, we scanned the data material for similarities and differences. Key quotes from different empirical activities are used in the paper to illustrate our reflections of findings.

Finally, when carrying out interpretive research two different roles can be identified, the outside observer and the involved researcher (Walsham, 1995). The two different roles offer both benefits and shortcomings, as an involved researcher you gain access to data and nuances in the interaction between the actors that might not appear to the outsider, meanwhile an outsider might observe and

reflect upon said data from a wider perspective. During the case study of Halmstad Living Lab we as researchers have been moving between these two different roles. During the observed activities the two researchers took turns making notes and observations. Furthermore, the researchers wrote their own diaries with reflections covering the activities conducted within the project.

3.1 Overview of the Case Background

The case study covers a year long development project aimed at introducing technology that aid elderly, home care personnel and next of kin by improving the management of home care visits. The project originated from a series of idea generation workshops facilitated by HLL that took place between home care personnel, next of kin, seniors and representatives from a developing firm specialized in locks, hereafter referred to as Alpha. During these workshops a problem concerning seniors, next of kin and home care personnel were uncovered, the inability to remotely tell if the seniors door was locked or not. The problem generated unnecessary work for home care personnel and next of kin while decreasing the feeling of security for seniors who for one reason or another found it cumbersome, or were unable to go to the front door to check if the door was locked. The stakeholders involved in the idea generation workshops, along with HLL decided to bring in additional partners and apply for a grant for governmental funding to continue working together towards a solution of the problem. The additional partners that were brought into the innovation network were another SME that specialized in wireless security hereafter referred to as Beta, and an NGO (non-governmental organization) representing next of kin home care givers. The two new partners both added something to the network, the NGO added the perspective of next of kin and Beta added knowledge regarding wireless technology. Furthermore, even though the municipality were not a formal partner in the project, they were given access to the results and also provided feedback on the ideas and the innovation. The municipality also enabled the involvement of home care personnel in the real life tests conducted in the end of the project.

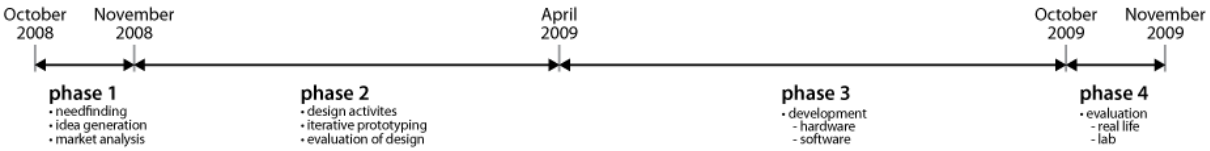

Figure 3. The four phases of the SML case.

The development project ran for 13 months and consisted of four phases (see Figure 3). The first phase included need finding, idea generation and market analysis. Typical activities during this phase were idea generation workshops, future workshops and focus groups involving seniors, next of kin from the NGO and representatives from Alpha and Beta. During the second phase the next of kin and seniors designed the actual device through mock-ups, scenarios and iterative prototyping. The users where divided into three types of focus groups. A primary focus group of next of kin worked closely with the IT-developers to generate and form ideas. Two secondary focus groups, one with seniors and one with next of kin, acted as reference groups and continuous evaluated ideas, concepts and prototypes developed. HLL facilitated these activities and Alpha and Beta acted as advisors and "guests" to these sessions where they answered questions and provided technical feedback to the user groups. During the third phase Alpha and Beta developed hardware and software, based on requirements and prototypes delivered from the second phase. The final phase consisted of real-life testing of the developed high-fi prototype, during the real-life testing senior citizens and next of kin were able to test the prototype in their own homes for a few weeks.

4 EMPIRICAL FINDINGS

In the following sections we present events and episodes from the SML case describing cognitive and social translations. The findings are presented based on the aspects found in section 2 (Table 1 and 2).

4.1 Cognitive translations in the SML case

In the SML case the Living Lab supported cognitive translation by acting as a mediator between communities with differing knowledge resources in the network aided by methods, tools, and techniques that helped materialize and represent knowledge. In this specific case *heterogeneous knowledge resources* where involved in the Living Lab to support a *generative* and *iterative knowledge process* leading to innovation closure.

4.1.1 Heterogeneous knowledge resources

HLL enabled and supported the interaction between heterogeneous knowledge resources by acting as a central node connecting different actors and user groups. The industrial partners mainly brought in knowledge related to technical expertise such as wireless transfers, sensor technology, Bluetooth technology and mechanical engineering into the innovation network. The researchers brought knowledge of areas such as user centred design, collaborative design, usability, user experience and general knowledge about system development and project management into the network. The different user groups primarily injected the innovation network with their domain knowledge but also with individual design knowledge and creativity. The knowledge differed between the user groups, e.g. the experiences and perceptions of a senior differed quite a lot compared to the next of kin group or the home care personnel perspective which sometimes lead to conflicting perspectives on a problem or a design solution. Furthermore, different ethnic and cultural perspectives were covered by the diversity of the user representatives which shed light on conflicting interests but also added complexity. However, the involved user groups enabled the stakeholders in SML to early on in the process gain insights that would probably not been uncovered until later stages of an innovation process without the heterogeneity of the involved knowledge resources.

4.1.2 Generative knowledge process

HLL facilitated a generative knowledge process by initiating activities that involved collaboration between actors within the network. *Production of knowledge* relevant for the SML innovation was primarily supported by different idea generation activities. The inclusion and collaboration between the different heterogeneous actors facilitated by the researchers resulted in new knowledge relevant for innovation closure by producing new ideas and concepts. These activities also generated knowledge about the different needs, wants and requirements of the user groups. The meetings between Alpha and Beta also generated out of the box ideas were Beta proposed the possibility to use their security system as a way of monitoring inactivity instead of activity, and by doing this opening up their products to a new market, instead of focusing on only security systems they could also support home care.

HLL used several techniques to materialize knowledge during the innovation process to bridge knowledge barriers between actors. The *knowledge materialization* was supported through different techniques in the collaborative workshops. In the first two phases of the innovation process scenarios, personas, traditional requirement documents and mock ups were used to translate knowledge between the heterogeneous actors. Most of the techniques and tools that were incorporated into the activities were new, both to the industrial partners and the user representatives, but Alpha and Beta both recognized their value as a way to make the input from the users tangible for their developers. The market manager from Beta said: "*I used the result from the workshop as proof for my argument to the development that we were on the wrong track*". This worked as a way of translating needs, wants,

requirements and design solutions between users and developers. With boundary objects such as mock ups the developers could better understand the solutions suggested by the users and that it would be worthwhile to invest time and resources into developing new technical platforms to deliver the product to the target group. Furthermore, requirements documentation were used as a boundary object to keep track on details regarding the prototypes. To enable the use of requirements documentation the user groups needed to be trained in how to interpret requirements to be able to comment and inform the requirement documentation that was used by the developers. In this case it was a new way of formulize their needs and requirements which with the facilitation of HLL worked satisfactory according to both the companies and the user groups.

Refinement of knowledge occurred throughout the project, however it was specifically noticeable during the conceptual design and requirement workshops where both the initial ideas and concepts were refined. During these workshops Alpha, Beta and the primary user group changed their view and understanding of the problem context through gaining a richer understanding of the care takers situations, but also regarding possibilities that technology either offered or restricted. One representative from Beta said: "*we have gained a greater understanding regarding how they (*the users*) think and how they want things to work and function*".

The knowledge transferred between the actors within the network where slowly integrated into both Alpha and Beta during the project. Both Alpha and Beta reported that they gained a deeper understanding of their respective target groups. The development manager of Alpha said: "*I feel that we have a much clearer picture of the use context and how the system in this case will be used*". The *knowledge integration* could be traced both to how the smart lock solution was designed but also to modifications in Alphas current line of products and upcoming products. One representative from Beta said: "*we have some ideas from the workshops that we really find interesting and have specified for our next revision of our product*". The change was also seen in the Alpha and Betas way of reasoning concerning care taker integrity and the connection between added value and willingness to pay for their current and upcoming lines of products. This can be illustrated by how Alpha found new business models that specifically targeted consumers instead of as done previously only offering their products to care service organizations and municipalities. The collaboration between the companies also led to synergy effects, the developing manager from Alpha stated that: "*we have opened up to each other and started to use each other competence in other areas as well, such as for example when ordering components*".

The evaluation of newly acquired knowledge occurred iteratively through the evaluation of ideas, concepts, business models, mock ups and high-fi prototypes. HLL facilitated the evaluation of knowledge through working with iterative cycles during the innovation process. This can be illustrated by the evaluation workshops with user groups where different actors knowledge were continuously evaluated leading towards integration and production of new knowledge for the actors. When the final prototypes were evaluated, by both the user groups in workshops and by end users in field trials, the technical design solutions acted as translators to be able to evaluate the knowledge built into these.

4.1.3 Iterative process

The cognitive translations evolved and progressed iteratively during the innovation process supported and facilitated by HLL. The first two phases was based on the following iterative steps: Identifying needs/requirement elicitation, (Re)Design, Prototyping, and Evaluation. The third and fourth phase consisted primarily of hardware and software development and finally evaluation of the demonstrator. Through the iterative evaluation part of the process, the innovation could emerge and evolve mimicking the knowledge created and translated between the different actors. When the developers gained knowledge and understood the user groups' needs, wants and requirements, the ideas, concepts and prototypes changed as a result which secured a better outcome according to the development manager of Alpha: "*due to the amount of people and the thoroughness of the process working with the*

problem situation, this is so much better than if only developers had worked with it the same amount of time. The prototype will be much better than what it normally would have been".

4.2 Social translations in the SML case

The following section describes the social translations that occurred in the case and how HLL acted as a mediator providing a common ground between the *heterogeneous actors* by facilitating the *negotiation of interests* between the different groups and supported the *alignment of perspectives* between the actors.

4.2.1 Heterogeneous actors

The set of actors within the case study were very diverse. Alpha and Beta had several similarities, such as being relatively newly formed small IT-developing firms but also many differences, such as differing fields of expertise and success in penetrating their markets. Together with the researcher group and the user groups these actors formed a heterogeneous innovation network. The primary user groups were also very heterogeneous in terms of background, gender and ethnicity. During the first month of the SML project, HLL needed to explicitly support the different actors' connection to the innovation network. HLL worked actively to build trust between all actors and themselves but also between the different actors. In the beginning both the companies and the user groups were uncertain of the interests of the other actors. A representative from Alpha said that:"you need to respect the integrity of the company and that you need to make money on your ideas, integrity is therefore needed if your collaboration with another company ends". Another example was that the NGO was suspicious of primarily the companies' interests but also the researchers. The individuals in the user group were uncertain of why they were involved and what they could bring into the process.

The approach was to facilitate communication of interests between the actors and clearly state the researchers own agenda and interests. After that all other actors' agendas needed to be made explicit. The lack of trust between the actors was mitigated by the neutral role that HLL could establish early in the project. When trust was established between the different actors and HLL, the researchers could mediate and connect the different actors to the innovation network through the first workshops and the ongoing meetings between the actors. The initial lack of self esteem found in some of the user groups were also addressed during the first series of workshops where the users realized that they were listened to and that it was their problem that was the core of the project. The establishment of them as domain knowledge experts helped the user groups to find their own social order in the innovation network. In order to achieve this, Alpha and Betas power was restricted during the workshops and moderated by HLL, to ensure that the perceived power between all actors were balanced.

4.2.2 Negotiation of Interest

Social translations occurred at the boundaries of the actors domains as they connected into the network. As highlighted earlier, HLL needed to facilitate the negotiation and alignment of the different interests brought in by the heterogeneous actors. HLL and the researchers needed to establish a neutral mediator role, gaining trust with both the companies and the different user groups as well as with the home care service contacts and the chair of the NGO. After the establishment of the mediator role, the different actors started to communicate through HLL in the initial start up of the project. HLL created a common ground where the different actors could meet and start aligning their interests finding win-win situations.

The initial process resulted in a transformation of the social space of the innovation network. From the beginning Alpha and Beta had a strong position as their interests where key interests which influenced the social order of the actors. However, with active involvement of the NGO and the user groups by setting up meetings and through the first workshops, the user groups and the NGO continuously took a more active part in the project which improved their rank in the social order. A prerequisite for this to

happen was both the active facilitation from HLL, but also due to the fact that the research funders of the project recognized the users as an important part of the project, by putting them on the same level as Alpha and Beta in the grant by allocating equal resources to all three of the funded groups (developers, researchers and users).

At the beginning of the project, Alpha and Beta were equally involved in the planning and realization of the project. They both had equal incentives for involvement, opportunities to reach new markets and develop technical solutions important for their core business. However, the social order of the companies changed progressively when monitoring services was minimized in the conceptual design, by the lessened focus on sensor technology Betas role changed. The integrity perspectives, as highlighted earlier, changed the smart lock solution to only include some basic monitoring functionality, this turn of events lead Beta to take on the social role of a technological developer for Alpha, whom assumed the role as the customer. The main incentives for both Alpha and Beta therefore shifted and with that their social role in the innovation network adjusted accordingly with Alpha taking a more dominant position.

4.2.3 Alignment of perspectives

In the SML case there were several examples of social translations and the alignment and mutual adjustment of perspectives of the actors during the innovation process. Especially the primary focus group that worked very close with the companies aligned their perspectives with the companies. This user group started reasoning in terms of company value and viewed the innovation from a business point of view. A main driver for this group, who initially was the ones launching the first SML ideas, seemed to be to get "their" idea out on the market. Their perspective moved closer to the companies, but also the companies' perspectives changed during the process of involving the different user groups. In one of the workshops, where Alpha worked together with a next of kin focus group, the company argued towards themselves that it was essentially wrong to capitalize on people's fears and lack of security. This episode was triggered by a woman whom addressed the issue when she understood the low cost for a web service providing SML information to the next of kin versus the higher fee to use it.

The next of kin groups also aligned their ideas and perspectives after the integrity discussion was raised by the home care service and the senior focus group. From the beginning, the primary user group consisting of next of kin representatives focused on monitoring services. Later this shifted more towards supportive services for both the next of kin and the seniors that were aligned with the home care service existing routines. Finally, the ethnic representatives also shifted their perspectives during the social translations in the innovation process. From the beginning ethnic questions was a key issue for these user representatives. Their main agenda and mission with their involvement in the project seemed to be to secure ethnic aspects and find solutions working for their own context. Their perspectives seemed to get more aligned with the other user groups during the process, whereas they still looked out for ethnic issues, they focused on other aspects later in the process.

5 DISCUSSION

In this paper we have used a Living Lab case study as an example of a doubly distributed innovation network. The overall control and distribution of the network was shared by the actors with HLL acting as a project coordinator. HLL was perceived as a neutral partner providing the actors with a common ground where social translation could be established. The innovation process started in activities where HLL could support the setup of the innovation network by facilitating the initial meetings between Alpha, Beta and the NGO. The health technology market is a new and emergent field similar to other turbulent markets such as mobile services. In these markets previously unconnected actors need to establish relationships and intertwine their perspectives, business models and technological frames to be able to innovate and diffuse new products and services (Hargrave and Van De Ven, 2006;

Yoo et al., 2009). HLL started the innovation process by building trust with the different actors and facilitating the negotiations between these actors. By supporting a sense-making process (Yoo et al., 2009) the identity and relationship of the actors in the innovation network constantly evolved and transformed. The actors seemed to align themselves towards a common goal during this process of social translation, the user representatives started to show an understanding of Alpha and Betas point of view and vice versa. This enabled the possibility for a wide and informal network quite different compared to a traditional innovation network within a single firm (Simard and West, 2006). The alignment of interests seemed to aid cooperation between actors which appeared to be fruitful for the innovation network. However it would be interesting to further investigate the perspective of alignment of interests in loosely coupled innovation networks since the user groups that initially joined the innovation network to add new perspectives ended up partly aligning themselves with Alpha and Betas values and goals.

A key challenge in doubly distributed innovation networks concerns how to mobilize actors with widely heterogeneous knowledge bases (Yoo et al., 2009). As showed in the case, knowledge creation important for the innovation was cognitively translated through a series of representations such as mock-ups and scenarios and was finally materialized in the demonstrator tested in real life settings. Design solutions proposed by the different user groups where brought forward to the developers who incorporated the solutions and brought prototypes back for testing. This iterative process where not just about finding needs, requirements and design solutions. The process also provided the companies with a better understanding of conflicting interests between the heterogeneous user groups. Furthermore the network and the process generated insights about possible business models as well as prioritizing functions for the innovation. The SML case also had some spin off effects resulting in new products on the market spawned from user generated ideas. The innovation network and the process therefore resulted in a "radical" thinking. We argue that the generation of the new ideas, insights and in the end the SML innovation can be seen as a direct result of the heterogeneity of the involved actors. This argument is similar to the ideas presented by Simard and West (2007) and the results presented by Boland et al. (2007). However, to be able to harvest the fruit of the heterogeneity of the involved knowledge resources, social translation need to be facilitated and supported. In the SML case HLL supported and facilitated the alignment of interests and perspectives by providing a common ground, or a trading zone (Boland et al, 2007), as a first step to establish the cooperation between the actors in the network.

6 CONCLUSION

By identifying and empirically exemplify how social and cognitive translations occurred in a Living Lab case study we have presented insights of how to support translations in doubly distributed innovation networks. Based on the concepts from Yoo et al. (2009) we have presented a theoretical background detailing the characteristics of social and cognitive translation. These characteristics where then used to identify and extract episodes and events from the case study presented in the empirical findings. Based on the findings we conclude that Living Labs can support heterogeneous set of actors and knowledge resources by supporting cognitive translation with techniques such as scenarios, mock-ups and prototypes. By working with an iterative process the involved actors can be supported to materialize prior and new knowledge through a generative process and to translate these between different communities of actors. By setting up and provide a common ground a trading zone can be established supporting the social translations within the network by offering a space where negotiation of interests and alignment of perspectives can be facilitated.

Further investigation of how alignment of interests between actors in the innovation network might affect the innovation network and the innovation itself is suggested for future research. Other suggested areas to investigate include the development of tools and techniques that aid cognitive translation. Finally, we suggest that future research further investigate how trading zones can be established to support social translation within innovation networks.

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