Social Aspects Influencing Relationships in Digital Innovation Networks
– The Smart Lock Case

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Abstract

Digital innovation processes are becoming more and more networked, where actors are growing dependent on each other’s competences, resources and knowledge. In networks developing digital innovation, actors need to identify, mobilize, and integrate diverse and heterogeneous knowledge resources to be able to innovate successfully. Social aspects seem to be important at the boundaries of communities where heterogeneous actors connect, negotiate, and adjust to each other’s perspectives. The aim of this paper is to explain how social aspects influence changes in relationships in digital innovation networks.

A case study approach was selected to study events involving multiple actors in an innovation and development project aimed at introducing technology that aids elderly, home care personnel and next of kin by improving the management of home care visits. We describe how social aspects such as trust, interest, and commitment among actors influence the changes in relationships.

1. Introduction

Digital innovation is the process of a) creating new combinations of digital and physical components that produce novel products or services and b) embedding digital computer and communication technology into a traditionally non-digital product or service [1;2]. Digital innovation processes are becoming more and more networked [3;4;5], where actors are growing dependent on each other’s competences, resources and knowledge [6]. Digital innovation therefore drives a need for collaboration which spans over organizational realms [1]. Innovation networks in this paper are seen as socio-technical networks that produce and consume knowledge necessary for innovation. In these networks innovation is enabled by the organizational actors, information, and communication tools [4].

Innovation networks need to support the whole innovation process including e.g. business modeling and the support of the diffusion of an innovation. In networks working with digital innovation, actors need to identify, mobilize, and integrate diverse and heterogeneous knowledge resources to be able to innovate successfully [4]. In particular, digital innovation processes are becoming quite complex when heterogeneous networks are formed across organizational boundaries [3;4]. Therefore, it is important to be able to address challenges such as differences in ownership and governance of an innovation and the heterogeneity of values and knowledge bases in an innovation network [4]. Scholars have realized the messiness, ambiguity, multiplicity and volatility of innovation spawning from distributed and dynamic networks of heterogeneous actors [7].

Research has increased attention towards the cooperative and networked features of innovation and argues that increased network heterogeneity promotes new combinations, support learning, and enables faster diffusion [4]. However, heterogeneity also creates learning boundaries and inhibits the spread of ideas and innovations [8]. To better understand these bipolar impacts of heterogeneity, scholars have begun to examine in more detail the types of interactions, the knowledge creation and communication, and the barriers in different types of innovation networks [8;4].

Several researchers have focused on different relations between actors and how these influence the exchanges within an innovation network [see e.g. 9;10]. 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 negotiations among actors become highly difficult to manage [4]. Different types of relationships influence the possibilities for innovation in a network [9]. Furthermore, social aspects influencing relationships among actors in heterogeneous networks have been highlighted as important [9;10]. Specifically, trust is mentioned as one of the most important social aspects of building relationships that leads to the fruitful exchange of the knowledge that is important for innovation. Trust has also been identified.
as important for entrepreneurial teams and innovation potential [11].

Social aspects seem to be important at the boundaries of communities where heterogeneous actors connect, negotiate, and adjust to each other’s perspectives, which lead to a redefinition of the social space [4]. Social aspects therefore could be argued as important for the relationships among actors in a network, hence indirectly influencing the exchanges within a heterogeneous innovation network. However, while there are examples within the literature of intraorganizational alliances that demonstrate the importance of social aspects other than trust in relationships, there is a lack of information regarding which social aspects are important and how they influence relationships within heterogeneous innovation networks [12].

The aim of this paper is to explain how social aspects influence changes in relationships in digital innovation networks. This work therefore contributes to the body of research about relationships between actors in innovation networks, and provides an example to practitioners coordinating digital innovation networks.

2. Theoretical background

Digital innovations that are created and driven by increased heterogeneity of knowledge in innovation networks are redefining products and services, changing business models, generating new business logics and re-organizing industries [4].

During the last two decades, there has been a shift in how innovation networks are formed and viewed by organizations, especially within technology development fields such as Information and Communication Technology (ICT) [9]. One common strategy before this shift was to incorporate other organizations with the knowledge or resources needed to be able to access new markets and to successfully innovate. Today, interorganizational innovation networks are much more common, and might either be temporary short term networks or long-lasting collaborations with various formal and informal ties and relationships between the actors in the network (in this paper the term relationships is treated synonymously with ties) [9]. Interorganizational collaborations can take a number of forms such as joint ventures, strategic alliances, subcontracting, and research consortia. Historically these collaborations were primarily motivated by concerns with market access, whilst today they focus more on development of new technologies. Today there is also a much greater diversity of actors and relationships in innovation processes where complex networks of organizations such as firms and universities are critical features, especially within fields with rapid technological developments such as the ICT field [9].

Interorganizational collaborations, especially within research and development, have been more and more central in recent studies [9]. One type of study examines the relationships between actors in the network and how these are influencing the innovation processes [see e.g. 9;10;12].

Innovating in an innovation network can be viewed as a social process in these cases [5]. 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” [4, p. 10]. An innovation created in a heterogeneous network that involves multiple actors, including user and consumer groups, will differ from other forms of innovation due to the complexities within and the interactions between the actors’ relationships and social changes. The complexity becomes even more evident whilst working with digitization of products and services [4].

Especially in fields of technological uncertainty, organizations and firms are more likely to look for actors to involve in an innovation network. One explanation to this is that firms can share the resources needed for developing innovative technology by forming networks and therefore also share risks [9]. Innovation networks have been shown in several studies to provide access to diverse sources of capabilities and information and the interaction between the actors increases the innovation level at the individual firms. This is especially evident in young and small organizations that benefit more from these relationships compared to larger firms. Successful external relations such as interorganizational relationships, therefore, fuel firm growth and innovation. However, to what degree and what limits there are is not yet addressed in current research [9].

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 [4]. The social interactions often occur at the boundaries of communities where heterogeneous actors connect, negotiate, and adjust to each other’s perspectives, which lead to a redefinition of the social space [4].

Similar ideas are presented by [9] that discuss how two dimensions of network ties differentiate networks. The first dimension concerns deep versus wide relationships, where deep relationships relate to homogenous knowledge and wide relationships relate to heterogeneous knowledge, which is more difficult to capture. The second dimension, formal versus informal relationships, concerns formal and contracted
relationships from relationships characterized by informal personal and social contacts. According to [10], wide relationships have greater potential to reach radical innovation while deep relationships 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 1). Adding to this complexity, innovation networks reaching outside the boundaries of the firm connect actors without any previous history into new networks [4].

![Figure 1. Dimensions of interfirm ties [10, p. 235]](image)

The social interactions can be seen as a series of negotiations of interest within the social space where the actors iteratively influence each other’s behavior [4]. There is an on-going shaping and re-shaping of the actors’ roles and social relationships with other actors in the network [4]. In these networks trading zones between different actors might occur that enable actors with different knowledge and agendas to negotiate, collaborate, and learn from each other [3]. The constant negotiation of interests and the interplay between the actors help them find ways to align their perspectives while striving for innovation closure [4].

3. Research approach

Our research objective with this paper was to explain how social aspects influence changes in relationships in digital innovation networks. We have chosen an interpretative perspective to be able to fulfill our objective. An interpretative perspective means that we view knowledge of reality as a social construction [13]. Examples of studies in interpretative social science are case studies, action research, and ethnographies [13].

A case study approach [13; 14] was selected in which we studied events involving multiple actors in an innovation and development project called the Smart Lock (SML) project. The relationships studied were categorized as interorganizational. The interorganizational relationships analyzed existed between companies, researchers, and a non-governmental organization (NGO).

The theoretical basis for our study is innovation networks, relationships within these networks, and social aspects influencing these relationships. The model of interfirm ties by Simard and West [10] is used to structure the data from the case. As such, interfirm and interorganizational is treated synonymously in this paper, as the model is not used to specifically analyze the data. Instead social aspects influencing changes in relationships have been chosen as an analytical lens. This lens has been used to find and highlight episodes of our gathered data to better help us understand the empirical findings as well as to address our aim with the research.

The data concerning the case used for the analysis was collected over a period of two years by the researchers, although the project only ran for 13 months. The reason for this was to provide data covering both the actors’ everyday practices regarding their efforts to innovate IT products and their practices after being involved within the innovation network.

The innovation network consisted of four organizations; 1) University (researchers), 2) NGO (next of kin to seniors), 3) Alpha (company), 4) Beta (company), and users (seniors).

The data collection process covered interviews, workshops, questionnaires, and evaluations. The interviews were conducted before, during, and after the project was finalized. Interviews took place both at Halmstad University and at the companies’ facilities, and were recorded on digital media for later transcription. In Table 1 an overview of the data collection activities during the SML project is presented; the phases mentioned correspond to the phases in Figure 2 on the next page.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>No. of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 formal interviews with Alpha and Beta</td>
<td>2</td>
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<tr>
<td>1</td>
<td>2 initial workshops</td>
<td>20</td>
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<tr>
<td>1</td>
<td>1 questionnaire</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>18 workshops</td>
<td>20</td>
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<tr>
<td>2</td>
<td>ongoing evaluation</td>
<td>12</td>
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<td>2</td>
<td>1 group interview with focus groups</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>1 interview with the NGO representative</td>
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<tr>
<td>3</td>
<td>3 formal meetings</td>
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<td>4</td>
<td>2 week &quot;real life&quot; tests with</td>
<td>16</td>
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<td>4</td>
<td>3 questionnaires and interviews</td>
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<td>4</td>
<td>1 group interview with focus groups</td>
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Furthermore, notes from meetings between actors in the network, field notes covering observations, archival documents, and reflections by researchers involved in the on-going activities (such as workshops) within the innovation network were included in the analysis of the data.

In order to categorize the data collected, patterns were identified in the gathered material [15]. Excerpts in the data sources were marked with assigned colors, facilitating data categorization according to corresponding social and relationship aspects. Within these marked excerpts, we scanned the data material for similarities and differences.

3.1. Overview of the case background

The case study covers a one year long innovation and development project taking place in a heterogeneous innovation network. The project was designed to introduce technology that aids 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 the researchers that took place between home care personnel, next of kin, seniors, and representatives from a developing company which specializes in locks, hereafter referred to as Alpha. During these workshops a problem concerning seniors, next of kin and home care personnel was uncovered: the inability to remotely tell if the senior’s 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 actors involved in the idea generation workshops, along with the researchers, 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 the NGO 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, representing care giving organizations, was 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 controlled some data needed for the prototype and also enabled the involvement of home care personnel in the real life tests conducted in the end of the project. They were therefore considered as an important actor and included in the analysis of the network.

After receiving the grants, which were equally shared by the companies, NGO and researchers, a 13 month project was budgeted and planned for. As the NGO received one-third of the budget, they became an equal partner in the project. Additional seniors (users) were recruited from senior organizations. The research funders especially sought after user driven projects (as did the researchers), therefore the project was both planned and got financial backing to be setup as an unique innovation project. The NGO had, for example, equal power as the firms concerning project decisions. Therefore, the NGO representatives and seniors could be viewed as actors with their own formal and informal relationships to the other involved actors in the innovation network. In the project the researchers had a dual role, as facilitators of the innovation process, and as managers of the project. The project ran for 13 months and consisted of four phases (see Figure 2 below).

The first phase included need finding, idea generation, and market analysis (made by the companies). Typical activities during this phase were idea generation workshops, future workshops, and focus groups involving seniors, NGO representatives, and representatives from Alpha and Beta. The NGO representatives and seniors were divided into two types of focus groups, representing the users:

- 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 continuously evaluated ideas, concepts, and prototypes developed.

During the second phase the primary focus group

![Figure 2. Four phases of the SML project](image)
designed the actual device through mock-ups, scenarios, and iterative prototyping. Continuous evaluation of the design was done by the secondary focus groups.

The researchers 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 focus groups.

During the third phase Alpha and Beta developed hardware and software, based on requirements and prototypes delivered from the second phase.

The fourth phase consisted of real-life testing of the developed high-fi prototype. During the real-life testing seniors and next of kin were able to test the prototype in their own homes for a few weeks.

4. The smart lock case

This section is structured based on the four phases of the case study. Every phase is analyzed from the perspective of the dimensions of interorganizational relationships (Formal-Informal, Deep-Wide). Any changes in these dimensions are then studied in an explorative way identifying social aspects influencing these changes.

4.1. Phase 1

The project began with two workshops where all three focus groups together with researchers and Alpha and Beta were participating. The participants listed and prioritized problems relating to their everyday life and worked on descriptions to explain and clarify these problems for the involved actors. The focus groups were also asked to discuss the needs and problems related to secure living with their family members at home and present the results at the second workshop.

The needs and problems identified at the two workshops were evaluated and ranked by a larger group of next of kin and seniors through a questionnaire. The questionnaire also aimed to identify further needs and problems. A wide range of needs and problems were identified and condensed into 22 thematic fields. Six of these themes were especially focused on in the SML project. The themes concerned: 1) being able to live in ones own home longer, 2) feeling secure when living alone as a senior, 3) problems related to geographical distances to next of kin, 4) not feeling that you do enough as a next of kin, 5) communication problems with care organizations, and 6) information about who has visited a senior. This material was then used by the focus groups and the companies as input value for the selection and development of ideas and concepts in the upcoming workshops.

During this phase, the relationships between all of the actors aside from the secondary focus groups can be categorized as going from an informal and wide relationship to a formal and wide relationship. The relationships were formalized which started to put demands on the input and output from the different actors. The focus groups provided insights into their own (or their next of kin’s) needs and problems which were facilitated by the researchers. However, to enable this transfer of information between the focus groups and the companies, the users as well as the companies had to start trusting each other as well as the researchers involved.

One way to facilitate the move from the informal to the formal relationship was to open up a discussion about why the actors were involved. What motivated them to be a part of the project, what were they aiming for, and what could be gained from their perspective if the project was successful? These initial meetings facilitated by the researchers were a way of establishing win-win relationships and clearly communicate the benefits of these relationships. This was also a way to increase both the interest and the commitment of the different actors.

The diverse knowledge challenged the coordination of the actors as well as the communication among them, however, ideas generated from the initial workshops were considered very interesting from all actors; in other words, the formation of the actors (their relationships) showed a great innovation potential.

In this phase facilitation was done by the researchers to: 1) communicate needs and problems, 2) help establish win-win relationships, and 3) strengthen interest and commitment by actors. In Figure 3, we illustrate how the relationships between researchers, primary focus group, Alpha and Beta are moving in the direction of formal and wide, while the relationships in the secondary focus groups stay informal and wide. In the SML project, this change in relationship from informal to formal was primarily seen as a result of actors gaining interest and trust which seemed to increase their commitment.

Figure 3. Relationships in phase 1
In the case of the secondary focus groups, the opposite seemed to occur. These two focus groups had a harder time finding their own roles in the project.

Social aspects such as a lack of trusting the companies and the researchers, interest of participating, and commitment to the project as a whole were plausible reasons for a lack of change in relationships. For example, there were discussions related to trust about who would really benefit from the SML system. Different perspectives could be taken, and sometimes they were not aligned. On one hand the seniors in the secondary focus group identified integrity issues when next of kin could get easy accessibility and accurate personal information. Another example was the next of kin secondary focus group that questioned the fact that companies would earn profit on their worries regarding their next of kin. The trust issues were identified as reasons to lower interest and commitment. This was evident in the next of kin focus group, which had lower attendance in meetings, as well as a higher degree of drop outs from the group.

4.2. Phase 2

A total of 18 workshops including all focus groups were carried out from November 2008 to June 2009. In these workshops, the primary focus group worked with the companies to refine the ideas and conceptualize them with techniques such as brain-storming, future scenarios, persona descriptions of the various actors and target audiences, design sketches, low-fi prototyping and mock-ups of the components of the system.

An on-going evaluation of the work was conducted by involving the two secondary focus groups. The focus groups also worked directly with the specifications and requirements for the components in the SML system and iteratively developed these both with and without direct involvement of Alpha and Beta. The outcomes from the need finding workshops, the design, iterative prototyping, and evaluation workshops, were used as input for Alpha and Beta in the development phase of the project.

The SML system included four different components. First, there was the “smart” lock. This was an engine driven lock based on existing products developed by Alpha. This unit was mounted inside the front door to lock or unlock the door electronically by for example, codes sent by a mobile phone.

Secondly, a remote control was designed. Both the hardware and software was fully developed within the SML project. The remote control was mainly developed by Beta and was designed to be able to interact with the smart lock (to lock and unlock the door). In a display on the remote control, the user could see and talk to the person outside the door via data sent from an intercom mounted outside the door. A downgraded version of the remote control was commercialized after the SML project ended.

Thirdly, a SML intercom was developed by Beta. It used Beta’s proprietary technology for wireless audio and visual communication. The intercom sent a signal and a photo of the caller on the door to the remote control. Finally, a SML web solution (next of kin web portal) was designed and developed. On this portal the user could see logs and history of when the door was locked or unlocked. It was also possible to see if the lock interaction was initiated by the remote or by the home care service personnel. Furthermore, the system provided the opportunity to present photos from the video intercom. Alarm functionality was also built into the system where an alarm could be sent via SMS or email. The next of kin web portal was commercialized after the SML project ended.

During the second phase of the SML case, the relationships between Alpha and Beta could be categorized as going from formal wide to formal deep. As described by one of the development managers, the relationships between the firms deepened as they started to share each other competences:

“...we have been better and better on sharing and it has become so much easier to utilize each other competences and we have started to share knowledge about technologies back and forth between the firms. Even though we worked at the same facility, we have been isolated from each other in the past. Now we have opened up to each other and also started to use each other’s components in our product lines...”

The managers also elaborated on the importance of actually formalizing informal relationships:

“A co-operation between the firms seemed to be bound to happen, but it never did before we both joined this project. This was the starting point that made it all happen.”

There were several positive spin-off effects of this. During development meetings, discussions of how to solve technical problems were more and more common when engineers from the two companies met. These discussions led to the consideration of solutions and features from the different companies’ product portfolios as potential problem solving methods for development projects within both companies.

The collaboration between the companies also led to synergetic effects, exemplified by the developing manager from Alpha stating 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”.
Both companies showed a strong interest and commitment to the project as both had equal benefits to gain. Alpha was the company that had the most to gain from the project, as the products and services were to be put in their portfolio and they already had the connection to the market. However, Beta had an opportunity to incorporate their components and technical platforms, therefore widening their existing market.

The move to deeper relationships seemed to weaken the innovation potential. Instead of primarily focusing on the users’ needs and finding solutions for these, the firms moved more into a mind-set of solving the problems identified from a more technical perspective. However, this aligned somewhat with the whole project which in this phase moved towards a more narrow design space as ideas were selected and started to be designed in collaboration with, and in several cases by, the users. Therefore, the weakened innovation potential could be a result of the phase of the project, as well as the change in relationship between the companies.

The researchers and the primary focus group could still be categorized as having a formal and wide relationship. All the actors started to trust each other at this phase and both the companies and the primary focus groups interest and commitment were considered as much higher than at the first phase of the project. This was particularly evident when the actors met, discussed, and worked together. Everyone was keen on seeing progress and worked towards a common goal. During the design work done by the focus groups, the innovation potential was identified as very high where the heterogeneous actors brought new insights to the table as well as enabled discussions which took the ideas and the design forward. There was a lot of work needed to be able to facilitate these meetings, but being able to gather the input from the focus groups and formalize it made it a meaningful experience for the companies. This was also the case the other way around as the technical requirements created by the companies had to be translated to be able to get feedback from the focus groups. Therefore, the diversity in the knowledge between the groups put quite high efforts on the researchers whom facilitated the process.

The secondary focus groups could still be categorized as having an informal and wide relationship. This group had a lower commitment compared to the other actors, and there seemed to also be some trust issues between the different actors and the secondary focus groups. For example, the seniors did not really trust the incentives for both the companies and the primary focus group regarding integrity issues in connection with surveillance and providing information to the next of kin (through the companies’ databases).

In this phase, the relationship between Alpha and Beta is moving towards formal and deep, while the relationships of the other actors stayed the same as in the previous phase (Figure 4).

![Figure 4. Relationships in phase 2](image)

To enable knowledge transfers between the actors, researchers had to facilitate the communication between the actors, primarily due to diverse knowledge bases. The trust, interest, and commitment between Alpha and Beta were categorized as higher. Alpha and Beta had both the same incentives of getting new products out on the market, but also to benefit from each other’s competencies and assets, which lead to a deeper relationship. In turn, they could start focusing on solving technical solutions. The secondary focus groups were categorized as having the same relationships, primarily due to the same trust issues as reported in the first phase, which in turn weakened the commitment in the groups. The primary focus group on the other hand still had a high level of trust, commitment and interest towards both companies and researchers. The participants in the group were highly involved in the activities and were very keen on working on design solutions that could lead to a successful system. As most members of the focus group had been involved since the beginning, they also felt that these were their ideas that became realized.

### 4.3. Phase 3

In the development phase, Alpha and Beta designed the hardware and software for the SML system with only a couple of interactions with the other actors. During this phase a communication problem between the actors was identified. Due to only involving the developing managers from the companies, they became central nodes, or gateways for bringing the information down into Alpha and Betas organizations. The requirements, scenarios, personas, and different mock-
ups contained rich data, but still not rich enough to be handed over to the developers who had not joined the co-creation sessions with the focus groups. With a closer involvement of the developing managers in the development process this would likely not be a problem. However, as it turned out in the SML case, the developers didn’t have sufficient communication with the involved developing managers that had been attending the workshops together with the focus groups.

There was one change identified in the relationships between the actors that occurred in the beginning of this phase. Due to privacy issues identified by the secondary focus groups, the project excluded health care monitoring features built on video technology. Also, several alarm functions were removed for the same reason. As a result, the core competence of Beta was not sought after in the technical solution. Instead they became a deliverer of more basic technology such as video and audio incorporated in the intercom. A change in the relationship was noted when Beta became more of a supplier to Alpha, with much fewer business incentives to participate. This led to a decrease in both commitment and interest by Beta (Figure 5).

![Figure 5. Relationships in phase 3](image)

Even if the companies’ trust and relationships to each other had not changed, Betas relationship to the project was definitely changed. They were still formally in the project, but it could be clearly noted that they took a much more informal role in relation to the other actors in the project. The relationship was still categorized as deep based on the homogenous knowledge compared to Alpha. The shift in relationship led to a lower level of innovation potential in the project, as fewer ideas and input came from Beta when their commitment and interest were lowered. This was one example of the difference between the social aspects of trust, commitment and interest, and an argument for keeping them separated while analyzing the SML case. Trust seemed to lead to commitment and interest, whereas the latter two seemed to be needed to keep a high level of innovation potential in a project regardless of trust.

4.4. Phase 4

The planning of the real life evaluation arrangement and the NGO’s efforts to find test subjects began in September 2009. The NGO contacted users and eight pairs (parent and child) were selected to participate in the evaluation, leading to a total of 16 participants, 8 seniors and 8 next of kin. All test pairs had experience in being a relative at a geographical distance. In addition the test pairs were selected with a balance between seniors with home care service, next of kin care, and seniors without direct care support.

The real life evaluation went on for two weeks and started with the installment of the SML system as well as a briefing of the test for the users. Two questionnaires, one for each week, were used to gather data. The questionnaires for the seniors focused on the system that was installed in their homes and the questionnaires for the relatives focused on the web system. In addition, a final group interview with every senior and next of kin pair was conducted in the end of the evaluation. The interviews lasted for approximately one hour and were conducted in the home environment of the seniors. The SML system was deemed very successful in the evaluation. For example, seniors with physical disabilities who had trouble moving around in their apartment found the remote control extremely helpful. Another example was relief of stress that some next of kin felt by always being able to see who had been at their parents’ home and when. This information also helped in their communication with the care giving organization. A communication that otherwise could be quite problematic due to lack of information. Finally, there was a high degree of willingness to pay for the innovation from the next of kin, which showed the commercial potential in the SML system.

During this phase there were no identified changes in the relationships between the existing actors in the project. However, one new actor had to be brought in during the tests.

As the municipality had care giving personnel visiting the test subjects, data that they were in control of had to be incorporated into the test. For example, the system registered when a representative from the care giving organization arrived to a senior, data that was also visible through the SML web solution. This led to a new iteration of trust building activities with the municipality in order to get them involved in the evaluation. The relationship was already there, but it was not established as Alpha was dependent on the data controlled by the municipality. The municipality had to be involved as an informal partner. To be able to
involve an actor informally this late in the project, social aspects were important for establishing the relationship. First, trust had to be built towards the project and the actors, which then enabled interest and commitment from the municipality. To enable trust building, the researchers for example communicated the incentives for the different actors to join the network, as well as what outcome the actors sought after. These activities to build trust with the municipality supported the successful evaluation of the SML system. The graph below is a representation of the final relationships between the actors in the project (Figure 6).

5. Discussion and conclusion

Innovating in an innovation network can be understood and viewed as a social process [5]. This paper has adapted that view and analyzed the SML project from a relationship perspective which resulted in findings regarding how social aspects influence changes in these relationships.

Earlier studies have shown that innovation networks provide access to diverse sources of capabilities and information which increase the innovation level. This is especially evident in small organizations. Successful interorganizational relationships therefore fuel innovation [9], which could also be seen in the SML project. By acknowledging the network as a socio-technical construction that produces and consumes knowledge necessary for innovation [4], we suggest that more emphasis is put on facilitating the relationships in the networks. The key to do this seems to be through acknowledging the social aspects in the network that influence changes in these relationships. The SML case shows that this is especially important in complex and dynamic innovation networks with highly heterogeneous knowledge resources [4].

In the SML project there were several instances of how the social aspects influenced the relationships which in return influenced the innovation process as well as the innovation potential in the project. For example, in the first phase of the project the companies, researchers, and the primary focus group moved into a formal relationship where the heterogeneity of the actors boosted the innovation potential. Another example, where the relationships instead reacted in a negative way was in phase 3, where Beta’s relationship changed into a deep and informal one. This influenced the interest and commitment, leading to lower innovation potential in the project.

As the heterogeneity in the network grows, the ongoing negotiation between actors who also protect the social order might become difficult [3; 4]. The SML project shows the need for a partner (in this case the researchers) that can facilitate the process in a way that positively supports social aspects which influence the relationships in the network. Aspects relating to trust as well as the importance of establishing interest and commitment were seen in the beginning of the SML project. Initially the primary focus group was especially suspicious of the firms’ interests, but also to some degree the researchers interest as well. The individuals in the focus group were uncertain of why they were involved and what they could bring into the process. The researchers had an approach that aimed at facilitating communication of interests between the actors and clearly stated the researcher’s own agenda and interests. This seems to both built trust and eventually commitment in the focus groups. Aspects relating to trust as well as the importance of establishing interest and commitment were seen in the beginning of the SML project. Initially the primary focus group was especially suspicious of the firms’ interests, but also to some degree the researchers interest as well. The individuals in the focus group were uncertain of why they were involved and what they could bring into the process. The researchers had an approach that aimed at facilitating communication of interests between the actors and clearly stated the researcher’s own agenda and interests. This seems to both built trust and eventually commitment in the focus groups. All actors’ agendas needed to be made explicit before the relationships could evolve into a more formal state.

The lack of trust between the actors was mitigated by the role that the researchers could establish early in the project. When trust was established among the different actors and the university, researchers could then help mediate and connect the different actors to the innovation network through the first workshops and the on-going meetings between the actors.

An example of the importance of heterogeneous actors in an innovation network supporting digital innovation, and therefore also a need for managing social aspects and relationships, could be found a bit later into the SML project. During the innovation process it became evident that the different focus groups had quite different needs for the system. The next of kin in general, wanted quite rich data regarding for example, movements in an apartment, possibilities to use cameras inside an apartment, overview who visited the next of kin and when. Many of these features were regarded as a breach of privacy from the secondary focus group who argued for their integrity and their privacy. In the end this lead to a change in the relationships for Beta who took on a supplier role in the network which changed their relationship to a deep and informal one. A conflict of interest could be
identified between the companies. Beta was looking for more video and image features in the system due to possible synergy effects with existing products, whereas Alpha was focusing on synergy effects on their behalf and their product portfolio.

In general the user driven innovation approach was perceived as positive for all involved actors. The companies reported that they gained a deeper understanding of their respective target groups. This knowledge 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. During these workshops, Alpha, Beta and the primary focus group changed their view and understanding of the care takers situations and the possibilities that technology either offered or restricted.

When Alpha and Beta gained knowledge and understood the focus groups’ needs and requirements, a better outcome was secured according to the developing manager of Alpha. Worth noting though is the uniqueness of the SML project. In this case the NGO who represented the users had equal formal power as the other actors to actually decide project outcomes. This is something quite different compared to more traditional user involvement approaches in digital innovation projects.

In this paper we have explained and presented how social aspects influence changes in relationships in digital innovation networks by analyzing the Smart Locks project. The analysis of the SML project shows how social aspects such as trust, interest, and commitment among actors influence and change the relationships. This work therefore contributes to the body of research about relationships between actors in innovation networks [see e.g. 9; 10; 12]. By specifically investigating the influence of social aspects on changes in relationships, this paper adds to current research about network dynamics and relationships. Furthermore, the SML project shows that the model about dimensions of interfirm relationships was applicable in an interorganizational setting, which also involved user groups and researchers.

We have presented actions that were taken to establish these relationships and facilitate the process in a way that supports the social aspects influencing these relationships. These findings should prove useful for practitioners working with setting up and managing innovation networks working with digital innovation.

We suggest that upcoming studies should investigate the social aspects even further, possibly by looking at the identified aspects of trust, interest and commitment to see how these relate to each other. Another suggestion for further studies would be to look in more detail about how the social aspects influence the relationships in digital innovation networks. This paper could then be regarded as the first step of these kinds of studies.

6. References