Dismantling the Co-creation Unicorn: Investigating the “How” in Inter-firm collaboration.

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Abstract

In order to face the challenges derived from an increasingly disruptive technological environment, firms often engage in collaborative arrangements with other firms. While it is argued that inter-firm networks can serve as a way to catalyze innovation, to manage risks involved in R&D and to enable the creation of new value through co-creation, the causes and reasons for inter-firm collaboration are well-known. However, little effort has been focused at critically examining the challenges that co-creation brings on a network and firm-level. This research addresses this issue by taking a process perspective on the formation and development of an inter-firm network in relation to its technologically disruptive environment. Building on a case study involving firms from that network, this research shows that such arrangements may also involve challenges for participating firms. These challenges relates to a paradoxical tension between exploitation of relation-specific assets and success in the long- and short-term, but also a challenge in terms of positioning the firm within the network.

1. Introduction

With increased demands for time-to-market (Grover & Kohli 2012), while mass-specialization becomes the new notion of value (Pralahad & Krishnan 2008) and in times of rapid technological development (Van de Ven 2005), the argument of organizing towards leveraging other actors resources instead of acquiring and keeping them all within the firm is clear. This type of inter-firm collaborations is frequently referred to as inter-firm networks and as previous research has demonstrated, inter-firm networking has the potential to catalyze innovation (Barrett et al 2011; Ozman 2009) and serve as a source for competitive advantage in an open innovation paradigm (Chesbrough 2003), as long as assets of the firm are developed in alignment with partner needs (Dyer & Singh 1998). However, while being a part of an inter-firm network is argued as one way to face challenges of an increasingly turbulent environment, little effort has been focused at critically examining the challenges that such membership in such constellations bring on a network and firm-level when acting in a technologically disruptive context. Evidently, firms are better at responding to evolutionary changes in their markets than dealing with revolutionary and disruptive changes (Christensen 1997) and while digitization has accelerated the rate of disruptive innovation (El Sawy et al 2010), organizing while working in a digital industry becomes particularly challenging with intermittent technological revolutions.

This thesis examines such a context as it investigates a regional network of firms (henceforth known as The Network) that resides within the digital creative industries where their business relies upon development and design of digital content. Driven forth by the company FocalFirm as the main acquirer of projects, The Network has successfully managed to undertake several big assignments from large international companies by leveraging each other’s knowledge, assets and resources in co-creation of web sites, games and videos. As inter-firm value creation relies upon firms’ developing relation-specific assets that complement those of partnering firms (Dyer & Singh 1998), the actors within The Network have over time developed technological specializations that complement or extend those found in their partners. At the same time, the firms have conducted projects of their own
where specializations have been utilized in internally managed productions. Building on the ability to combine expertise in specific areas, the network has grown organically over time and strengthened the relation-specific assets amongst its members. Thus, a technological heterogeneity which could not be contained with a firm has emerged on a network level, which if utilized provides resources for actors within to handle a rapid technological development.

The study reported here demonstrates that not only do inter-firm networks constitute viable solutions to challenges derived from a disruptive technological environment. They also, as they emerge, provide challenges of their own in terms of tensions concerning firms position in a network, and tensions between the short-term and long-term strategy of collaborating firms. Although inter-firm collaboration has emerged as a popular subject and previous research has demonstrated why such networks emerge, little effort has been made in investigating how these collaborations adapt and evolve over time in response to disruptive technologies. Recognizing these gaps in previous research, this thesis aims to answer the following research question:

How do inter-firm networks emerge and evolve over time in relation to a disruptive technological environment?

In answering this question, this research aims to contribute to a growing area within information systems research that concerns inter-firm collaboration and the co-creation of value within information technology contexts (Grover & Kohli 2012).

2. Related research

This chapter reviews research related to the subject of disruptive technologies (2.1) and inter-firm collaboration (2.2). The first section aims to provide an overview of the digital creative industries and the nature of the technological disruptions that firms encounter therein. While technologically disruptive environments are argued as being an important reason to engage in inter-firm networks, a review of what they imply in this context is important in order to create an understanding of the theoretical constructs used in the following analysis. The second section concerns previous research conducted in the field of inter-firm collaboration. While most of said research focus on why firms engage in inter-firm constellations, the section will give an overview of inter-firm collaboration antecedents. It will also provide insight into an emerging area of research that relates organizational ambidexterity to inter-firm contexts.

2.1 Disruptive technologies in the digital creative industries

Companies are generally good at responding to evolutionary changes that occur in their industry (Christensen 1997), implying that firms are often able to respond to changes in their environment as long as they occur gradually over an extensive time period. However, adapting to revolutionary change is often deemed as a more difficult task. In what D'Aveni (1991) refers to as environmental turbulence, technological shifts or substitutions can create new competitive environments that disrupts established strategies and competencies within the firm. This is also recognized by Christensen (1997) whose basic argument is that incumbent firms fail when their competences are rendered obsolete by new technologies.
Furthermore, technology is said to exist within paradigms that incorporate knowledge related to it and the trajectory of how it will progress over time (Dosi 1982) e.g. as long as one technological paradigm is dominant within an industry, firms can build upon previous strategies and competencies and still be competitive. When a new technological paradigm emerges, firms are forced to develop new strategies and competencies related to a specific technology.

Overall, this could be understood and consolidated in the concepts of sustaining and disruptive technologies (Christensen 1997). In the light of above statements, sustaining technologies are those that emerge in an evolutionary manner and supports the current technological paradigm and the strategies and competencies related to it. Disruptive technologies, on the other hand, would be those who emerge out of the existing paradigm and render previous strategies and competencies obsolete.

Actors within the creative industries comprise firms who uses culture as an input while their outputs are mainly functional, including the sectors of architecture, graphic design, fashion design or advertising (European Commission 2010). However, the focus of this study is on firms that work solely in developing creative outputs in a digital domain, i.e. those working with games, video and web development. While their outputs are results of managed intellect rather than managed physical things (Quinn 1992), competitive advantage lies in gaining and advancing in knowledge of technology associated with their area of business (Van de Ven 2005). Hence, competitive advantage in their context depends on having a high level of knowledge in how to create or develop games, video and web sites.

According to Carlo et al (2011), sources of technological disruptions in digital content development contexts can derive from emerging services, emerging platforms and emerging development processes. In the context of the digital creative industries this can be seen in the following way: Firstly, services refers to new technical and business solutions as results of innovation around new types of information technology (Carlo et al 2011). With this broad definition, services relates to a variety of application functionality that allows users to create, manipulate, store and consume content (Yoo et al 2010). In the context of the digital creative industries, I argue that this imply services that can serve as integrated parts in project outputs (e.g. Facebook, YouTube, Twitter who allows integration and exchange of information with web sites). Secondly, platforms are defined as products, technologies or services upon which firms can develop complementary products, technologies or services (Gawer 2009). Hence, platforms in the digital creative industries comprise tangible devices (such as computers, smartphones or tablets) that, as they emerge, allows for firms to create web sites, games and videos that can be used on those platforms. Thirdly, development processes concerns development tools, methods, teams and their structure that change according to emerging services and platforms (Carlo et al 2011). In the digital creative industries this implies that when new services (such as Facebook) or platforms (such as the smartphone) emerge, these will exert pressures on established methods or standards for designing and developing film, games and web sites (such as when the Apple iPhone would not support Adobe Flash).

As shown in this section, technological disruptions may be understood to emerge in either evolutionary or revolutionary manners and organizations seems to experience more difficulty in handling the latter. As the digital creative industries are characterized by a rapid emergence
of novel services, platforms and development processes, I argue that technological disruptions in this specific environment derive mainly from those sources. In such times of intense technological change, firms become challenged in meeting an disruptive environment on their own (Gassmann 2006). Therefore, firms are increasingly looking towards sharing and collaborating with other actors through inter-firm networks, a subject that will be addressed in the following section.

2.2 Inter-firm collaboration

As companies become involved in collaborative ventures that are both long-term and recurrent and when their actions become interdependent, they reach the organizational state of a network (Powell 1990). Whether the network is described in terms of inter-organizational relationships (Ring & Van de Ven 1994), collaborative innovation ecosystems (Barrett et al 2011) or clusters (Porter 2000), they all basically refer to the same approach: expanding the capabilities of the firm by making strategic use of capabilities found outside of the firm. Thus, inter-firm networks is the concept used to describe the manifestation of inter-firm collaboration activities in this research.

According to Dyer & Singh (1998), competitive advantage in inter-firm networks can be created as alliance partners combine or exchange their specific assets, knowledge, and resources. However, this relies upon a network-wide alignment of specializations amongst partners. In order to co-create value with other actors, a firm needs to have the specialization that is required by potential partners. Conclusively, internal assets, knowledge and resources need to be developed in conjunction with those of the partnering firms.

The evolution of regional inter-firm collaboration is often characterized by the growth and the internationalization process of a district leader who chooses which local competences and capabilities to use as strategic resources (Albino et al 1998). Furthermore, network centrality, i.e. the number of connections that a specific firm has with other firms at a certain time, is both a measurement of power within in an inter-firm arrangement and a prerequisite for gaining from such (Powell et al 1996). Combined with an insight that successful inter-firm collaboration relies upon an alignment of relation-specific specializations amongst partners (Dyer & Singh 1998), inter-firm co-creation becomes dependent on the needs of the district leader who ultimately decides which assets, knowledge and resources that are needed within the network.

A recurring theme in the area of organizational research is that success for companies residing in turbulent environments, such as those characterized by intermittent technological disruptions, relies upon their ambidexterity – the ability to be aligned and efficient in management of current business demands while at the same time being adaptive to environmental changes (Tushman & O'Reilly 1996). These ideas traces back to March (1991) who noted that organizations, when faced with emerging changes in their environment, can adapt by either exploring new opportunities or by exploiting old certainties. While exploitation “includes such things as refinement, choice, production, efficiency, selection, implementation, execution” (March 1991 p.71), exploration, on the other hand, concerns “search, variation, risk taking, experimentation, play, flexibility, discovery, innovation.” (March 1991 p.71). While being both efficient and adaptive can be seen as directly
contradicting activities that requires fundamentally different organizational structures, contexts and strategies (Raisch & Birkinshaw 2008; O’Reilly & Tushman 2004), Powell et al (1996) argues that network collaboration serves as a vehicle for both exploration and exploitation that allows firms to utilize external resources to compete in both novel and familiar business areas. In fact, previous research has argued that interrelated firms can achieve ambidexterity on a network level while at the same time avoiding the complexity involved in achieving it within single-firm boundaries (Ferray 2011).

Driven by environmental uncertainties (Oliver 1990; Vanhaverbeke 2005; Van de Ven 2005), increased demands for specialization and time-to-market (Grover & Kohli 2012), the cost and complexity of internal R&D, and as an increasing amount of knowledge can be found outside company boundaries (Chesbrough 2003), firms are increasingly looking towards leveraging assets, knowledge and resources of external actors. Thereby, there are vast examples of knowledge gained regarding the antecedents for inter-firm collaboration and the advantages of being involved in such arrangements. As has been described in this section, the emergence and development of inter-firm collaboration often relies upon the growth and internationalization process of a leading firm. Hence, it also known that actors central within a network has the greatest potential to gain from it, which relates back to the concept of ambidexterity. In order to handle a disruptive environment, organizations need to be ambidextrous, i.e. to both explore and exploit and there is an emerging stream of research that has addressed that this in fact can be achieved on a network level.

However, while previous research has extensively shown why firms form networks, earlier efforts have failed to explicitly address how such networks evolve over time. Hence, instead of investigating the why, this research aims to focus on how inter-firm networks emerge and adapt in an environment characterized by disruptive technology. This is achieved through a qualitative case study in the context of a successful network in the digital creative industries.

3. Method

This chapter describes the research process of this thesis. It starts with declaring the general approach taken, how it relates to the research context at hand and how data collection was conducted (3.1). Following that section is an explanation of how data analysis was performed and why it was performed in the way that it was (3.2). Finally, the chapter’s last sections contain limitations related to the method chosen (3.3) and a declaration of the research site at hand (3.4).

3.1 Research approach and data collection

The purpose of this study is to explore how an inter-firm network evolves over time as it engage in co-creation and adapt to a disruptive technological environment. Thereby, interest does not lie in providing exact measurements or enumerations of a phenomena. Rather, the aim of this research is to create an in-depth and detailed understanding of a process which constitutes this research as qualitative (Patton 2002). The research approach taken here is case study research. Yin (2009) describes a case study as:
“[...] an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.” (p. 18)

Furthermore, Yin (2009) argues that the case study approach is especially suitable when the researcher has no or little control over behavioral events and when the research focuses on contemporary events. Hence, the case study approach was taken in this research as it investigates a contemporary event in the form of ongoing inter-firm collaboration, it focuses on a real-life context and the researcher had no control over events within that context.

It is argued that qualitative data comes from three different types of data collection: in-depth and open-ended interviews, direct observations and written documents (Patton 2002). As Yin (2008) argues that multiple sources of data should be used when conducting case studies, both interviews and written documents was used in this case. While the first served as a primary source for data, the latter (following the recommendations made by Yin (2009)) functioned as a source for complementary data and as a way to verify that which was found during the interviews. At the time of this study, The Network consisted of nine firms and one educational program at the local university. From these nine firms, four participated in this research, resulting in a total of six interviews with firm managers, art directors and university representatives (see table 1). They were all chosen because of their roles within the companies, roles that implied great influence over how the firms would act in response to technological disruptions. In some cases, the interviewees held key positions in both their firm and in The Network which at times created confusion in determining what was to be interpreted as firm- or network level strategies. However, while having this potential problem in mind prior to the start of data collection, it also provided important insights of how specific firm-level strategies have developed in relation to those of The Network. The interviews were conducted with a semi-structured approach that allowed new questions to arise according to responses given by interviewees. Prior to interview initiation, an interview guide was developed that contained the general themes that were to be explored (see appendix.1). The interviews were conducted during a time frame of two months and their duration varied from 45 minutes to 1 hour. All interviews were conducted at the offices of respective firms and they were all digitally recorded and later transcribed. During the interviews, additional notes were taken by the interviewer as a way of ensuring that no important information (such as body language and expressions) was missed.

<table>
<thead>
<tr>
<th>Company / institution</th>
<th>Role within company / institution</th>
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<tr>
<td>FocalFirm</td>
<td>Manager</td>
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<td>PartnerFirm1</td>
<td>Manager</td>
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<td>PartnerFirm1</td>
<td>Art Director</td>
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<tr>
<td>PartnerFirm2</td>
<td>Manager</td>
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<tr>
<td>PartnerFirm3</td>
<td>Manager</td>
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<td>University</td>
<td>Program manager</td>
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Table 1. Interviewees and their respective roles within their companies
3.2 Data analysis

The analytical process in this research consisted of two stages; coding of data and analysis of the collected material. Both coding and analysis of data was informed by theory, meaning that theoretical constructs were developed out of existing research in the area of technological disruptions and inter-firm collaboration. While the purpose of this research was to explore how an inter-firm network evolves over time in relation to a disruptive technological environment, the nature of technological disruptions in the context of digital content development and design had to be examined. Findings in previous research showed that environmental disruptions were in many cases consolidated in the emergence of new technologies and that this was especially the case in digital and knowledge-intensive industries (see 2.1). Looking at the specific context of the digital creative industries, this could be understood as emerging services, platforms and development processes would constantly apply pressure to firms working with design and development of digital content, as they had the argued potential to rearrange competitive environments and render previous strategies and competences obsolete. Thus, the coding process focused on applying categories of technological disruption to the empirical data and matching those to empirical statements regarding the effects that they implied on firm- and network-levels. Additionally, the data was also used in a second scheme that matched technological disruptions chronologically to events taking place within firms and events on an inter-firm level. Through this approach, both what was perceived by the interviewees as directly related events in relation to emerging technology and events that were not explicitly direct effects of it could be compiled in order to potentially identify relations between them.

In the following data analysis, the identified emerging technologies that were interpreted to have instigated important firm- and network-level events were used as key technological disruptions. Those key events then functioned as milestones or phases by which the emergence and evolvement of The Network in relation to a disruptive technological environment could be analyzed and understood. The analysis was theoretically informed in the sense that previous research had argued that in order to handle a disruptive environment, firms needed to engage in both exploration and exploitation (see 2.2). Thus, the analysis focused on finding events and statements in relation to technological disruptions which could be related to actors either focusing on their current technological specialization or on adoption of emerging possibilities.

While the data analysis process was guided by theory, it is important to note that it was grounded on empirical data. Through an iterative approach, focus was alternately put on development of the theoretical constructs and applying those on the empirical data until an understanding of how The Network had emerged and evolved over time in relation to a disruptive technological environment.

3.3 Methodological limitations

The ability to generalize from research results is a critical issue for all researchers (Walsham 1995). According to Yin (2009), this is especially the case for those conducting case studies as the possibility to generalize from one single case if often questioned. However, as Yin
argues, it should be expressed that case studies do not aim to be generalizable to a general population or universe. Rather, case studies are generalizable to theoretical propositions and aims to expand those by providing an in-depth view of a complex phenomenon. According to Walsham (1995), there are four different types of generalizations that can be drawn from case studies: development of concepts, generation of theory, drawing of specific implications and contribution of rich insight.

In the light of this, the case study conducted in this thesis falls within Walsham’s third category as it aims to enlighten tendencies rather than predictions within the area of inter-firm collaboration and to provide useful insights for research done within that context.

3.4 Research setting

The Network is an inter-firm network consisting of around ten industrial and institutional entities, all working within the digital creative industries. The firms within the Network each employ from two to around thirty people per company, of which the biggest being FocalFirm.

The regional industry saw the light of day in 1994 with the start of its first firm (henceforth AncestorFirm) and the start of additional firms during the following eight years. While these firms became quite successful during these years and created a buzz around the regional industry on a national level, inter-firm collaboration between them was nonexistent. Around 2003, several employees left AncestorFirm to start their own companies within the region. One of these being FocalFirm who would become the catalyst for the Network as it, while only employing a handful of staff at the time, applied a strategy of inter-firm collaboration from its first assignment. Starting out as an ad-hoc collaboration, the Network served as a resource used in complex projects acquired by FocalFirm. By leveraging technological specializations found within regional firms, FocalFirm was able to take on large projects by outsourcing specific parts to its partners. As all partners could be found within an area of one kilometer and as many of them had previously worked together in AncestorFirm, strong social relationships and trust allowed for uncomplicated collaboration over firm boundaries. Combined with the fact that the specialized skills found within the Network was of a internationally high level, the Network grew organically with the success of FocalFirm and the collaborative projects which it acquired.

The network has since it started had connections of a varying degree with the local university which has provided educational programs directed at the digital creative industries. Initially, it served as a kind of spawning pool for talent that could be scouted by the regional firms, thereby playing an important role in the birth of the regional industry. Over time its role became less prominent until disappearing completely in 2007 as the educational program directed at the digital creative industries which it currently held, was cancelled. However, it would once again reclaim its importance with the launch of a new program in 2011.

Over time, the ad-hoc and production based collaboration in the region grew into a more formalized network that would work towards common issues of the actors within it. Directing its attention to education of new talent and current employees, and towards marketing the regional digital creative industry on a national and international level, the Network strived towards securing its competitive position long-term.
During the length of FocalFirm’s existence, its projects have displayed a diversity of a massive scale where novel services, platforms and development processes have been used in combination to create ground-breaking outputs in the form of games, videos and web sites. At the same time, FocalFirm has managed to acquire a wide range of internationally well-known clients and gained global recognition through several awards and prizes. While this has been accomplished by a small firm who by definition contains limited resources, FocalFirm and The Network have often been referred to as an example of a highly successful inter-firm collaboration and an archetype model for creative organizing in a digital context. In the light of this, The Network stands as a well suited object for research in this case as it shows upon a process where inter-firm networking seems to have led to great success. A process that will be explained in the following chapter.

4. Results

This chapter accounts for the empirical findings in this research and it is divided into subsections that each represents the emergence of key technological disruptions and events taking place at that same time on a firm and network level. An overview of the phases is provided in Figure 1.

**Figure 1. The emergence of disruptive technologies divided into chronological phases.**
4.1 2003 - 2007: Technological stability

In 2003, internal disagreements at AncestorFirm lead to the formation of new regional firms started by previous employees. One of those being FocalFirm who, while only employing two people at the time, set out with the notion of being a small firm that would co-operate with other companies. By managing to get an international telecommunications-company as their first client, their first project required resources which could not be found within a company consisting of two people. Therefore, they turned to previous co-workers and friends who helped them to tackle the width of technological expertise required by bringing knowledge in design, film and Flash development to the table. As it turned out, the project was seen as a great success and the output was internationally recognized as one of the most creative web sites that year. Based on its prosperous result, this project set the standard for how organization in future projects taken on by FocalFirm would be organized; when insufficient resources resided within the firm itself, FocalFirm would look to other companies which could provide the expertise required in specific projects.

During this phase, Adobe flash (at this time Macromedia) was the dominant technology used amongst the firms in The Network as AncestorFirm, FocalFirm and PartnerFirm1 all saw it as their technological specialization and used it extensively in both their own and inter-firm projects. One exception being PartnerFirm2, whose manager noted:

“Well, traditionally AncestorFirm was very Flash-heavy. Four years ago, PartnerFirm1 was also very Flash-heavy. Because that was really the only way that existed earlier to deliver rich online experiences. [...] We put a lot of effort into HTML, CSS and JavaScript, that has always been the foundation of PartnerFirm2 in terms of technology.”

Amongst other actors in the region, a diversity of technological specializations could be found as certain companies focused on digital design, back-end programming or the production and editing of film. As FocalFirm continued to acquire large and complex projects, the resources from its surrounding partners could be utilized in order to accomplish a wide range of project scopes which spanned over several technologies. While FocalFirm was inclined to engage other firms in their projects, this was never the case in projects acquired by other companies within The Network. Underlying reasons were explained to derive from the nature of projects acquired by FocalFirm compared to those of other firms, as the manager of PartnerFirm1 put it:

“Well it’s more economy in that which you have in-house, you don’t have to pay a lot of consulting-fees. To have my art director doing my design doesn’t cost me as much as if I would hire a designer [...] That’s the thing, depending on what type of customer you have. I mean, if you have small local firms that wants a small web, then you can’t afford to be creative.”

The general notion of interviewees was that in order for inter-firm collaboration to exist, the projects which were to be the subject of collaboration had to bear enough economical and creative “wiggle-room”. As FocalFirm was the actor that could bring these types of projects and distribute them amongst the other firms, it became the locomotive that drove The
Network and the firms within it forward. While several of the projects acquired by FocalFirm gained international recognition and praises, the other firms were also able to attain credit through adding these projects to their own portfolio. In this way, FocalFirm, partnering firms and The Network as a whole developed organically as success for one meant success for the other.

During the length of this phase, FocalFirm migrated quickly to become a global actor that worked with large international clients. While the projects acquired by other firms within the network mainly concerned local and national clients, FocalFirm and its partners were never put in a situation where they would directly compete against each other. However, this could be the case for the partner firms as their clients were often based on the local market. The strategy of FocalFirm to act on a global market also meant that it early on met with international firms within the digital creative industries and engaged in collaboration with some of them. While a substantial degree of work related to FocalFirm’s projects was still distributed amongst members of The Network at this time, FocalFirm was also acquiring resources from national and international firms. This meant that some projects comprised strictly firms from The Network, others comprised a mixture of The Network and other firms while an amount of projects contained strictly firms from outside The Network. Overall, collaboration within The Network was thriving, as FocalFirm in most cases could find the technological specializations which it needed within The network.

Concurrent with the development of the firms within The Network, a program was held at the local university that educated students in skills related to digital design and development. Following in the tracks of the regional industry, it started out by matching the competencies needed at AncestorFirm. However, as multiple web production agencies spawned in the region, the program changed its educational direction towards matching a more diverse skillset. All interviewees conformed on the important role that this program had played in the emergence and development of the regional industry as it served as a spawning pool for talent which could be employed by firms within The Network. However, over time the program seemed to lose its importance as the knowledge found in the students which it produced was corresponding lesser and lesser with the needs of the industry. Ultimately, the program was cancelled, and although its role had been of small significance during its final years it would still leave a big gap, as expressed by the manager of PartnerFirm1:

“Yes, they cancelled that creative education program. I’m sorry to say that it disappeared a couple of years ago. That was our spawning pool, to be able to handpick talents from there [...] Everybody here at PartnerFirm1 has some affiliation to that educational program. Either through being students there themselves or by some other connection. People have been handpicked from that education which have enabled us to get incredibly skilled people that has derived from that specific educational program.”

As described, this phase was characterized by a period of technological stability that allowed firms within The Network to exploit their technological specializations. As no other technology really challenged it, Adobe Flash became the dominant standard used by a majority of the firms. During this time, collaboration was a common event, as FocalFirm used the competences found within other firms of The Network in the projects that they acquired.
Evidently, the existence of the education program played an important role in the formation of the firms and thereby was of great importance in the formation of The Network itself.

While persistent technologies allowed the firms and The Network to grow and develop, environmental stability would not last forever. As will be described in the following sections, emerging technologies would in later stages exert pressures upon both the firms and The Network, starting out with the emergence of social media services and smartphones.

4.2 2008 - 2009: Social media services and smartphones emerge.

During the beginning of this phase, actors noticed fundamental technological changes happening in their industry. As explained by the manager of PartnerFirm2, they experienced what they express as frustration as the things that their company had developed and produced previously in internal and joint projects did not seem to work as they used to. According to their analysis, they found that this development could be traced to technological trends that were heavily affecting their industry:

“And what happened in 2008 and around that time was that social media was growing strong. You started to see that there was emerging user-patterns on the Internet which you hadn’t seen before. Other things that became apparent trends were [...] what is called Internet of Things, that also things become connected and it was also [...] of course mobiles and tablets [...] It’s those things that lead to us becoming who we are today and that work more with thinking. Naturally also with doing but also with thinking as it’s not as straightforward any more [...] one time it’s something very traditional and other times it’s something very innovative on new platforms and so on. This calls for a fundamentally different way of thinking in terms of business strategy, in how you work as a designer, it requires new approaches in architecture and technology [...]”

Although social media services such as Facebook, Twitter and YouTube had been around for a couple of years, the companies within The Network express that it was not until during this time that the services started to fundamentally disrupt their industry. As expressed by the manager of FocalFirm, social media services brought completely new challenges with them compared to the technological developments which they had encountered in the past:

“It’s a bigger step for us today to go from a site, such as those we developed in the beginning with a maybe like a banner, to how we will connect with social media like YouTube and everything that is today.”

With the emergence of mobile computing platforms, what is generally referred to as smartphones, (and not least with the release of the Apple iPhone) the firms within The Network experienced that the nature of designing and developing for the Web sat out on a trajectory which they had not previously anticipated. Although smartphones came with embedded capabilities to process, store and transfer information in similar ways as the established personal computer (PC), they were also restricted in those capabilities in terms of the amount and ways in which information could be processed, stored and transferred. Ultimately, with the growing adoption of smartphones in society and an increasing customer demand for content adapted to their capabilities, this implied that design and development of
websites now had to take a new series of devices into consideration. The manager of PartnerFirm1 expresses this added complexity like follows:

“Above all, with the emergence of the mobile phones, everything has to be scaled down and it has to be responsive web design [...] You just don’t make one version, you have to think a little bit longer. It’s more work involved in getting a web site to look good today and work on all platforms today [...] Ok, I don’t give a crap of how it works technically. It’s more about [knowing] what is possible. You have to keep up. This thing with responsive web design, I have really put a lot of effort in trying to understand that we have to take that step because that’s the future. It will be, because there are so many [mobile] platforms out there.”

As stated in the quote above, the emergence of smartphones brought demands for what the manager refers to as “responsive web design”, implying that a web site should be built in a way that allows it to adapt according to the screen size and resolution of the device used in a specific viewing of that web site. While the prior process of developing and designing a web site could be seen as pretty straightforward process in comparison, PartnerFirm1 now had to consider a plethora of devices, their accompanied software and screen resolutions.

At this time, The Network underwent a process towards becoming a more formalized form of collaboration. Leaving the approach of strictly being a production network that solved the short-term resource needs of FocalFirm, actors within The Network started working towards common long-term goals and towards securing the regional digital creative industry. As the manager of PartnerFirm2 notes:

“What we have worked with quite a lot in the Network these last three-four years, that is to also work with long-term issues for this film, web and games industry in the region. Part of that is recruitment, how can we ensure that there are people that can and want to work with this in the future? What kind of educations are there? How can we work towards supporting and pursuing that type of questions? How can we educate and inspire in our companies as well? So that’s an important question to us.”

As noted in the quote above, one step in this process was to strive towards getting educational programs in place that would fill the gap of the previous and see to that future recruitment needs in the regional industry was met. During recent years, the firms within The Network had not seen the same development and growth as they had previously experienced and they argued that a partial reason to derive from the fact that new employees with the competences required in their field could no longer be found within the region. Another way to boost access to competence within The Network was to enable training and development for the ones already employed. The last explicit step was to try and market The Network on a global level. A further step towards formalization of The Network could be seen in actor’s notion of what a membership in The Network implied. While the collaboration in projects by leveraging the resources found in partnering firms became a part of a bigger package, it was still to be an important one and membership thereby could not be gained unless the applying firm could contribute with the right type and level of competences. This is expressed by the manager of PartnerFirm2 in the following way:
“People say that they want to join The Network and that they want to become members because it seems like cool stuff is happening here, but in that part, in the production network, you only get membership if you have the right type of competence, if you have an edge that is world-class in an area and that you can contribute to this network.”

Conclusively, this phase represents a time of emerging services and platforms that challenged the established processes within the firms. Firstly, the emergence of social media services meant that the scope for projects conducted by FocalFirm started to imply a process of finding creative ways to incorporate those services into the game, web site or video that were to be developed. Secondly, as smartphones became popular devices for consuming web-content, the process of developing websites changed towards becoming responsive, implying a process of web design where the limitations and possibilities of mobile units had to be taken into account. During this period, a significant step towards formalizing the collaboration between the firms was taken. In its essence, this step concerned a process of shifting focus from a short-term perspective to a long-term strategy where actors within The Network would cooperate to ensure the future of the regional digital creative industry. While smartphones disrupted established development and design procedures in this phase, it would in combination with other mobile technology eventually have subsequent effects of a more profound nature, a subject that will be addressed in the next section.

4.3 2010: Flash is condemned and the iPad is launched

Since the Apple iPhone launched in 2007, it had become one of the most popular mobile phones in the world and it stood as a standard-bearer for a new type of mobile communication, characterized by constant Internet connectivity. The emergence of smartphones and their PC abilities, as described in the previous section, forced Firms within the network to rethink their approach towards how to design web sites. However, it would also have subsequent effects. As the iPhone had never supported Flash technology, there were ongoing speculations regarding if and when Apple would incorporate Flash within their platform. In April 2010, speculations were abruptly interrupted, as Steve Jobs (co-founder and CEO of Apple) posted the following message on apple.com:

“Flash was created during the PC era – for PCs and mice. Flash is a successful business for Adobe, and we can understand why they want to push it beyond PCs. But the mobile era is about low power devices, touch interfaces and open web standards – all areas where Flash falls short [...] New open standards created in the mobile era, such as HTML5, will win on mobile devices (and PCs too). Perhaps Adobe should focus more on creating great HTML5 tools for the future, and less on criticizing Apple for leaving the past behind.” (Jobs 2010)

A short time after Jobs had made the above statement that Adobe Flash was not be supported by Apple’s mobile platforms, Apple launched the iPad. With the emergence of this new technology that mixed the larger screen size of the laptop with the mobility of the mobile phone, the new concept of tablet-PCs became established amongst producers and consumers of digital content.
As previously mentioned, FocalFirm and PartnerFirm1 both saw Adobe Flash as their specific specialization and they all used it extensively in their projects as they saw it as the only way to create rich online experiences. While Apple’s mobile platforms grew in popularity and stood for an increasing proportion of visits to web sites, firms within The Network noticed a shift in client preferences. With the increase in number of platforms and users of those platforms, project outputs were now to span several devices and the standards and processes related to specific platforms. Not only did this imply a strong decrease in projects that could involve Flash, it also meant that clients were increasingly looking towards reaching as many platforms as possible while keeping expenses as low as possible. Previously, projects had often been aimed at creating novel, rich and remarkable experiences but this notion was now shifting towards a focus on information and efficiency. As the manager of PartnerFirm1 noted:

“You want it refined and down-scaled now. Content is king, it’s not supposed to be cool anymore, it’s supposed to be nice and clean. Web design has changed these last years.”

While Adobe Flash was becoming less of a viable standard to use within projects acquired by FocalFirm and PartnerFirm1, they had significantly different prerequisites to deal with this shift. While FocalFirm had applied the strategy of outsourcing the parts of projects that required knowledge which could not be found within the company, PartnerFirm1 had a tradition of solving all parts of design and development internally. Ultimately, this implied that FocalFirm could in fact stick to the strategy of leveraging competence found outside of the firm in order to meet the environmental shift from the standard that they perceived as their specialization. PartnerFirm1, on the other hand, expressed that they dealt with the disruption internally by trying to gain competence in alternative standards.

Concurrent with these technological developments, the inter-firm collaboration in The Network was decreasing. While other firms within The Network initiated stray events of collaboration on smaller projects of their own, FocalFirm’s earlier outsourcing to its regional partners was becoming a significantly less frequent activity. FocalFirm still acquired large and economically generous projects, but instead of leveraging resources within The Network, FocalFirm increasingly engaged in collaboration with firms found outside of it. As expressed by the art director of PartnerFirm1, a reason for this was the recent developments related to Adobe Flash:

“[…] we experience less and less of it. It’s not that common now. Compared to previously when we were a bureau strictly dedicated to Flash […] The Flash-era has gone. Then, at that time, we collaborated more often.”

As this phase describes, technological disruptions through the emergence of new mobile platforms ultimately implied that technological specializations amongst firms within The Network became challenged. Ultimately, this meant that FocalFirm and PartnerFirm1 had to revise established competence and development processes within the firms. It also affected inter-firm collaboration in The Network as the competence related to Adobe Flash that had been cultured within PartnerFirm1 was rendered obsolete in relation to the needs of
FocalFirm. While this phase was short, the technological disruptions that occurred within this period of time had significant effects on both firm- and network-levels. However, as will be described in the next section, the environmental turbulence showed no intention of subsiding.

4.4 2011 - 2012: HTML5 and the Internet of things

As described in the above section, the decreasing popularity in utilizing Adobe Flash could be related to its inability to operate on different platforms. Concurrently, a new standard for design and development of content for the Web, HTML5, had been under development. While previous versions of HTML were becoming of age and lacking support for the new types of content that had become increasingly common on the Web, HTML5 aimed at offering functionality that could enable rich experiences involving several types of media e.g. the functionality previously offered by Adobe Flash. Furthermore, due to the fact that it was supported by several browsers (including that found in Apple’s mobile platforms), it employed a universal fit towards most platforms.

Although interviewees described difficulties associated with HTML5, such as differences in browser support for certain elements or functionalities which made testing a complex task, they describe a notion of having no choice but to adopt it, as it was the only way to achieve the multi-platform experiences crave by their clients. As described earlier, PartnerFirm2 had since it started based its projects on the HTML standard and PartnerFirm1 had been focusing on Adobe Flash, they faced this technological disruption from different starting positions. While PartnerFirm2 could build upon previous competences gained from extensive use of the HTML standard, PartnerFirm1 were forced, at least to a high degree, to leave its previous competences behind. However, differences was also found in the ways that the two different firms perceived how competence in new technologies should be gained. According to the manager of PartnerFirm1, its notion of learning the possibilities and limitations of new technology was that it was preferably done in real projects as this would ensure income during the learning process and that real problems were better suited for learning than imaginary ones. PartnerFirm2, on the other hand, describes another attitude towards learning where it also occurs outside of projects. As its manager expressed it:

“We prioritize learning a lot, you have to do that [...] about half of our time is billed and that’s approximately how we want it [...] this certainly affects our salaries, our turnover and our profit in the short-term but we see it as an investment in that we will have the right position in a couple of years while others won’t.”

A technological development that had also gained attention amongst the firms within The Network at this time was what they referred to as “Internet of things” or “installations”. With this, the interviewees were referring to the notion that computing abilities and connectivity were becoming ubiquitous as ordinary physical objects out in the real world was becoming able to transfer, process and display information. While those abilities had previously been restricted to PCs and mobile platforms, they were now increasingly embedded into other artifacts (such as cars, TV’s or toys) which thereby implied a further expansion of the number of platforms available for digital content. Evidently, FocalFirm embraced this development as
it during this phase conducted projects aimed at physical installations rather than those which could be consumed through PCs and mobile devices. In fact, its manager notes that installations became an explicit part of what Focal Firms saw as core competences of the firm:

“We were more of a web bureau three years ago and now we are more of a digital bureau with focus on three different platforms. That is PC, mobile and installations, and we did hardly ever do any installations two years ago”

While FocalFirm added physical installations to their technological portfolio, PartnerFirm3 had started its operation in the region and had become an official member of The Network. As its specialization in terms of technology was interactive multi-touch solutions for large displays, installations were a major part of their business. As its manager notes, no real collaboration between the parties had yet taken place but there had been previously and there might be in the future:

“We have talked in the past with FocalFirm about applying our technology. We flirted with the idea to do like interactive touch solutions for a clothing chain where people could just look at products in the store in a digital format instead of looking at the physical objects [...] we’ll see what happens. We just let the companies [within the network] know that we are here.”

At this time, collaboration within The Network, in terms of production in projects acquired by FocalFirm, was limited to FocalFirm acquiring resources from PartnerFirm2. As technology involved in projects had grown increasingly complex, FocalFirm experienced that the right type and the right level of skill could no longer be found within The Network. The manager of FocalFirm described this in the following way:

“We sometimes skip The Network already in the beginning. They are still important but I don’t know if they are as important now as they once were. Preferably they would, but in the end it’s all about quality. The fact that what we take in has to hold the quality that we expect. Just as we have to be amongst the best in the world, our partners have to be as well, and some are while some aren’t”

Since the loss of the previous education program (see 4.1), The Network had experienced a lack of a talent pool from which new employees and competences could be scouted. By engaging in discussions with the local university where they expressed their need for competences and the possibilities for collaboration between a potential education program and firms within The Network, the new program launched in 2011. The educational content within was focused on digital production in a multi-platform, -technology and -media context and how digital content were to be designed and developed in order to be distributed across those. The program manager explained the collaboration between the education program and The Network in the following way:

“[…] it manifests in that firms from The Network contribute with practical tutoring in different software tools, we’ve had people that work with these tools on a daily basis that have held briefings and different kinds of tutorials […] we have
This phase has described the emergence of HTML5 and the Internet of things, two important technological disruptions that has contributed to the growing complexity involved in conducting projects within the digital creative industries. It has also shown how the firms within The Network has dealt with the challenges and opportunities that they brought. Evidently, the firms had different approaches and prerequisites for adopting them and thereby achieved different outcomes which in turn had subsequent effects on inter-firm collaboration within The Network. Collaboration within the network, in terms of production in joint projects, followed a declining trajectory that had started in the previous phase (see 4.3). This phase, however, showed evidence of the formalization process started earlier (see 4.2) in that The Network’s only concern no longer was to focus solely on solving short-term production needs. In fact, The Network successfully managed to initiate a new education program at the local university and also to influence the educational content within it.

5. Discussion

“While conceptually the idea of cocreation is intuitive and simple, the process through which firms can successfully implement it is likely to pose several challenges.” (Grover & Kohli 2012 p. 231).

This thesis has aimed to answer the following research question: How do inter-firm networks emerge and evolve over time in relation to a disruptive technological environment?

This has been investigated in the form of a case study conducted at an inter-firm network residing in the digital creative industries and the firms within it. By taking a process approach, this research has identified events which can be related to two main areas of the emergence and evolvement of inter-firm collaboration: the why of inter-firm collaboration and the how of inter-firm collaboration. Firstly, it has illustrated how actors, when faced with a rapid and ongoing technological development, can leverage resources found in partners or work together with them towards common goals in order to handle disruptions derived from their environment. Hence, it extends existing knowledge of inter-firm collaboration antecedents by illustrating possible incentives or pressures that can initiate a process of opening up organizational boundaries to external resources. Secondly, this research also shows how technological disruptions have influenced firms and their network and how they were managed on a firm and network level. Thus, it contributes to an area of research that is under-theorized, namely how inter-firm collaborations adapt and evolve over time in response to an ongoing a disruptive technological development. In what follows, findings related to the above stated areas will be addressed and discussed.

5.1 The why of inter-firm collaboration

Previous research has shown that disruptive environments can serve as a catalyst for inter-firm collaboration (Oliver 1991; Vanhaverbeke 2005; Van de Ven 2005) and that
environmental disruptions often derive from an ongoing and rapid technological development (Christensen 1997; D'Aveni 1991). This research conforms to that notion and notes upon the disruptive nature of technology, as in this case, technological disruptions were indeed affecting the firms and established processes and competences within them but they were also, at least by FocalFirm, handled by leveraging resources found outside of the firm. As shown in this case, emerging services and platforms exerted pressure upon established development processes (Carlo et al 2011), manifested by the effects that social media services, smartphones and tablets had on previously used techniques and standards. While these events challenged some of the competences and resources found within the firms, FocalFirm utilized their partners as assets to overcome the increasing technological heterogeneity involved in their projects while still being able to specialize in one technology internally. Thus, inter-firm collaboration could be argued to constitute a useful strategy for handling a disruptive technological environment as emerging demands for technological heterogeneity deriving from outside of the firm is matched to a heterogeneous joint portfolio of technological specializations within a network. In fact, while relating inter-firm collaboration to existent research that argues that firms must enable themselves to both exploit their current area of business and explore that which lies on the horizon (March 1991; Raisch & Birkinshaw 2008; O'Reilly & Tushman 2004), inter-firm collaboration could indeed be one way to achieve organizational ambidexterity on a network level. While FocalFirm leveraged the resources found in other actors within The Network, it enabled itself not only to exploit the technological competences within the firm but also managed exploration through utilizing assets found in other firms. This implied that FocalFirm could in fact conduct projects that spanned over several technologies, although it actually did not have the technical abilities in-house, by outsourcing parts of development to those who had the right resources to do it.

5.2 The how of inter-firm collaboration

No doubt, the potential advantages of inter-firm collaborations are many and the perspective provided in this thesis touches upon a few of them. However, when looking upon inter-firm collaboration from a process perspective, it becomes evident that while such arrangements may offer ways to respond to environmentally driven challenges, inter-firm networks may also involve new challenges for participating firms. While the findings stated in the above section can mainly be related to what is already known about inter-firm collaboration, namely why these types of arrangements are made, this research has also, perhaps more importantly, provided insight into how inter-firm collaboration emerge and evolve over time.

It has previously been argued that inter-firm collaboration relies upon an alignment of relation-specific capabilities (Dyer & Singh 1998) e.g. that firms involved in collaboration need to adjust their capabilities to the needs of their partners. It has also been argued that those firms with a central position within networks can exert the most amount of power within them and have the greatest potential to gain from collaboration (Powell 1996). Being the acquirer and provider of projects for The Network, FocalFirm was the actor with the highest numbers of connections with other firms and also the one who decided which type of technological specializations that were needed from them. As argued in the above section, this ultimately implied that FocalFirm was able to both exploit its current business area but also to
explore emerging technologies and hence avoiding some of their disruptive effects. This, in turn, implied that while the other firms had the relation-specific assets needed by FocalFirm they got to participate in projects acquired by it. As those projects received from FocalFirm differed from those that could be acquired internally in terms of client’s economical and creative height, the co-creation projects acquired by FocalFirm were perceived as desirable to add to the portfolios of the respective firms and also enabled both FocalFirm and its partners to grow. In the first phase (see 4.1) characterized by technological stability, when services, platforms and development process were in a period of sustainment, partnering firms were able to build upon specializations related to a specific technology that was the source of value that they could bring to the co-creation table. As long as the knowledge and resources related to a specific technology were what FocalFirm needed, exploitation became a self-preserving action that enabled collaboration between the firms. However, as emerging technologies disrupted the current technological paradigm, previous specializations were no longer needed within The Network as FocalFirm found assets for collaboration on a national and international level instead when those of value to them could no longer be found within the region.

This implies that for the partnering firms, exploitation of relation-specific assets served as a profitable short-term strategy as it was the foundation upon which co-created value could be built. However, as emerging technologies disrupted an established relation-specific asset, the firm that had adopted that specific asset became excluded from collaboration, at least in terms of the co-creation that took place in FocalFirm’s projects. Evidently, the partnering firms had different ways of handling their disruptive technological environment where PartnerFirm1 saw exploration as an activity that should be performed within live projects and PartnerFirm2, on the other hand, aimed to organize itself towards ambidexterity through an approach where learning and innovation could also be done without getting direct economic results. The path chosen by PartnerFirm1 implied that the level of exploration that could be achieved within the firm was in direct relation to the nature of the projects which it managed to acquire. If the firm were to explore new services, platforms or development processes, they had to be a part of a project scope. Hence, exploration within PartnerFirm1 became dependent upon the economical and creative height involved in the projects acquired internally and from FocalFirm as this would allow them to shift from one technological paradigm to another. However, as emerging technologies altered the preferences of FocalFirm and rendered PartnerFirm1’s specialization less valuable, projects would no longer be distributed to PartnerFirm1 by FocalFirm. Thus, exploration, in the end, became solely dependent upon the projects which PartnerFirm1 could acquire on their own. The strategy of PartnerFirm2, on the other hand, was more oriented towards long-term success as it dedicated half of its time to exploitation and engaged the other half in exploration regardless of the economical short-term effects. Ultimately, the different approaches had different outcomes in terms of collaboration with FocalFirm as PartnerFirm2 was the only firm from within The Network that it engaged in their projects during the last phases.

Thus, the focus on exploitation for partnering companies proved profitable only short-term. In the long-run, however, technological specialization implied a decrease in collaboration activities, at least within The Network, as FocalFirm sought the competences that it needed in
other firms when specializations within The Network were disrupted. This shows that while exploitation of relation-specific capabilities might serve as a foundation upon which co-created value can be built, it can also serve as an impediment for long-term collaboration. In an disruptive environment characterized by a rapid technological development, firms may in fact have to become ambidextrous in order to remain successful over time. This implies the ability to exploit current relation-specific capabilities while at the same time being vigilant to shifts occurring inside the inter-firm network and in the surrounding environment and to act upon those shifts. In the light of this, a disruptive technological environment can arguably imply a tension between short-term and long-term strategies for inter-firm collaboration, as exploitation of current relation-specific capabilities might be the foundation upon which co-creation can be built. However, as emerging technologies disrupt those capabilities, they might serve as impediments for co-creation in the long run and to change them might prove difficult for the single firm. At least if exploration activities is restricted to directly income-generating activities, as in live projects in this case.

The emergence and development of The Network has also shown the importance of position within inter-firm collaboration arrangements. It has been previously argued that those firms with a central position within networks have the greatest potential to gain from collaboration (Powell 1996), and it was evidently so in the case of FocalFirm. Being the acquirer and provider of projects for The Network, FocalFirm took on the role of locomotive and pulled the other firms onward. However, this position also allowed them to both build on their own core competence and to apply more variation when needed. Hence, through their position in The Network as the main acquirer of projects, FocalFirm were able to leverage the heterogeneity of technological specializations found within the other firms during its initial stages. This allowed it to both exploit and explore through its internationalization process and find collaboration on a global level during its later stages.

6. Conclusions

Numerous research has already demonstrated why firms engage in collaboration across firm-boundaries and also the benefits which can be gained from such arrangements. However, little is known about how these emerge and evolve over time. This research has addressed this issue and described how a network of firms within the digital creative industries has developed in conjunction with a rapidly changing technological environment. By taking a process approach to examine inter-firm networking in relation to a disruptive technological environment, two major implications to the domain of inter-firm collaboration was found. Firstly, exploitation of relation-specific capabilities within companies can imply a tension between short-term and long-term success for both the firm and the network in which it resides. Secondly, inter-firm collaboration can be one way to achieve organizational ambidexterity on a network level, however, this seems highly dependent on the level of network centrality that a specific firm holds.

This research is limited in that it only comprises a small number of firms within one single network and can thus only offer a partial view of the challenges and opportunities involved in inter-firm collaborations. Therefore, further research within the area of inter-firm
collaboration is needed as more in-depth analyses of existent inter-firm networks will provide a more detailed understanding of the “how” in inter-firm collaboration. While this research has used disruptive technologies as a way to understand how inter-firm networks emerge and evolve over time, future research could apply other theoretical viewpoints in order to further expand an understanding of the complex process involved as companies engage in inter-firm collaboration activities.
References


Appendix 1: Interview guide

**Theme 1: The emergence and development of the firm**
This theme relates to information regarding how the firm started and how it looks like today. Examples being: What types of projects have they undertaken and what technologies do they work with? How do they characterize their firm? How do they work with research, development and learning processes within the firm?

**Theme 2: The emergence and development of The Network.**
This theme contains questions regarding how the interviewee has seen the development of inter-firm collaboration over time. Thus it relates to questions like: How would they describe the collaboration and what role do they see themselves having within The Network? In what way has this developed over time?

**Theme 3: The use of technologies.**
This theme relates to the use of emerging and sustaining technologies and the nature of the projects that has been undertaken by the firm internally or in collaboration with partners from The Network. It relates to questions like: What types of projects do they undertake alone and what types of projects becomes subjects for collaboration? Which of the projects would they consider to be the most challenging and why? What types of technologies have affected their established processes over time?