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INNOVATION IN MOBILE GAMING, AN ACTOR NETWORK THEORY ACCOUNT ON TRANSLATION

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MOBİL OYUNLARDA INOVASYON, AKTÖR AĞ TEORİSİ ÜZERİNDE BİR ÇEVİRİM ARAŞTIRMASI

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LIST OF SYMBOLS AND ABBREVIATIONS

2G	Second-generation Wireless Telephone Technology
3G	Third-generation Mobile Telecommunications Technology.
ANT	Actor Network Theory
CDMA	Code Division Multiple Access
CEO	Chief Executive Officer
CERN	The European Organization for Nuclear Research
COO	Chief Operations Officer
EDGE	Enhanced Data Rates for GSM Evolution
GDC	Game Developers Conference™
GPS	Global Positioning System
GSM	Global System for Mobile Communications
ICI	Innovation Capacity Index
ICT	Information and Communication Technologies
IGDA	International Game Developers Association
ITU	International Telecommunication Union
KIBS	Knowledge Intensive Business Services
MMS	Multimedia Messaging Service
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NMT	Nordic Mobile Telephone
PC	Personal computer
R&D	Research and Development
RIS	Regional Innovation System
SHOK	Strategic Center for Science Technology and Innovation
SME	Small & Medium Enterprise
SMS	Short Message Service
SRA	Strategic Research Agenda
UK	United Kingdom

UN	United Nations
US or USA	United States of America
VAS	Value Added Services
WCDMA	Wideband Code Division Multiple Access
WW2	World War II

ABSTRACT

This thesis is an account of innovation in mobile games, a subsector of video gaming, which went from a marginal business in the early 2000s to a $35B industry in 2015. The thesis uses Actor Network Theory (ANT) as the theoretical background and implements Callon's (1986) four moments of translation in an analysis of the mobile game producer Rovio, which developed Angry Birds, a game that created the first global mobile game boom in 2009. This thesis provides a contribution to the ANT literature as a comprehensive account of a fast-growing sector. In doing so, it analyzes Rovio's early failures, contrasting them with its eventual success with the revolutionary Angry Birds. The thesis heavily relies on qualitative research methods triangulating between archival data analysis, interviews and questionnaires. The findings suggest that problematization, social fluid, black boxes and voids created when a black box is broken are critical concepts in understanding innovation processes. In fact, those concepts, mostly taken from ANT, help to make sense of the abrupt change in Rovio's trajectory. It is also argued that the four moments of translation may be repeated and re-started. Flattening the macro- and microscale and treating the game and mobile phone handset as actors further contribute to the insights presented here. The thesis also situates the case of Rovio and Angry Birds in the broader context of innovation studies.

ÖZET

Bu tez mobil oyun alanında inovasyon süreçlerini araştırır. Mobil oyunlar video oyunlarının bir alt sektörü olarak değerlendirirlir. Bu sektör 2000'li yılların başında marjinal bir iş alanı iken 2015 yılında 35 milyar Amerikan Doları büyüklüğüne ulaşmıştır. Bu tez bir Aktör Ağ Teorisi (ANT) üzerine dayanır ve Callon'un (1986) çevirimin dört momentini kullanır. Bu method ile Fin'li mobil oyun üreticisi Rovio'nun 2009 Angry Birds adındaki oyunu üreterek ilk global mobil oyun dalgasını oluşturma sürecini inceler. Bu tez ANT literatürüne katkı sağlarken aynı zamanda üzerinde çok fazla inovasyon araştırması yapılmamış olan bu hızlı büyüyen sektör üzerinde de kapsamlı bir akademik çalışmadır. Bu tez Rovio'nun ilk dönemdeki başarız olarak nitelenebilecek sonuçlarını ikinci dönemdeki büyük başarısı ile karşılaştırır. Bu tezde yoğun olarak kalitatif araştırma methodları kullanılmıştır. Arşiv verileri, mülakat ve anket yöntemleri ile triangülasyon yapılmıştır. Bu tezin sonuçlarında ANT içerisinde kullanılan sorunsallaştırma, sosyal sıvı, kara kutu ve kara kutuların kırılmasıyla oluşan boşluklar kritik kavramlar olarak öne çıkarlar. Bu kavramlar üzerinden Rovio'nun gelişim eğrisindeki ani değişimin derinlemesine analizi yapılabilmektedir.Bu tez aynı zamanda Callon'un (1986) çevirimin dört momentinin çizgisel ilerilemesinin gerekmediği, momentlerin akışlarının değişebileciğini ve yeniden başlayabileciğini önerir. Makro ve mikro ortamların beraber incelenmesi, oyun, oyuncu ve mobil telefonun aktör olarak analiz edilmesi bulgulara önemli katkılarda bulunmuştur. Daha geniş bağlamda, bu tez Angry Birds oyunun gelişimini inovasyon araştırmaları içindeki yerini belirleme konusunda katkı sağlamıştır.

INTRODUCTION

The focus of this dissertation is a case of innovation that revealed mobile games as a serious business, which played out exactly at the beginning of the smartphone era. Through this research, I aim to gain deeper insights into innovation processes.

Innovation is becoming a major focus area on a global scale because of the increasing difficulty of creating value for many countries. Even developed economies that are using economies of scale and scope very well experience difficulties in this area. These countries are experiencing a slowdown of population while there are large populations of people elsewhere around the globe becoming integrated into the capitalist form of production, which forces labor costs down. Innovation, in this respect, offers important possibilities to create additional value in a tight business environment. Innovation has the capacity to break and recreate standards, which creates completely new economies. The most well-known example of this process may be electricity, and more recent cases include renewable energy and mobile communications.

Patent filings are one of the most important proxies for innovation. One of the ways to score high on this proxy is to have a high number of trials. The higher the number of trials, the higher the probability of successfully obtaining patents and creating innovations. Thus, cultivating innovation seems to be a numbers game: the inherent uncertainty in the relationship between innovation, research and development make the numbers game a useful strategy. However, this approach, although insightful to a certain extent, is insufficient if one wants a deeper view of what really happens during the process of innovation. If research on innovation advances to a

level of better foresight into the results of innovative efforts, it could lead to more effective strategizing than just a numbers game.

With this goal in mind, the present thesis is built upon Actor Network Theory (ANT). ANT offers unique methodologies for understanding innovation and seeing through the nebulous weather that transpires throughout innovation processes. The unique definition of actors, in which technology can play a part, and the flattening the levels of analysis to avoid missing relations are some of the key features that make ANT particularly well suited for research into innovation.

This dissertation examines the growth of mobile gaming, which is related to the mobile communications, video games and software industries. All these industries are constantly shaping their respective environments and, in turn, are also being shaped by them. The advent of mobile communications, for instance, ended the monopoly of landline telephony operators while drastically changing the way people communicate. According to the GSM Association, there are over 8 billion GSM subscribers worldwide in 2017 (https://www.gsmaintelligence.com).

Video gaming is another key sector in this thesis. It is a sector with stable growth and a global user base. Before the rise of home computers and videogame consoles, on which videogames could be played at home prior to the current ubiquity of the internet, the term "arcade game" was a synonym of "videogame" and this genre dominated the industry since the 1970s. Early in 1972, Atari launched Pong, which is generally believed to be the first commercially successful videogame in history (Kuittinen, 1999). In the early 1980s, two iconic games, Pac-Man (Namco 1980) and Donkey Kong (Nintendo 1981), made significant impacts on the growth of the video game sector. By 2013, there were 1.2 billion active gamers worldwide (Warman, 2013), with numbers growing by 6.7% and expected to create $86 billion in

revenue in 2016 (De Prato, et al., 2014). Even so, my assessment from the literature review is that there is not adequate research in this field, which is filled with innovation. Lee (2010) also highlights this gap and the need for more research in this field. The "creative industries" fall into a major research gap, particularly with regard to the issues of innovation and competition, in the contemporary innovation research literature (A. Y. Lee, 2010). Recent studies suggest that there is a great deal of innovative and competitive activity in creative industries which still remains hidden from detection and measurement using conventional methods (Green et al., 2007, Miles & Green, 2008, Miles & Green, 2009).

Thus, this dissertation aims to close this research gap. Within the video gaming industry, innovations in mobile gaming brought this sector from a marginal area to a significant growth driver, which now forms the core of the industry. In fact, a survey from Information Solutions (2011), with both UK and US online panelists, showed that when asked to identify which gaming-enabled device they played games on most often, 44% cited their phones, ahead of videogame consoles (21%) and computers (30%) (De Prato, et al., 2014). Smartphones that enable mobile game playing are also rapidly gaining in popularity. They are at the intersection of the software industry and mobile communications, a trend which became prominent with Apple's introduction of the iPhone and Google's reply with Android. There were 1.4 billion smartphones in 2013, expected to grow to 2.5 billion by 2020 (De Prato, et al., 2014). The emergence of smartphones played an important role in the expansion of mobile games. In the survey from Information Solutions (2011) mentioned above, 93% of smartphone owners said that they played a game at least once each week, and 45% played daily. The goal of my research is therefore to enable a deeper understanding of how the video gaming and mobile communications sectors have merged to generate hype around mobile games, as well as to gain more qualitative insights into innovation. This requires an awareness of the sector trends I

mentioned and their implications, together with the processes that have played out in individual cases of innovation. These case studies rest on top of foundational arguments concerning innovation: that it is a numbers game; that it requires a fostering milieu; that it requires transforming knowledge and that the "entrepreneur" plays the critical role. Thus, the sector trends and individual cases should be knitted together as seamlessly as possible to create a "flat" account, through which I can analyze how both impact and reinforce each other.

Turning to the innovation aspect of the story, it is worth mentioning that innovation is becoming an increasingly relevant means by which economies create value. Thus research on innovation has also gained in recognition and importance. Initially, entrepreneurs were considered to be nearly superhuman beings who could imagine a totally new way to fulfill a need and align a large set of economic actors towards fulfilling their vision. Over time, increasing attention started to be given to the factors that can foster innovation. Knowledge, financing, geographic proximity and networks are among the most common topics that are now being researched.

Innovations change the way human needs are met and some even change the way people live. The process of innovation is itself also full of change and uncertainty. I chose to investigate a process of innovation that highlights these characteristics and in the chapters that follow, I present an in-depth account of this process illuminated via qualitative research. As mentioned earlier, I will rely on the ANT framework developed to research innovation. ANT uses the term "translation" to explain the process of innovation, and my account will expand on this. For the present purposes, translation can be defined as a series of changes initiated by the relations between actors.

ANT suggests that the thorough understanding of innovation can be achieved through examining multiple complementary accounts of

innovation, each of which provides an in-depth view of one or few cases. As an analogy, we may compare this process to cartography or topology (Latour, 2010). Each account contributes to the development of a complete map by providing a detailed topology of a certain section. Thus, I intend to contribute to the development of a comprehensive understanding of innovation by developing an account of translation in one single case. Instead of a quantitative formal account, I intend to create an account that sheds light on the processes within an innovation process, particularly the critical turning points, the roles of actors and the roles of technology. The insights from this case will add to the collective knowledge gained by implementing ANT for the study of innovation. The case study I have chosen is that of mobile games, which illustrate a translation process at the intersection between mobile communications and gaming. Mobile communications already changed the way people interact. Mobile games constitute one of the landmarks of the change in the relationship between people and their mobile phones. Thus, mobile phones are becoming entertainment devices in addition to communication devices. Case studies concerning this change are currently limited, which makes this research a timely and worthwhile contribution to the field.

The case study I will describe here is that of a Finnish company, Rovio, which developed the mobile game Angry Birds. This game became a global phenomenon, far more successful than any game previously developed for mobile phones. For this reason, my intent behind the present work was to create an account of the translation of mobile gaming through the actor network of Rovio. Mobile gaming can be perceived as the marriage of mobile communications and gaming, which were once two distinct sectors meeting two different needs rather separately. Mobile games enabled people to alleviate boredom, which is the basic motivation behind games, in a location-independent manner. A series of changes transformed mobile communication devices into gaming devices, and a further series of changes

made the mobile game industry into a serious business. By following Rovio and the actor network it formed, I investigated and highlighted these changes.

In conducting this case study, my main finding was that, by following the actors in the Rovio case, I could pinpoint critical contradictions, events and decisions that led to the explosive success of the company and I was able to move beyond the popular discourse of Rovio trying and failing 53 times, then succeeding on the 54th try. Building on this study, I provide insight into the development of the mobile gaming sector by following the actors in Rovio's case thanks to the ANT framework.

My research strategy involves the use of primary and secondary data to create a map of relations around Rovio, and analyze this map through the innovation framework developed by Callon (1986), known as Actor Network Theory (ANT). ANT encourages researchers to focus on relations that matter in the formation of a particular change and ignore the relations that don't have an effect on the change. ANT has a distinct advantage over other methods of analyzing innovation in that it creates a framework where the relations between a small player like Rovio and giants like Nokia or Apple, and even more importantly with technological actors like the Apple iOS AppStore, can be traced with ease, regardless of whether the actors are human or not, whether they belong to the macro-, micro- or institutional level, etc. Those classifications become prohibitive in innovation cases where a relationship between a very small actor and a giant institution can be amplified via technology.

This property of ANT leads to the question of how to understand which actors are significant, especially if the list of actors, living or non-living, is very big. According to ANT, this is a social process, where actors try to make themselves indispensable in a network of relations. The actors that

matter form and expand their networks by creating alliances with other significant actors, enrolling actors who will work for their cause and positioning themselves in critical positions by which they become obligatory parts of the network. There are many strategies discussed in the ANT literature that help shed light on which actors matter in translation and why. This is an especially valuable piece of ANT that emphasizes the social relations in innovation and helps to distinguish it from other theories through its capacity to see through the processes at play in innovation.

I use Callon's ANT framework as a tool to distill relations that led to the translation of mobile gaming. The research implications of this thesis are expected to generate enthusiasm for further research in this sector, in the form of follow-up research on Rovio or other actors that have contributed to mobile gaming. One theoretical contribution of this thesis concerns the consideration of Callon's framework of innovation and the concept of black boxing.

This research is organized in six sections. Subsequent to an overview of the innovation literature, I provide theoretical background on ANT. The methodology section concentrates on research methodology and includes discussion of my research question, data sources, data analysis methodology and periodization strategy. In the following chapters, these findings are reviewed, interpreted and discussed in order to prepare the ground for conclusions.

To sum up:

- Chapter 1: Literature Review

In this chapter, I review the literature on innovation and gaming.

- Chapter 2: Theoretic Background

In this chapter, I put forth the main pillars of ANT and how it is employed in my research.

- Chapter 3: Methodology

In this chapter, I explain in depth my research question, research domain, research model and data collection and analysis methods.

- Chapter 4: Findings

In this chapter, I present my findings on two periods of Rovio's development, situated within ANT's framework for understanding innovation.

- Chapter 5: Discussions

In this chapter, I review my findings and incorporate further insights.

- Conclusion

The conclusion situates the present work in the broader context of innovation studies and discusses the academic contribution of the research undertaken here.

1. LITERATURE REVIEW

The literature on innovation concentrates on several main themes concerning innovative activity, among them:

- innovation processes
- systematic innovation
- institutions for innovation
- knowledge creation and transfer
- networks and relations and location

Here I will provide an overview of how to define and understand innovation, of how to gain an in-depth understanding of the processes involved and of the factors that have a significant impact on innovation. As my case relates to a longitudinal innovation process in an environment that actively fosters innovation, those themes are particularly deserving of focus.

Schumpeter's (1934) definition of innovation provides a convenient starting point for this discussion. Schumpeter sees innovation as the central cause of economic development and capital accumulation enabling the continuation of above-normal profits and a dynamic economy. Schumpeter introduces the notion of "creative destruction" (1942), highlighting the changes innovations bring to the institutional environment. Creative destruction, according to Schumpeter, is at the center of capitalism. Innovation is considered to be the main explanation of economic development. As innovations disturb existing structures and make existing technologies and jobs obsolete, they also foster economic growth by creating new sectors.

In the Schumpeterian model (1934), the entrepreneur is an exceptional individual who single-handedly manages the whole innovation process. The entrepreneur is conceived of as being endowed with exceptional qualities

like insight, intuition, a sense of anticipation, quick reactions, skillfulness etc. He is an innovator who introduces new combinations of resources, creating disequilibrium in the market.

Actor Network Theory (ANT) criticizes this aspect of the Schumpeterian model as it attributes an overwhelming task to the entrepreneur (Akrich, et al., 2002a). ANT focuses more on the relations within a network that may originate from the entrepreneur but lead to a collective innovative action. The bringing together of market and technology is therefore considered the result of collective activity rather than the monopoly of an inspired and dedicated individual (Akrich, et al., 2002a). Thus, entrepreneurial qualities become collective virtues. This collective actor must be able to react to all fluctuations; it must be in a position to seize all opportunities. Rigid and mechanical models, overly precise tasks and role definitions and constraining programs must all be avoided in order to innovate (Akrich, et al., 2002a). Thus, ANT looks into processes, decisions, social interactions between actors, heterogeneity, non-linearity, conflicts and confusions. All these aspects highlight the uncertainty inherent to innovation and the difficulty of foreseeing any innovation before it happens.

William Cronon (1991) wrote an important book on Chicago with reference to these issues. Cronon is a history, geography, and environmental studies professor at the University of Wisconsin. Although he is not an ANT researcher, his research on the development of Chicago is regarded as a masterpiece in the application of ANT to social research (Bender, 2007). Cronon depicts the landscape of Chicago and relations between different relevant actors from the beginning of 1800s. He then introduces translating actors such as land reforms, real estate traders, speculators, railroads, grain elevators, the futures market, actors in the commodification of lumber and meat and so on. All these actors changed the economic relations in America as well as the city of Chicago in particular. At different times they all

contributed to the chain of changes that made Chicago one of the American metropolises by the end of the 1800s. The methodology of Cronon's research has been an important guide for this thesis.

ANT started to take shape in the late 1970's and early 1980's, when Michel Callon and Bruno Latour were focusing on the social understanding of science, technology and engineering. Thomas Hughes' (1993) book on Edison's success in creating the first electrical networks was an important forefather of ANT. In contrast to Schumpeter's work, this book focused on network relations around the innovation of electricity and discussed the importance of the system architecture that Edison brought together as well as the many human and non-human objects that came together under this architecture. Latour (2010) suggests that Hughes' 'networks of power' can be equated with the actor networks of ANT. ANT pushes us to perceive everything as a network (Latour, 2010). Thus, it has an ontological stance about what things are. Latour in "Laboratory Life" provides an ethnographic understanding of how hard scientific facts are constructed (1980), which also involves a great deal of social interactions. Another key account in the development of ANT was Callon's work on scallops in St. Brieuc Bay (1986), where scallops were analyzed as actors in the same manner as people. Additionally, this work provided a framework for analyzing an innovation process (Akrich, et al., 2002a; Akrich, et al., 2002b). In fact, this is the framework I will be using heavily in this thesis.

According to ANT, innovation can be perceived as an 'assemblage' of various elements resulting in a product or service that disrupts—at least partially—the existing market, changes it and redefines it (Latour, 2005). This assemblage gets created as the actor moves in the actor-network. At the point of departure, the actor may have an idea or hunch about the innovation, but most of the time there is a huge gap between the initial idea and the final offering. This gap is filled through numerous interactions with

other actors, which can be human or non-human. These interactions change the object of research as well as the actors themselves. Through these interactions a network is formed that starts to act as a collective actor. As a collective actor, the network has a stronger stance from which to foster innovation. Therefore, it can change the sectors around it as well as the individual actors within the network.

It should be noted that ANT has received heavy criticism because it defies many concepts of social sciences. Winner (1993) criticizes the inclusion of nonhuman actors because they do not possess intentionality. Collins and Yearly (1992) suggest that if nonhumans are considered as actors then scientists would be the ones who can determine their power, thereby moving the research object away from sociologists. Amsterdamska (1990) criticizes the overwhelming descriptiveness of ANT perspectives and the need to make judgement calls on which actors matter within a network. Despite these criticisms, I have found ANT to be a very useful framework for the present study.

In addition to ANT, a complementary perspective on innovation can be gained from categorizing innovations into various classes. Schumpeter (1939) identified five types of innovation: introduction of a new good, introduction of a new method of production, opening of a new market, conquest of a new source of supply of raw materials or half-manufactured goods and implementation of a new form of organization. In a similar approach, Amara, Landry and Doloreux (2009) define product, process, delivery, strategic, managerial and marketing innovations as different types of innovations. In contrast, Lundvall (1998) talks about styles of innovation. He suggests that learning rather than rational thinking becomes important in innovation, which impacts the style of innovation. Specifically, he suggests that knowledge about ‘facts’, ‘principles and laws of nature’, ‘the skills and capability to do something’, and ‘knowledge about who knows how to do

what' impacts the style of innovation. Similarly, Isaksen and Karlsen (2010) talk about different modes of innovation differentiating purely technological innovations from managerial innovations.

Innovation is closely related to knowledge. Knowledge itself has been analyzed, defined and classified. One important classification appears to be between codified and tacit knowledge (Foray & Lundvall, 1998; Howells, 1996; Johnson, Lorenz, & Lundvall, 2002). Codified knowledge is documented and can be transferred, whereas tacit knowledge is embedded within the specialist. These are more know-how types of knowledge that can be transferred only by close cooperation between people.

There is a literary stream that links the types of innovation to bases of knowledge upon which it can be produced. Asheim and Coenen (2005) make a distinction between analytical and synthetic knowledge bases, indicating different mixes of tacit and codified knowledge. Different knowledge bases may differ in qualifications and skills, required organizations and institutions involved. These authors also suggest that different knowledge bases require different supportive environments to foster innovation. These environments include but are not limited to universities. Drawing on Asheim and Coenen's definitions, Sotarauta (2011) compares two Finnish industries, intelligent machinery and digital content services, that draw upon different kinds of knowledge bases. Sotarauta suggests that synthetic firms rely more on several sources of documented, codified, engineering-based and other explicitly addressed knowledge than the symbolic firms, while the "symbolic innovation process" is clearly more local, inductive, creative and conceptual, and a combination of various sources of new ideas, trends and images. Additionally, human resources and skill accumulation are important elements in innovation. Storz, Riboldazzi and John (2014) analyze innovation in the video game industry in the US and Japan. They find that inter-firm mobility is beneficial for innovation in

the US, but has negative effects in Japan. However, inter-functional mobility is beneficial for innovation in both countries. Similarly, Casper and Storz (2017) provide empirical evidence that bounded career patterns are beneficial in the Japanese video game development industry. Thus, skill accumulation can happen as one actor plays roles at multiple firms like in US or within the same firm like in Japan.

In parallel to the question of understanding the processes of innovation, there is also a large volume of literature that asks whether it is possible to cultivate innovation. This stream looks heavily into the environmental factors in innovation as there are incidences of heavy innovation activity being concentrated in certain environments. Discussing the environments in which innovations occur, Lundvall (1998) questions whether science and technology search activities automatically lead to innovation. He suggests that institutional elements can help learning towards innovation, especially acquisition of tacit knowledge through learning by doing, using and interacting. These institutional elements can be summoned under a National System of Innovation.

Asheim & Isaksen (1997) suggest that interactive learning is a fundamental aspect of the innovation process, which is greatly facilitated by geographical proximity and territorial agglomeration. Hommen, Doloreux and Larsson (2006) examine the workings of a policy-driven regional innovation system, the Mjärdevi Science Park in Linköping, Sweden. They suggest a list of features to describe such a science park, including formal and operational links with a university or major center of research; a model encouraging the formation of knowledge-based businesses resident on site; and a management function that is actively engaged in the transfer of technology and business skills to the organizations on site. They adopt a “triple helix” metaphor (Etzkowitz & Leydesdorff, 1995), which examines how active cooperation between government, universities and businesses is applied in

the Mjärdevi Science Park, and suggest that this perspective has proven effective in fostering innovation. Using the rainforest analogy, Hwang and Horowitt (2012) emphasize that the complexity of relations increases the possibilities for realization of innovative projects. Similarly, Feldman, Gertler and Wolfe (2006) emphasize the significance of regional innovation systems in a global economy. They refer to Polanyi's (1992) concept of embeddedness to explain the prevalence of regional character of innovation systems. Embeddedness suggests that economic relations are embedded into social relations and cannot be analyzed separately. As some researchers have put it, "Economic processes are embedded in a variety of institutions, including habits and customs, as well as government, religion, culture and the legal framework of a society" (Wolfe & Gertler, 2002). This entails that behaviors and institutions are also affected by the structure of social relations (M. Granovetter, 1985).

Dörhöfer, Minnig, Pekruhl and Prud'homme van Reine (2011) reveal strong empirical support for the hypothesis that cultural embeddedness and long-term engagement within regions provide an added value for companies. This holds for companies with traditional roots in a region as well as for companies that come to be based in a region other than the one in which they originated. Feldman, Gertler and Wolfe (2006) perceive universities as the center of embeddedness in these regional systems, enabling the critical task of technology transfer, while the methods of this transfer are constantly changing. Along similar lines, Landry, Amara and Doloreux (2012) focus on knowledge transfer. They analyze knowledge-intensive business services (KIBS) and suggest that knowledge exchange is as important as knowledge creation. Doloreux (2004) investigated the innovation-related activities and networking of 53 small- and medium-sized enterprises (SMEs) in Ottawa, Canada and found that they rely on external networks of customers and suppliers more than on the innovation process within the firm. KIBS can even serve as innovation agents for their clients (Wiig Aslesen And &

Isaksen, 2007). Traded and untraded knowledge may be becoming more important than trading tangible resources in the creation of competitive advantages (Almeida, et al., 2002; Nonaka, 1994; Spender, 1996; Teece, 1998; Von Krogh, 1998; Zollo & Winter, 2002). Results of empirical research by Gertler and Levitte (2005) document the importance of global and local networks. However, importantly, they also find that for successful innovation, firms need to have the capability to absorb knowledge flows. They also highlight the role of formal intellectual property transactions in promoting knowledge flows. Cooke (2002) develops the concept of value creation from the interaction of knowledge upon knowledge. Similarly, Tödtling (2011) suggests that innovation is a highly interactive process that arises from both internal and external knowledge. Thus, knowledge-intensive companies need to interact with each other to further develop knowledge and create value (Tödtling, et al., 2011). Cooke and Piccaluga (2006) suggest that there is a relation between the knowledge economy and regional development, which takes form as processes and policies. Similarly, Tödtling, Lehner and Trippl (2006) suggest that regional innovation systems (RIS) provide opportunities for interactions that lead to innovation in knowledge-intensive sectors. Furthermore, the density of RIS has an impact on these interaction opportunities and the character of knowledge and innovation links (Tödtling, et al., 2011). Bathelt, Malmberg and Maskell (2006) compare these locally created innovation interactions with global interactions. They question the view that tacit knowledge transfer is confined to local milieus whereas codified knowledge may roam the globe almost frictionlessly. They suggest that there are conditions under which both tacit and codified knowledge can be exchanged locally and globally. They argue that the existence of both high levels of local buzz and many pipelines can provide firms with competitive advantages. Onsager, Isaksen, Fraas and Johnstad (2007) underline the importance of glocal (global and local) networks for the innovation capabilities of high-tech firms in small regional clusters. They also emphasize the historic development

and national stimuli in building regional innovation systems. Isaksen (2009) shows evidence from six Norwegian clusters for the importance of historical development and local and global networks while criticizing the discourse on local buzz and global pipelines, suggesting that this theory lacks analysis on the national level.

On the other hand, ANT problematizes the notion of distance (Murdoch, 1998). Murdoch suggests that formalized networks fold spaces. In other words, space should be understood in terms of relations rather than distance. Thus, spatial properties cannot be distinguished from objects 'in' space and space itself can only be understood as a "system of relations" (Harvey, 1969). According to Harvey there is no external viewpoint from which to assess and measure distances absolutely; distance "can be measured only in terms of process and activity." Thus, from an ANT perspective, it can be suggested that innovation systems can create value as long as they condense relations and interactions within them. This condensation can be in terms of the number of connections with limited interaction, or as Granovetter (1973) calls them, 'weak ties.' It can also be in the form of intense relations, or strong ties, that enable transfer of tacit knowledge. Overall, it is important that actors get closer to one another, independent of geographical distance.

A further step in cultivating innovation is the innovation system, or the systematic processes that create knowledge and cultivate innovation. Lundvall (1998) suggests that innovation systems can help foster learning that leads to innovation, especially the learning of tacit knowledge. These systems also increase interactions between firms. In his research on the biotechnology sector, Cooke (2001a) defines the three key elements of an innovation system as exploitation of basic science, venture capital and cluster-formation. Asheim & Isaksen (2002) reveal that local resources are exploited in the innovation process. Regional resources include in particular place-specific, immobile contextual knowledge that can be either tacit or

codified in nature. Cooke (2001b) specifically emphasizes the role of venture capital in the commercialization of science. Venture capital is a special form of financing organization that is specialized in investments in early-stage growth companies, which carry higher risks but have higher potential for return than established firms.

A key focus area of the innovation system literature is on clustering. Cooke (2010) perceives clusters as policy instruments that catalyze innovations across industry or cluster borders by facilitating transversality of knowledge flows. Clustering is an active placement of firms, especially startups in the same or similar industries, in a single physical location. This location can be a science park or a whole region where there is a concentration of activity in a certain field. Malmberg and Power (2005) probe the assumption that clusters help firms to exchange, acquire and generate new knowledge. Three means of knowledge creation in clusters are emphasized in their work: through various forms of local inter-organizational collaborative interaction; through increased competition and intensified rivalry; and through spillover following from the local mobility and sociability of individuals. Dörhöfer and Minnig (2012) conducted a case study of the Basel pharmaceutical cluster and showed that local social capital and culture are important success factors for innovation within and beyond the borders of the cluster.

Similarly, some other empirical research has shown that clustering can produce significant positive effects on rates of new firm formation and firm productivity, innovation, profitability and growth (Beaudry & Breschi, 2003; Boschma, 2005; Gordon & McCann, 2005; Rosenfeld, 2007). Devine-Wright, Fleming and Chadwick (2001) suggest that well-functioning social networks facilitate the speedy dissemination of novel information, expertise and resources. Using insights from network theories they identify the key roles to be played by individuals and organizations: the gatekeeper; prime mover; bridge builder/intermediary; representative

spokesperson; and monitor. They suggest that in well-functioning networks these roles are played in ways that are credible, consistent, legitimate and equitable. Doloreux and Parto (2005) contend that the innovative performance of regions is improved when firms are encouraged to become better innovators by interacting with various support organizations and with other firms within their region. They suggest that the institutional characteristics of the region, its knowledge infrastructures and knowledge transfer systems, as well the strategies and performance of firms, represent important basic conditions and stimuli for promoting innovation activities.

In line with networking for innovation, Tödtling, Prud'homme van Reine, and Dörhöfer (2011) investigate the concept of open innovation, which is built on ideas of "interactive innovation" and "innovation networking". They suggest that there are various mechanisms for open innovation used by companies, such as R&D and innovation collaboration with other firms and universities, relations to spin-off companies, and informal knowledge interactions within the local milieu or "open innovation campuses". They find that there is no uniform "model of open innovation that applies to all types of regions". They also show that there is rarely an ideal model of "uncontrolled" open innovation, but rather different forms of innovation practices that are somewhere in between the open and the closed models. They also find that change towards a culture facilitating open innovation can take considerable time.

Gertler (2010) examines universities in local economies, as well as creativity-based strategies, and shows how locally distinctive institutional architectures lead to differentiated social and economic outcomes. In terms of developing such architectures, Arthurs, Cassidy, Davis and Wolfe (2009) propose a methodology for policymakers and managers to understand innovation pathways and cluster dynamics in order to design effective strategies. Chaminade and Vang (2008) suggest that such cluster strategies

can also be effective in developing countries. In fact, they can help transform indigenous firms from competing on low cost towards becoming knowledge providers in global value chains.

To sum up, the literature suggests that innovation is a phenomenon that can have significant power to chagne the institutional environment, has various types and styles, is closely related to knowledge and develops as an assemblage via the interaction of actors. Certain environmental features and institutions can help foster innovation so that the idea of cultivating innovation in an innovation system attracts interest. Within such a system, venture capital and clustering appear as important themes. It is suggested that regulatory bodies can help supply developing innovation systems with a purposeful set of policies, which can even work for developing countries.

This thesis analyzes a case that has a significant amount of non-linearity, confusion, conflicts and unanticipated outcomes. Therefore, it resonates quite well with the research model put forth by Akrich, Callon & Latour (2002a). This model does not concentrate on the entrepreneur as the sole actor, but rather analyzes the ongoing negotiations between actors that change their roles according to the challenges they face. The factors that foster innovation may be relevant in this case as well, since the startup I examine was founded in Helsinki, Finland, a country with a heavy focus on innovation and which is home of Nokia, one of the key players in mobile communication, at least during the period from 2003-2010. Thus, it is important to be aware of the environmental and systematic factors, although they seem to fail to explain the specific case without an in-depth analysis through a framework like ANT.

Gaming:

The case examined here is one of mobile gaming and reflects the growth of the sector. Mobile gaming can be considered as a continuation of video gaming in which the industry has become capable of making use of the mobile communication industries. Therefore, literature on video games is also another important dimension for review.

Video games constitute a fruitful domain for social studies. There is a range variety of vantage points from which they can be examined, ranging from the time people spend playing games, its impact on the health of the person and the society, to developing rhetoric and influence power relations. There is good literature surrounding the procedural aspects of video games, teaching people how to understand and manage processes. Video games provide a safe environment for people to fulfill their desires to discover and develop their creativity. Video games can be used to affect public opinion, build support for certain policies, market products or recruit people.

Bogost (2008) analyzes a video game called Animal Crossing for Nintendo GameCube and DS, where the player leaves home and embarks on a new life in a small village. Bogost (2008) vividly describes how the economic, social and political relations come together within the video game.

Greenfield and Brannon (1994) find evidence that in the long-term, video games could contribute to the development of spatial representational skills required for humans to "interface" effectively with computer technology.

Gee (2014) looks at major cognitive activities involving video games, including how individuals develop a sense of identity, how we grasp meaning, how we evaluate and follow commands, how we pick a role model, and how we perceive the world via video games, even violent ones.

Squire (2005) conducted a case study through which he suggests that video games could help educate students for whom traditional education is ineffective. He outlines the benefits of and obstacles to widespread game implementation in education. Similarly, Flynn (2013) investigates the relationship of video games and improvement in executive functioning and finds evidence that gaming improves speed of decision execution in children, but those decisions may not be more accurate. Similarly, Dye, Green and Bavelier (2009) find evidence that action video games help enhance attentional skills that allow people to make faster correct responses to targets. On the other hand, Wallace (2012) finds evidence that video games, especially fast-paced ones, are correlated with reported symptoms of attention deficit disorder and hyperactivity. Similarly, Han, Kim, Bae, Renshaw & Anderson (2016) find evidence for a predisposition for depression in compulsive game players.

Juul (2010) challenges the common understanding that video games are for game enthusiasts who spend a great deal of their time playing games. Talking about the casual gamer, he highlights the technological changes that altered the relationship between the human and non-human actors in this sphere. New technology has made game playing easy, flexible and enjoyable for the ordinary person, giving rise to casual gamers. Similarly, Millington (2016) challenges the understanding that video games are unhealthy. Drawing on Nintendo's Wii Fit Plus game, he investigates how Nintendo merges the entertainment and health sectors.

Willson (2015) looks into social games run on social networking platforms. He suggests that those games are a part of a wider regime of social interaction and creative identity work. He argues that social games are spaces of creative expression, social dynamics and identity co-creation that cannot be understood without considering their broader contexts.

Production of video games has evolved into a complex network. Johns (2006) describes the production networks of the video game industry through an examination of their evolution and how the organization of production is manipulated. She argues that while hardware production is organized by console manufacturers using truly global sourcing strategies, the production of software is far more complex. In fact, software production networks are bounded within three major economic regions: Western Europe, North America and Pacific Asia.

Venkatraman and Lee (2004) implement social network analysis to investigate the production of video games. They examine how network structure (density overlap and embeddedness) and technology characteristics of a platform (dominance and newness) shape interorganizational coordination of product launches in the U.S. video game industry. They find that the network structure and technology characteristics of a platform significantly shape the decisions of game producers. Thus, production of games is an event significantly embedded in its social environment.

The relations created by playing video games are an interesting social phenomenon. The event of playing a game binds the player with the game (a non-human actor), with other players via a technological channel, (another non-human actor) and with producers of the game. Giddings (2009) suggests using a "microethnographic'" approach with methodological strategies both for analyzing gameplay and for identifying and conceptualizing relationships between technology, agency, and aesthetics in everyday techno-culture across and between the virtual and the actual. This approach suggests a new model of techno-culture in everyday life, shifting analytical and critical attention away from established research objects and notions and toward the "event'" of gameplay as one with non-human as well as human participants, brought into being by relationships and translations of human and non-human agency. To provide more insights into the area of

production with reference to human and non-human agency, Atkinson (2000) describes the Soft Information Systems and Technologies Methodology (SISTeM), and demonstrates its utility in information systems and technology-based projects. Atkinson (2000) suggests that his methodology has the capacity for orchestrating the emergence, consolidation and continual development of real-world actor networks. Chesher (2007) looks into the use of mobile communication in building a massive temporary community around a rock concert, where tens of thousands of people participated in a concert via their mobile phones. Using ANT, Chesher (2007) illuminated the invisible actors in the background that enabled such a mass social event using mobile communications technology.

The ANT literature specifically dedicated to the development of mobile games is rather sparse. Olla, Atkinson & Gandceha (2003) talk more generally about wireless systems that include mobile applications and development centers. They acknowledge the complexities attached to wireless systems, and consider them very different from traditional information systems projects. Therefore, they choose to use the concepts of ANT to gain a richer understanding of complexities involved in wireless systems development from a social technical perspective.

2. THEORETICAL BACKGROUND: ACTOR NETWORK THEORY

The theoretical basis of this thesis is Actor Network Theory (ANT). ANT provides a process-based understanding of innovation, which is a key requirement for understanding the case I analyze. The case of innovation at Rovio spans several years. I have chosen to analyze two periods of this span separately, for the reasons I elaborate upon in Chapters 3 and 4. One major reason is that in these different periods the efforts towards innovation achieved different results. However, there were no significant changes in the institutional environment that surrounds the company during the span I investigated. Thus, innovation theories that focus on environmental and systematic factors or that investigate the resources available for innovation do not fit well in understanding how Rovio could have experienced different outcomes with similar inputs. Therefore, there is a need for a deeper vantage point that goes into actions, decisions, processes and relations. In terms of analyzing relations, I found it was not enough just to get an understanding of the internal relations within the company; rather, it was also necessary to examine the external relations between the company, its environment and movements in the sector in which the company was situated. ANT provides a very suitable framework for analyzing and synthesizing all these aspects, and provides an in-depth view of the innovation processes. This framework enables understanding and learning from an initially non-trivial innovation case such as that of Rovio.

2.1 ABOUT THE ORIGINS OF ANT

Semiotics is an important antecedent of ANT. There may be differences in the object of research but there are quite a few similarities in the underlying philosophy and approach to research. ANT is influenced by important figures in semiotics like Algirdas Julien Greimas and Michel Serres.

Translation, for instance, is a metaphor from Serres (1974). ANT started to take shape in the late 1970's and early 1980's in Paris. Michel Callon and Bruno Latour are the two key figures in this development. The term ANT, devised by Michel Callon, appeared around 1982, but the approach is itself a network that extends out in time and place (Law, 2009). A common topic in ANT in its infancy was the social understanding of science, technology and engineering. Thomas Hughes' (1993) book on Edison's success in creating the first networks of electricity was an important foundational work in ANT. This book talked about the importance of the system architecture that Edison brought together and the many human and non-human objects that were assembled under this architecture. This book contained elements like non-human actors and politics in science that became part of ANT. Latour (2010) suggests that what Hughes called 'networks of power' in this work are actually actor-networks.

Another important early contribution to ANT was Michel Callon's (1980) account of the failure of the electrical vehicle in France. This project failed mainly due to a lack of enrolling key actors. This account led to the definition of a key problem for ANT: How can we describe socially and materially heterogeneous systems in all their fragility and obduracy (Callon, 1980)? At that time, Latour (1980) was working at laboratories observing the process of scientific fact creation. Latour realized that claims are often very vague in the laboratory and analyzed how these vague claims become hard facts over time. Drawing on the work of A. J. Greimas and ethnomethodology, he explored the semiotics of the practices that lead to scientific truth-claims (Law, 2009).

Latour in "Laboratory Life" provides an ethnographic understanding of how hard scientific facts are constructed (1980). A scientific fact is usually very clear and unquestionable. It is usually taken for granted. However, before something becomes a fact, everything is very uncertain and many

opportunities are discussed. The process of constructing a scientific fact is indeed pretty chaotic, messy and also political. This process can be perceived as a continuous effort to drop all the modalities in a statement, as modalities signal uncertainty. Thus, a statement becomes a fact once all modalities have been dropped, at which point it is called a type five statement. (Latour & Woolgar, 1980). This process involves not only processes of scientific experimentation, but also a great deal of social interactions where the developers of a new hypothesis try to have the hypothesis accepted in the scientific community. They especially try to convince the opinion leaders and sponsors of the field. Sometimes the acceptance of a new hypothesis means the destruction of an old scientific fact. In such cases the old fact becomes a rejected fact and the new hypothesis becomes an unquestionable fact.

In his investigation of laboratory research, Latour did not adopt the notion of ANT in its entirety, but he incorporated several important elements of ANT into his work. Specifically, he mapped different relations that lead to scientific fact creation. He also carefully analyzed the physical aspects of a laboratory and depicted their impact on knowledge creation. Translation is present in this work in the form of purification of scientific text from modalities.

Another key account in the development of ANT was Callon's work on scallops in St. Brieuc Bay (1986). In this work, Callon defined the key actors as the scientists who wished to implement a new method of rearing young scallops, fishermen who needed to agree to the conditions of this new method, which forced them to forego short-term gains for longer-term benefits, and the scallops that had to cooperate in order to grow larvae in protected areas. Callon mapped the net of relations built among these actors. It is striking that scallops were analyzed in the same manner as people.

Additionally, Callon's work provided a framework for analyzing an innovation process. This is the four-step approach I discussed earlier. Later on, Akrich, Callon and Latour (2002a, 2002b) incorporated other elements and elaborated further on this framework.

The work of ANT, developed from these initial works, has been elaborated upon and changed by various academicians in a large variety of fields. The network of ANT has thus grown. The intellectual concerns of the actor network tradition today include precarious relations, the making of the bits and pieces in those relations, the logic of translation, concern with materials of different kinds and how it is that all these components hang together, if they do (Law, 2009).

2.2 WHAT IS ANT & WHY USE IT

ANT is a social constructivist approach to developing accounts of social realities. These founders of the field prefer to call it an approach (Latour, 2005) rather than a theory, as ANT equips scholars with methodologies and concepts that can be put into use to explain the development of various social realities. Theories usually try to explain why something happens, but ANT is descriptive rather than foundational in explanatory terms. It tells stories about "how" relations assemble or don't. It is better understood as a toolkit for telling interesting stories about, and interfering in, those relations (Law & Hassard, 1999).

This capability and elasticity is especially useful in technology and innovation studies, where uncertainties play an important role. In fact, ANT is developed from social research on science and technology. It has matured as a framework for understanding science and innovation. ANT is well suited to adding technology into the equation. In ANT, technology can be an

actor just like any human actor. ANT accepts the existence of such non-human actors, treats them as being on the same level as human actors and follows the interactions between them. Thus, technology or any technological artifact can play an important role in understanding social transformations and have a valid place in accounts based on ANT. ANT is very suitable for a case-based examination of an innovation process where the environmental aspects that may cause or unravel uncertainties can be researched in an actor network framework. In fact Latour, Callon and Akrich (2002a, 2002b) proposed a four-step approach specifically to account for innovations, which has become quite popular among innovation scholars. It involves phases known as problematization, interessement, enrollment and mobilization.

The first step, problematization, is when an issue becomes interesting enough that some actors start pursuing it. The problem statement needs to be challenging but also intriguing so that others find a motive to pursue it as well. Problematization also leads to definition of the actors who have a genuine interest in the stated problem and want to gain support of other actors to widen the pursuit for a solution. Problematization includes the starting point of view for the innovation process, but it also defines the key actors in such a way that they become indispensable to the problem (Callon, 1986). The relations between the key actors, which are defined in this phase, are subject to change throughout the process.

The second step, interessement, is the phase when the initial actors try to recruit some other actors, who could in fact have a significant impact on the solution, to tackle the problem. Callon (1986) defines interessement as the group of actions by which an entity attempts to impose and stabilize the identity of the other actors it defines through its problematization. He notes that the etymology of this word means ‘to be in between’ (inter-esse), or ‘to be interposed.’ To interest other actors is to build devices which can be

placed between them and all other entities who want to define their identities otherwise. To illustrate this, let us assume A, B, C, D and E are different actors. A wants to enroll B in his cause. In order to do this, A interests B by cutting or weakening all the links between B and the invisible (or at times quite visible) group of other entities (C, D, E, etc.) who may want to link themselves. Thus, the initial actors need to find ways to attract their key actors while distracting them from competing problematizations. In the process of interessement, the meaning attached to the project by the initializing actors needs to be translated into meanings that will motivate the other key other actors. The ways of doing so are called interessement devices.

Successful interessement leads to enrollment, which is defined as the device by which a set of interrelated roles is defined and attributed to actors who accept them. Enrollment is full of negotiations: in order to construct a system of alliances, the parties negotiate the roles and coordinate actions and ways to tackle obstacles.

The final phase is the mobilization of allies, in which the representativeness of the spokespeople plays a key role in solving the problematization. During this stage, spokespersons are selected and activated so as to ensure the adhesion of the collectives to the network. For example, Akrich, Callon and Latour provide an account of how Edison succeeded in electrifying America (Akrich, et al., 2002b). They emphasize the fact that Edison spent considerable time and energy meeting journalists, forming public opinion and negotiating with public officials. Thus, public relations and politics are represented as essential aspects of an innovation process. All these social relations within the four phases tie in quite masterfully to aid in understanding the ways technology develops and innovations happen. This approach is especially appropriate for analyzing the Rovio case.

There are several peculiar aspects of ANT that may be rather hard to grasp at first but offer a great deal of explanatory power for understanding innovation. One of those lies in the breadth of the definition of an actor. An actor can be a human, an animal (Callon, 1986), a non-living object, a technology or a company. ANT is an action-based approach. It prioritizes subjects that act; objects that move and change. Therefore, an actor should be considered as a source of action, or an object that has an effect on social phenomena. This breadth in the definition of actors helps pinpoint the factors that have had a significant impact on the social reality being researched. It also means that according to ANT, human actors may not always be more important than non-human actors. In ANT, the crucial roles of software code, science reports, strategic documents, etc. can be appreciated independently of their connection to a human. At the same time, humans are not necessarily considered actors, unless they cause action. The idea is to focus on the factors that really have an impact on the changes to the researched social reality at a certain time.

> To pursue the metaphor of a supermarket, we could call 'social' factors not any specific shelf or aisle, but the multiple modifications made throughout the whole place in the organization of all the goods—their packaging, their pricing, their labeling—because those minute shifts reveal to the observer which new combinations are explored and which paths will be taken (what later will be defined as a 'network'). (Latour, 2005)

Another peculiarity is the reluctance of ANT to differentiate between different levels of analysis. This may be counterintuitive as sociologists typically like to work with multiple levels, such as micro-macro, local-global or small-big. Leveling makes analysis easier, clarifies scope and allows for ignoring some associations. Scientists can say that they are concerned with the micro level only, or with local relations only, etc. ANT

prefers to collapse these levels onto each other, creating a 'flat' model. Flatness here refers to placing everything into a 2-dimensional space, drawing a map of the social in a way. Latour provides an analogy from Edwin Abbott's book, *Flatland* (1991). In *Flatland*, Abbott made the actors live in a 2-D world, made up of lines. "It might seem odd at first but we have to become the Flat-Earthers of social theory," says Latour (2005).

ANT suggests that all relations worthy of becoming part of the actor-network should be mapped into the network independently of any predetermined leveling. In this way, the scientist has to create a flattened topography, from scratch. The idea here is to pinpoint the factors that have the biggest impact on the change of a social reality at a certain time. Thus, classifications may impose pre-determined values to the factors. Whereas at a certain time, a global technology may have a significant impact, at another time a local manager may cause a significant change.

A third peculiarity comes from the name of the approach. The term 'actor network' is actually used to sidestep the distinction between agency and structure (Ritzer, 2004), in line with the idea of keeping the social aspects flat. An actor network can be considered as a structure that has agency. An actor network is an action-based description of relations around the key actors that reveal how the object of research is transformed through these relations. ANT focuses on how collective projects are constituted (Barley & Bechky, 1994; N. Lee & Hassard, 1999; Munro, 2009). It is a constructive approach that focuses on actions derived from interactions between actors. ANT works from an ontology of becoming, rather than assuming that entities can be defined in terms of predetermined competencies and capabilities (Hernes & Irgens, 2010). Thus, ANT opposes the view that context dominates and that social objects are fitted into prescribed categories. As Latour states, "Society is no more 'roughly' made of

‘individuals’, of ‘cultures’, of ‘nation states’ than Africa is ‘roughly’ a circle, France a hexagon or Cornwall a triangle” (Latour, 2005).

ANT considers that only the actors that effect change should be part of an actor network. This is a quite different understanding of a network in a Social Network Analysis sense. An actor network is a relational entity that has agency (Latour, 1999). As the actor network moves from actor to actor, it evolves and changes. An actor network is not the map of all possible connections, but rather a path of translations through which the process of change and innovation progresses. A connection that does not lead to an event or just serves as an intermediary entity has no place in the actor network. The sum of all associations, or all types of links in the environment, which is considered as network by some theories, is regarded as a vague background object. John Law and Annemarie Mol have used the word ‘fluid’ to describe it (1994). Latour uses the term ‘social fluid’ (2005) to define this background. The actor network is a portion of this fluid in which actions and mediators are concentrated.

A final peculiarity of ANT is its keen belief in constant change (Latour, 2005). ANT is really concerned with concepts like change, movement, action, distraction and evolution. ANT is not interested in static phenomena. Rather, ANT is focused on understanding causes and results of changing phenomena. According to ANT, everything is in constant change, and social relations are especially ephemeral. It is posited that physical objects such as buildings, documentations, flags, organization charts, computer programs, etc. help stabilize this constant change and give a sense of durability. As Latour puts it, “It is always things—and I now mean this last word literally—which, in practice, lend their ‘steely’ quality to the hapless ‘society” (Latour, 2005). According to ANT, social relations need physical objects to build a (perceived) stable ‘social structure’. Therefore, these

physical objects need to be granted the attention they deserve in social research. ANT does this by including non-human actors into the picture.

2.3 POSITIONING THE THESIS ONTO ANT: KEY CONCEPTS

This thesis takes the case of Rovio as the major research object. Rovio is a mobile game company that was founded in 2003, backed by an angel investor. From 2003 to 2008, the company had several small successes but despite these, it was on the brink of bankruptcy in 2008. Surprisingly, a product released in 2009 made the company one of the biggest producers of mobile games in the world. The highlighted story circulating among Finnish innovation clusters is that the talented entrepreneur tried hard for many years and only after 53rd or so trial did they make it big. In order to add further depth to this story, I will rely on Callon's (1986) four-step framework for innovation.

Several other concepts of ANT have significant relevance for the case. One of these concepts is "black boxing." ANT looks into the process of how networks gain strength, stabilize and simplify to become a kind of black box (Ritzer, 2004). In a black box, internal workings are less visible and become secondary to the function. Such a structure becomes more durable. ANT is a process-centric approach interested in change. Thus, ANT is not only interested in the creation of black boxes but also in their demolition. Latour (1987a) suggests that a process called a "trial of strength" can restructure or demolish black boxes.

According to ANT, innovation can be perceived as an 'assemblage' of various elements resulting in a product or service that disrupts—at least partially—the existing market, changes and redefines it (Latour, 2005). This

assemblage gets created as the actor moves in the actor-network. At the point of departure, the actor may have an idea or hunch about the innovation, but most of the time there is a huge gap between the initial idea and the final offering. This gap is filled by numerous interactions with other actors, which can be human or non-human. These interactions change both the object of research as well as the actors themselves. Through these interactions, the actor is articulated onto its actor network, which is constantly changed by other actors as well. Adopting this approach, I will analyze the creation of the groundbreaking game called "Angry Birds," developed by Rovio, as the result of an assemblage of various elements that was built over the course of seven years in a non-linear fashion.

2.4 LIMITATIONS OF ANT

ANT is a very empowering approach for social research. The power of the approach lies in the fact that the concepts put forth by ANT get better understood once they are put into action. They can lead to very interesting findings that are not anticipated at the beginning of the research but which evolve through the interaction between the findings and the concepts. However, one should note that ANT is not without its own challenges. Firstly, it is mostly conceptual rather than descriptive, so the researcher needs to develop his/her own methodology by interpreting the concepts of ANT. This enables creativity but makes it challenging to set up the working methodology. This challenge can be made easier by following the lead authors of the field when they do case studies. In my case, Callon's study on scallops (1986) provided good guidelines for setting up the methodology.

Another challenge with ANT is that it talks about what it is *not* almost as much as, and sometimes even more than, what it *is*. This effort to

differentiate itself from other social theories makes it hard to get to the core of the theory quickly and to design strategies to operationalize it.

The concept of keeping the social view flat is another example of a challenging feature that, once managed, becomes empowering. Trying not create dichotomies between the macro and micro or global and local is challenging, as the academic mindset is mostly hard-wired to make such distinctions. Furthermore, the flatness does not imply ignorance of difference of size and impact of different actors. What I consider the key value here is not putting significantly different actors into different buckets of analysis and thereby isolating them from other. Especially in cases of innovation, very fruitful findings come about at the sidelines of global and local or macro and micro. The interactions between actors that are significantly different from each other and otherwise would appear in different levels of analysis are those that provide very valuable insights into innovation.

3. METHODOLOGY

3.1 THE RESEARCH QUESTION

The thesis centers around the translation of games into a mobile platform. For this reason, my research focuses on the innovations in mobile communications and gaming that enabled mobile gaming to ramp up. More concretely, the research question relates to technological and social processes needed to transform the mobile handset, initially created for mobile calls, into a gaming device, whereby new game development companies were founded specifically to create mobile games and existing gaming companies started investing into mobile gaming. This also pertains to the question of how gamers who initially played on game consoles or PCs started using to use their mobile phones as a gaming platform, and conversely how regular phone users started becoming gamers. A series of changes happened to the way games are produced, to the people who play them and the producers who produce them. My research centers on these changes, which eventually made mobile gaming a serious industry. I try to illustrate these changes with the case of Rovio.

Rovio did not become an instant success, but had to undergo several tough processes that mirrored the changes in the mobile communication and gaming sectors before mobile gaming became a global phenomenon.

For analyzing these changes and innovation as a social process more generally, ANT is a very suitable framework. Actor networks are not static objects but dynamic ensembles that are created by the articulation of various actors to a leading actor or a group of leaders. I begin my investigation of the actor network involved in this case by analyzing the actors, processes and conflicts within, during which the articulations of these actors with the

mobile communication and gaming industry created an account of the translation of mobile games.

3.2 THE RESEARCH DOMAIN

Why Rovio? Rovio is representative of the translation in mobile games from several perspectives. Angry Birds was the first commercial hit mobile game on a global level, with significantly greater success than previous hit games. In a way, Angry Birds justified the business case for future investors in the sector and helped mobile games to be taken much more seriously than before. Rovio was a developer-centric organization, meaning that the core of the company consisted of game developers who wanted to create good games. Prior to Angry Birds' success, the mobile gaming sector was dominated by a handful of handset developers, mobile operators and distributors who formed cliques with the mobile operators. Angry Birds signifies the change in the power structure by providing an example of an independent game producer becoming successful within this gaming oligopoly. Another reason to study Rovio is the duration of the case study. The period of interest expands to almost all of the 2000s and early 2010s. Mobile games went through significant changes within this timeframe. Thus, Rovio changed itself, together with the changes in the mobile sector, especially the changes in handset technology, operating systems and distribution channels.

In fact, two different episodes of translation can be recognized by following Rovio, with the earlier period (2003-2008) illustrating more of failure than success. In terms of innovation research, it is useful to contrast success with failure. This case provides this contrast within the two different periods analyzed here.

3.3 DEFINITION OF ACTORS

The starting figure within Rovio was Nikas Hed, who was the key developer behind Rovio. By tracing Hed's personal account, I will analyze the four moments of translation, which consisted of long processes of actions, negotiations and changes. At the time when our study begins, Hed was a young computer programmer who had been into games since his childhood. Sakari Toivakainen, a childhood friend of Hed, says, "Niklas was very into his physics games. He used to code in Pascal. He was 12 when he made this ball and it's moving. When he gets an idea, he never lets go" (Cheshire, 2011). The general question Hed set forth to answer was simple: "Can mobile gaming be a scalable business?"

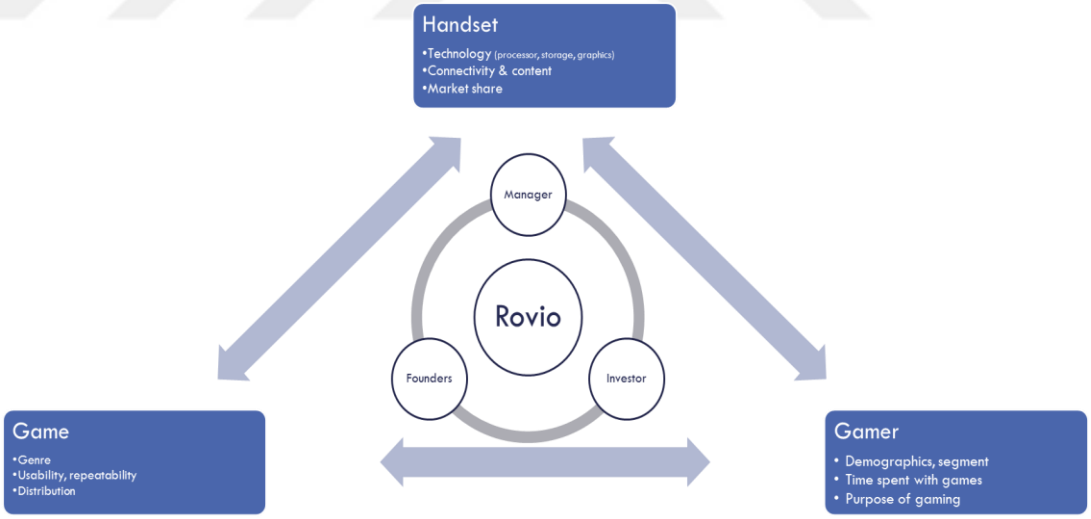
Hed joined forces with Jarno Väkeväinen, and Kim Dikert, fellow students at the Helsinki University of Technology. These three actors were the initial drivers of the problematization, when there was no company other than their joint efforts. They officially founded a company called Relude in 2003. As Hed and his friends embarked on this journey, they recruited some actors, defined the roles they would play in the process and started to build relations within which they themselves would become an obligatory passage point. The formation of the company together with the new relations they started building made them indispensable in the network.

Hed's question led to the definition of two sets of actors. The first set was related to the scalable business part of the question, so it related to the company. Hed defined the two key actors related to the company, who were the manager and the investor. Hed and his friends had proven their skills in developing games but they needed support in business management. They needed a go-to-market strategy and to build key business relations to establish themselves as mature game developers. Basically, they needed to figure out how to make money with games. Another key ingredient to the company was financial resources, which Hed and his friends did not have.

In order to move the company into the direction of a successful mobile game developer, they needed a stronger team to develop and distribute the games, the funds for which they didn't have. They also needed funds to set up strategic partnerships.

The second set of actors related to the mobile gaming part of the question. These actors represented the core relations within the mobile gaming business. Three key actors in this set included the product (game), the handset (mobile phone), and the gamer. The game relation can be defined as the gamer playing a game using a handset. This was the key relation Hed and his friends needed to master: they needed to define which gamers would play which games through which handsets. All the actions, success or failure of the problematization can be read from this triangle.

Figure 1: Definition of Actors



The game:

I chose to analyze the game as an actor as it was the main product created by the game developer. However, there is more to a game than being a

product. A person who plays a game creates a relation to the game and it is this relation that is at the core of the triangle. A mobile game may be an extension of a computer game, such as a PC or console game, but it has a quite different relation to the gamer than games on other platforms. First of all, a mobile game accommodates to the lifestyle of the gamer, whereas other games require the gamer to be at a certain predefined place. A mobile game usually demands less time from the gamer than the other games, thus it also changes the profile of the gamers as it offers a different relation.

There are many parameters that must be defined when designing a mobile game. Is it a generic free-time game or a specific niche game that requires a large time investment? Is it fun, exiting or childish? How is played? What are the controls? Are the graphics simple or detailed? Is it free to play, and if so, how is it monetized, and who plays the developer? All these questions and more are decisions to be made in designing a game.

The handset:

I chose the handset as an actor as it is the main interface in the relation between the game and the gamer. The handset is a key device by which the game becomes operational. It actually defines the limits of this relation with its technical specifications and the way it operates. Technical aspects like processing capacity, battery life, graphic interface and storage capacity determine the technical limits of the game. Its operating system, its relation to operators and the openness or insularity of the ecosystem determine the limits of the business aspects of the game.

The handset has unique features compared to the other game play interfaces like PCs or consoles. Those interfaces offer devices where physical media like CDs, cassettes or cards can be inserted. In these cases, the business evolves around producing the games and distributing the game media in retail channels. However, there is no media inlet in handsets, or at least there was not in the early 2000s. This means that there are only two ways a game can get onto a handset. The first is that the handset exits the factory

with the game already on it. To achieve this, the game producer has to negotiate with the handset developer. The second way to get a game onto a handset is to download it. In early 2000s this was possible but quite challenging.

Another consideration about the handset is its technological capabilities including the capabilities of the operating system and compatible software, the graphical interface, memory and processor capabilities and user interface. All these aspects define and limit the possibilities of mobile gaming.

The gamer:

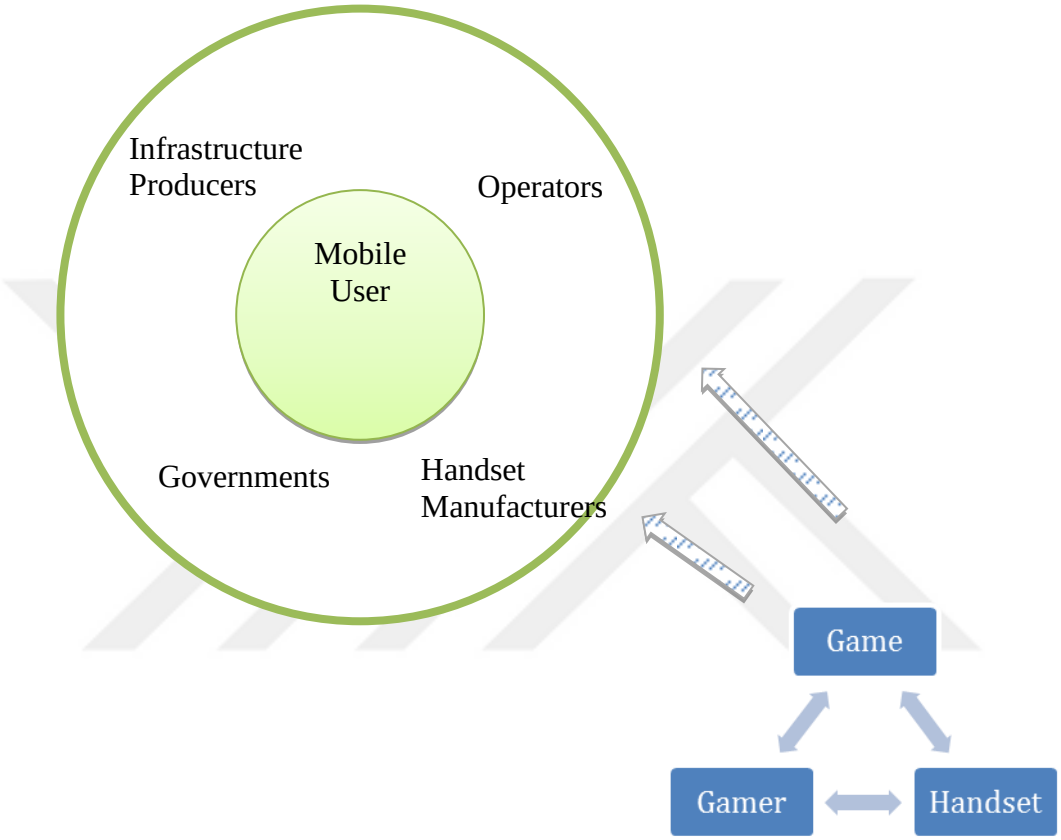
Who are the gamers interested in mobile phones? What types of people play games on mobile phones? What are their motives in playing games on mobile phones? Are they just trying to pass time while waiting for something, or are they really focused on what they do? How much time do they spend on mobile games? Do they spend money on mobile games, and if so, how much? These are questions that form an important part of the triangle of game, handset and gamer. Failing to understand the gamer can be an important reason why the problematization fails, as the gamer is the one who eventually pays for the game.

3.4 THE RESEARCH MODEL AND CONSTRUCT

As the research construct, I position the triangle of game-handset-gamer on top of a larger ecosystem, which is the mobile communications sector. The sector started out as an oligopoly of handful of actors that formed a clique by developing a standard called GSM, and developed a self-sufficient system around it. Latour uses the word social fluid (2005) to define such a background. The research model takes into account this fluid which depicts

the environment by reviewing the relations in the mobile communication sector.

Figure 2: The initial view of the mobile communications sector



However, this fluid is not to be considered static. Through my research it became apparent that this clique in the mobile communications industry was only stable in appearance for a limited period of time. In fact, it was constantly evolving without losing its general shape for a while and underwent a series of revolutions afterwards. Research has pointed out that the improvements in handset processor capability and data communication technology pushed the mobile communications sector into a merger with the software industry.

I followed the network formed by the key actors and the impact of the network through the four moments of translation within this fluid and its interaction with the actors. This is the area where the triangle of the game-handset-gamer forms relations and creates a presence.

In order to analyze the Rovio case, I created detailed relation maps for the periods I investigated, depicting certain moments in Rovio's development. I used blockmodeling to analyze the map. This method helps summarize the network at a higher level of abstraction. The abstraction works within the logic of Actor Network Theory, where only relations that influence the translation are highlighted. I used the summarized blockmodel to create a summarized relation map that represents the network as the actor. Below is an example of this process that depicts the foundation of Rovio.

Figure 3: Detailed Relation Map

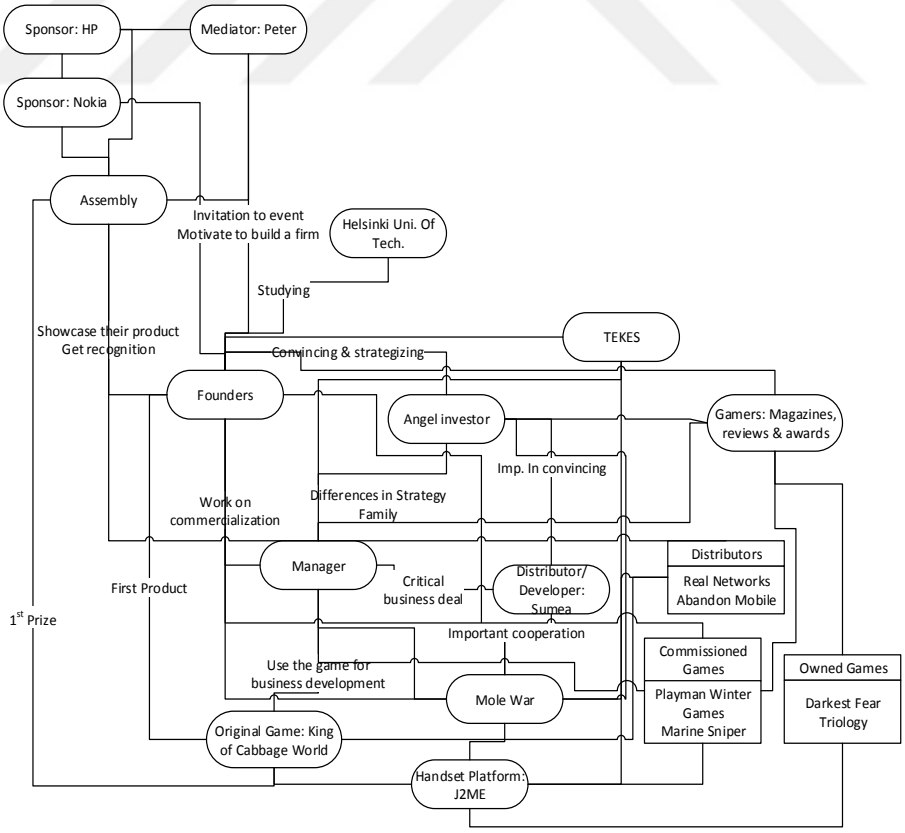
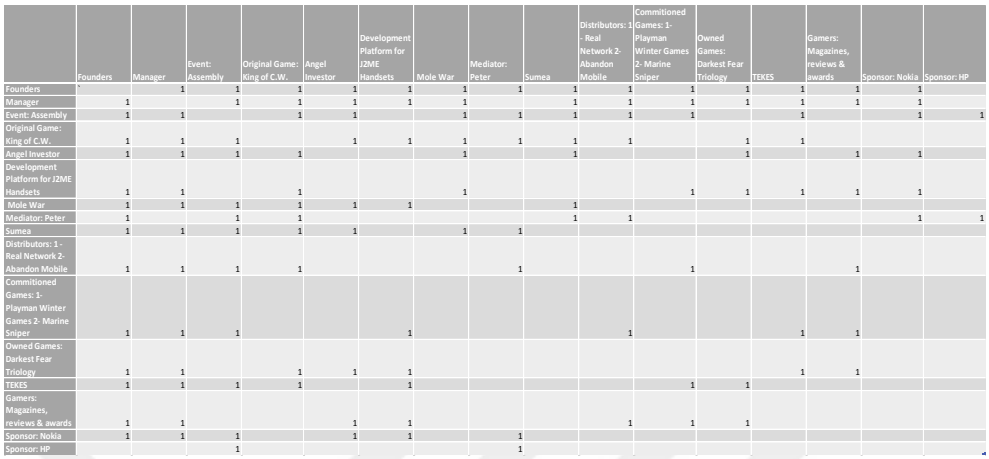


Figure 4: Detailed Blockmodel



	Founders	Manager	Event: Assembly	Original Game: King of C.W.	Angel Investor	Development Platform for J2ME Handsets	Mole War	Mediator: Peter	Sumea	Distributors: 1 - Real Network 2- Abandon Mobile	Commitioned Games: 1- Playman Winter Games 2- Marine Sniper	Owned Games: Darkest Fear Triology	TEKES	Gamers: Magazines, reviews & awards	Sponsor: Nokia	Sponsor: HP
Founders	`	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Manager	1		1	1	1	1	1		1	1	1	1	1	1	1	
Event: Assembly	1	1		1	1		1	1	1	1	1		1		1	1
Original Game: King of C.W.	1	1	1		1	1	1	1	1	1		1	1			
Angel Investor	1	1	1	1			1		1			1		1	1	
Development Platform for J2ME Handsets	1	1		1			1				1	1	1	1	1	
Mole War	1	1	1	1	1	1			1							
Mediator: Peter	1		1	1					1	1					1	1
Sumea	1	1	1	1	1		1	1								
Distributors: 1 - Real Network 2- Abandon Mobile	1	1	1	1				1			1			1		
Commitioned Games: 1- Playman Winter Games 2- Marine Sniper	1	1	1			1				1			1	1		
Owned Games: Darkest Fear Triology	1	1		1	1	1							1	1		
TEKES	1	1	1	1		1					1	1				
Gamers: Magazines, reviews & awards	1	1			1	1				1	1	1				
Sponsor: Nokia	1	1	1		1	1		1								
Sponsor: HP			1					1								

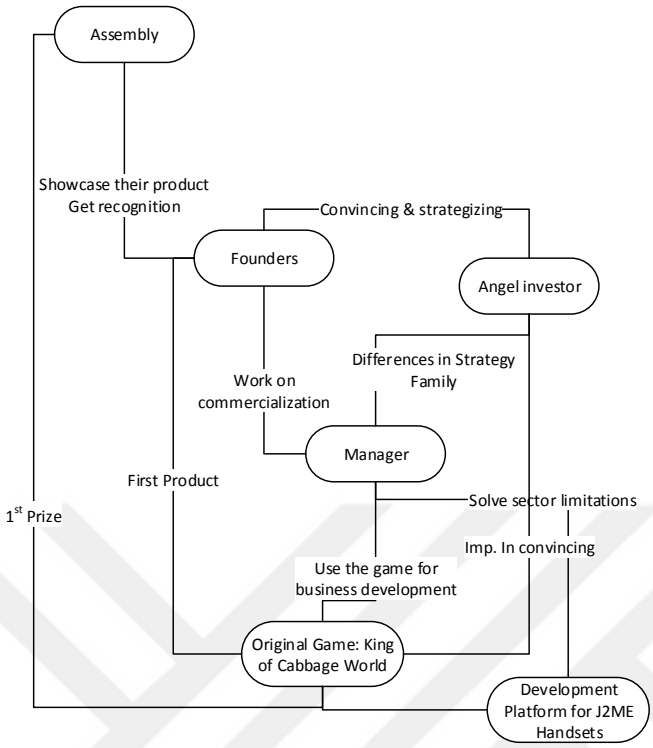
Analyzing the density of relations, the detailed blockmodel can be reduced to a summarized version that proves a good abstraction of the network.

Figure 5: Summarized Blockmodel

	Founders	Manager	Event: Assembly	Original Game: King of C.W.	Angel Investor	Development Platform for J2ME Handsets
Founders	`	1	1	1	1	1
Manager	1		1	1	1	1
Event: Assembly	1	1		1	1	
Original Game: King of C.W.	1	1	1		1	1
Angel Investor	1	1	1	1		
Development Platform for J2ME Handsets	1	1		1		

Using the summarized blockmodel, the relation map can also be crystallized, focusing on the key relations in the network.

Figure 6: Summarized Relation Map



The summarized blockmodels and relation maps are presented in the findings section. The detailed blockmodels and relation maps are provided in an appendix.

3.5 DATA SOURCES AND DATA COLLECTION PROCEDURES

Data for the research detailed here was collected from three sources: archives, interviews and questionnaires.

Archival data: The Rovio case spans over ten years, from 2003 to 2013. For such a longitudinal analysis, archival data is considered a primary source. In this thesis, I have frequently relied on online archival data. Through an online archive system called 'Wayback Machine' I was able to access backdated official websites of the key actors in the thesis, such as

Rovio, Ericsson, Nokia and the GSM Association, among others, to gather backdated official data, including monthly releases from Rovio from 2005 to 2011.

Table 1: Rovio Releases from Wayback Machine

Date	Title
March 9, 2005	Rovio Enters Mobile Gaming Market
April 25, 2005	Meet Rovio at E3 2005
May 13, 2005	Rovio Announces War Diary: Burma
June 15, 2005	Rovio joins the International Game Developers Association IGDA
July 18, 2005	Darkest Fear receives an Airgamer Award
July 22, 2005	Meet Rovio at GDC Europe 2005
August 10, 2005	Rovio Mobile joins industry leaders in Forum Nokia Pro
August 19, 2005	Pertti Miettunen joins Rovio's Board
September 21, 2005	Rovio's technology platform received funding from the National Technology Agency
December 8, 2005	ROVIO and MFORMA launch horrifying new mobile game in U.S.
December 19, 2005	Darkest Fear wins first prize in Airgamer's most popular mobile game 2005 competition
December 23, 2005	Rovio Mobile Ltd. closes second round of financing
January 2, 2006	Rovio releases version 2.0 of its mobile game development platform
January 17, 2006	Rovio announces Q1/2006 games line up
January 24, 2006	Darkest Fear receives Best Sound Award in Mobile Game Faqs Awards 2005
March 21, 2006	Paid to Kill and Darkest Fear receive Mobile

	Games Award from Midlet Review
April 25, 2006	Rovio Acquires Pixelgene
October 26, 2006	Darkest Fear 3: Nightmare receives the Airgamer award
January 17, 2007	Darkest Fear Trilogy Honoured in 2006 Game Awards
May 17, 2007	Rovio and Upstart Games Announce New Distribution Agreement
August 17, 2007	Burnout Receives Pocket Gamer Award
February 21, 2010	Angry Birds nominated for IMGA, go vote now!
February 21, 2010	In the news
February 22, 2010	Angry Birds @The Olympics
February 22, 2010	Company
February 24, 2010	Space Impact: Meteor Shield is out!
February 25, 2010	Angry Birds on BBC Radio 1
February 26, 2010	Angry Birds Levelpack 1 is now on the OVI Store
March 8, 2010	Angry Birds iPhone game soars to 500k units sold in one month
March 24, 2010	Angry Birds is the #1 App in the World!
April 2010 – March 2014	278 additional releases

I combined this archival data with secondary sources. Some highlights of these sources are:

- In-depth article on Rovio's story including an interview with Mikael Hed, published in *Wired* Magazine
- Interview with Peter Vesterbacka on Cnet

- Story on Rovio's 51 unsuccessful attempts before Angry Birds in *The Atlantic*
- Article on Angry Birds' success on Techcrunch
- Statistics: Essential Facts about The Computer and Video Game Industry 2013 published by esa

The full list of the secondary sources is provided in the appendix.

In-depth interviews: I conducted in-depth interviews with 18 high-level respondents, including a former CEO of Ericsson Turkey & Middle East and a senior manager from Rovio, to get a better grasp on the mobile communications sector, the Rovio case and the general business and innovation environment in Finland. In terms of the Rovio case, the interviews helped me to see the challenges, the strategic approaches the turning points of the company, which in turn helped me to articulate the case onto ANT. The interviews lasted around 60 minutes and were mostly unstructured, including several prepared open-ended questions that enabled the interviewee to go in-depth into the topics of interest. They helped me collect data on the processes, relations, ideas and strategies of Rovio; on the various events and strategies that characterized the development of the mobile communication sector; relations, resources and cooperation in Finnish innovation clusters; processes and organization of innovation cultivation organizations; real experiences of several entrepreneurs; in-depth experiences in research and development activities and their reflection on product development and marketing. The full list of interviewees can be found in the appendix.

Questionnaire: I also conducted a small online questionnaire with the motive of gaining a better understanding of the business environment inside Finnish innovation clusters. This was useful especially for my second research question, and for articulating the Finnish innovation environment onto both the actor network and the case of Rovio. Ten respondents, most of

which are owners or managers in cluster companies, mostly in the Helsinki region, completed the questionnaire. Although these 10 respondents did not constitute a large pool of interviewees, they yielded interesting qualitative input as the questionnaire had about 60 detailed questions. Some questions had significantly concentrations of certain answers, which indicated a significant tendency for the answer to be representative. For instance, networking, internationalization and knowledge basis acquisition appeared to be the key motivations for companies to join clusters, outweighing other parameters. The high trust culture with high levels of honesty, fairness and seriousness around commitments were also very significantly emphasized. The respondents almost unanimously agreed that the business environment in clusters is a very high trust environment. The full questionnaire results are in the appendix.

Table 2: Questionnaire Demographics

	Male	Female	No Answer
Gender of Respondents	84%	0%	16%

	Founder	Member of BoD	Manager
Roles of Respondents	50%	17%	33%

	Median	Mean	SD
Employee Size of Company	9	344	740
Foundation of Company	2011	2002	14

	Company in a Cluster	Not in a Cluster	No Answer
Cluster Relation	100%	0%	0%

	Uusimaa (Close to Helsinki)	Other	No Answer
Cluster Location	70%	30%	0%

3.6 DATA ANALYSIS

The The core of the data analysis consists of mapping of Rovio's relations over different stages of their development and analyzing these relations within the ANT framework, as shown in Figures 3, 4, 5 & 6. I documented all the relations Rovio had based on these data sources and highlighted the ones that 'mattered' using blockmodeling, as explained in the research construct section. The 'social fluid' (Latour, 2005) for this analysis is the mobile communications sector, as Rovio's success was embedded in the changes in the mobile communications sector (as in Figure 2). This analysis crystallizes the networks Rovio built that had an impact on mobile gaming. The triangle of the game-handset-gamer abstraction onto the mobile communications sector forms a good framework for data analysis. The interviews and other secondary documentation provide depth to the understanding of highlighted relations and the formation of the network.

4. FINDINGS

Games began appearing on mobile phones at the end of 1990s and early 2000s. These were basic games with poor graphics and usability, serving mostly a niche gamer community, and a few very basic, generic games for everyday users. By the early 2010s, however, mobile games had become a flourishing field of activity in rising companies attracting big investments and a gamer community even larger than that of the traditional gaming industry. How did this drastic change happen? The first big hit mobile game was called ‘Angry Birds’, developed by a Finnish company called Rovio. Angry Birds is a fun physics game where round birds are catapulted by the player, with the objective of hitting pigs hidden in various locations. The birds are angry, as the title of the game suggests, because the pigs have stolen their eggs. Angry Birds is easy for anyone to play and it can be played in any free moment without the need to invest serious time; also, it happens to be quite addictive. This game succeeded in capturing the hearts of millions around the world and kept its top position in the game markets for quite a long time. However, Angry Birds was only the final chapter in the long process of translation of mobile games. The findings section is organized according to the two periods mentioned in the methodology section. Thus, in Section 4.1 I discuss the first period, where the mobile communication was somewhat of a black box with a limited set of actors dominating the whole sector. The second period, discussed in Section 4.2, relates to the expansion of the sector when big software players became significantly embedded in the sector and allowed a large set of software developers to contribute mainly through the content stores they created. The first period extended from 2003 to 2008, while the second period started by the end of 2008 and extended to 2010.

4.1 PERIOD 1

When Rovio started embarking on developing mobile games, the mobile communications sector was in a state that can be characterized as a black box. The standardization undertaken by entities in North America, the UK, Japan and Europe ended up with the GSM system emerging as the leader.

Figure 7: Mobile communications sector, Period 1

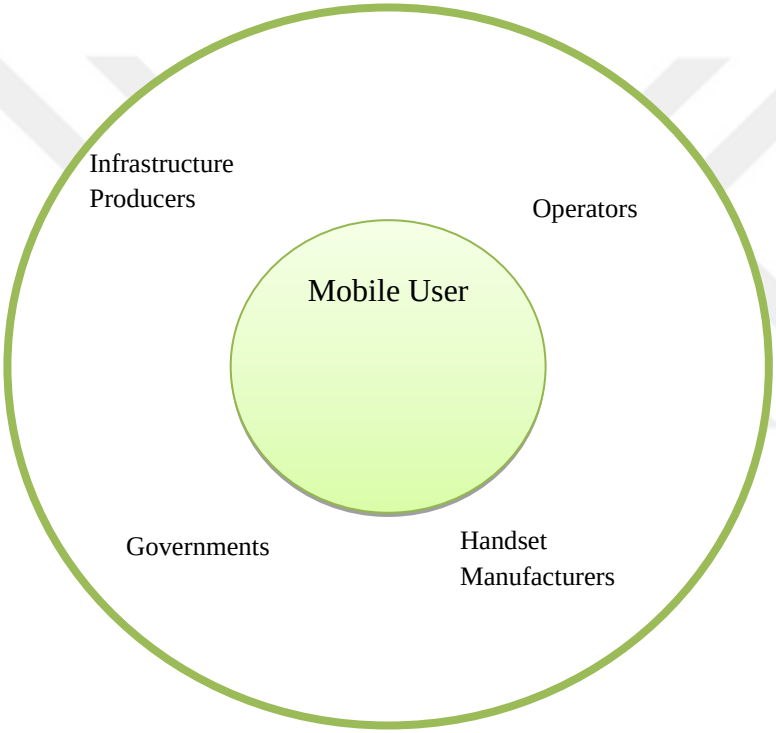


Figure 7 depicts the initial stage of the mobile communications sector. It was a rather strong clique involving handset manufacturers, infrastructure producers, network operators and governments. These four sets of actors formed a self-sufficient system with little room for an outsider to enter into. In this sense, the initial setup of the mobile communications sector was a black box that inhibited change to a large extent. This system did not need

external parties to grow, as there was already a large-scale geographic expansion occurring through which these main actors could scale their businesses, offering their black-boxed system to new international markets. In addition, there was a huge demand for mobile communications that kept these actors busy.

4.1.1 Background on Black Boxing in Mobile Communications

Before the arrival of mobile communications in 1970s, the telecommunications industry was dominated by a small number of landline giants. In North America, these giants included Nortel and AT&T; in Europe they were Siemens, Alcatel and Ericsson; in Japan they were NTT and Fujitsu. In one of the interviews I conducted, it was explained as follows:

> They had big networks, they had government support and they were very profitable. Therefore, when the technology on mobile communication started to become visible, these companies wanted to keep their competitive positions. So, they wanted to develop standards to keep their positions (interview).

Research on mobile communications had been conducted in the US, UK, Japan, Nordic Europe and Continental Europe since the 1940's. All these actors were developing their own independent methods to solve the technological challenges of mobile communications. A system designed by Motorola became operational in 1982 in the US. Japan's first commercial radiotelephony service was launched by NTT in 1978. However, it is safe to suggest that today's mobile communications sector was born in the Scandinavian countries. The first fully automatic mobile communications system was the Nordic Mobile Telephone (NMT) system, launched in 1981

in Denmark, Finland, Norway and Sweden. Sweden and Finland were the two driver countries in mobile communications. The system introduced by the Scandinavian countries was in a good place from both technological and operative perspectives compared to its American and Japanese rivals. This encouraged the big counties of Europe, such as Germany and France, to co-operate in the development of a pan-European cellular technology to rival those of the US and Japan. This resulted in the GSM system, with the acronym originally derived from Groupe Spécial Mobile but later changed to Global System for Mobile Communications. The work towards a standardized system in Europe started in 1982. The first GSM Technical Specification and the Memorandum of Understanding for deploying a common cellular system was developed in 1987. The first phone call according to GSM standards was made in 1991 in Finland. The former CTO of a major mobile communications company explains how GSM got the upper hand in the standardization:

> The first generation, the NMT system was analogue; it didn't offer many opportunities for business development. However, the second generation or 2G, which was the basis of GSM, was digital and additionally it offered the roaming capability. Roaming was a very important technological advantage. Roaming allowed people to talk in different networks, without changing the phone or the sim card. So people could use the same device when traveling to other countries without any special effort. This was the key advantage of the GSM standard and it was especially important for Europe (interview).

However, GSM was not immediately predominant in the US and Japan. As mentioned before, there were important landline players in these countries who wanted to enforce their own standards. As a former executive from Ericsson explains:

> Nobody was cooperating; everyone was fighting a war until may be after 3-5 years of GSM winning. There were standards like DTX, European TX, and AMS and there were two leads, Motorola and Ericsson. And there was Nokia in NMT. (interview)

GSM's high-quality voice calls, easy international roaming and support for new services like text messaging (Short Message Service) laid the foundations for a worldwide boom in mobile phone use. However, the biggest challenge that GSM faced came from the US. The CMDA technology developed by Qualcomm was a major competitor to GSM. Qualcomm developed the infrastructure and Motorola produced the phones. There was no need for subscriber identity module (SIM) cards in the CDMA framework; the retailer would enter a code into the phone at the point of purchase and it was then ready to use. But more importantly, the technology was actually somewhat more effective because it could carry more data within the frequency. As a former executive from Ericsson explains, "It was the Japan's support to GSM that moved the direction of this war towards GSM." (interview)

Therefore, GSM became the dominant standard in the world. The first GSM operator in the US began running in 1995, just four years after the GSM operator was created in Finland. However, GSM would still benefit from Qualcomm's technology during the development of 'third-generation' (3G) technologies. The GSM standardization developed in the 1980s was the major cornerstone of the impressive growth in the mobile communications sector throughout the 1990s. Coupled with that was another key development, the transformation of the private but regulated market. This transformation happened as a national policy in each country, breaking up the monopolies of landline companies through the issuance of multiple licenses. All fixed operators were monopolies. When mobile operations

started as private corporations, they became alternatives to the monopolies. As a former executive from Ericsson explains:

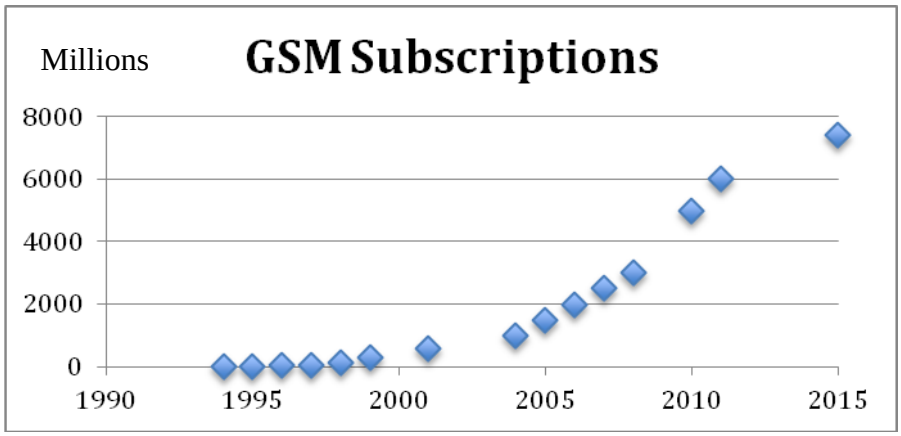
> "With that all financing models, pricing models, marketing models started to change, which made the mobile operators more sophisticated than the landline monopolies. Mobile operators were able to serve its customers faster and better than landline operators." (interview)

This helped foster the growth of the mobile communications market. The total number of GSM subscriptions reached 1 million in 1994, 50 million in 1996, 100 million in 1998, 500 million in 2001, 1 billion in 2004, and 5 billion in 2010. Out of the 220 countries that currently run one or more GSM operator, 100 became members by 1997 and 172 by 2001.

> The number of his subscribers increasing from 1 million to 50 million would create a market. In short, on one hand you see the driving forces in technology, on the other hand you see the transformation of the market as a private but regulated market. This transformation happens as a national polity in each country, moving from monopoly to multiple licenses. (interview)

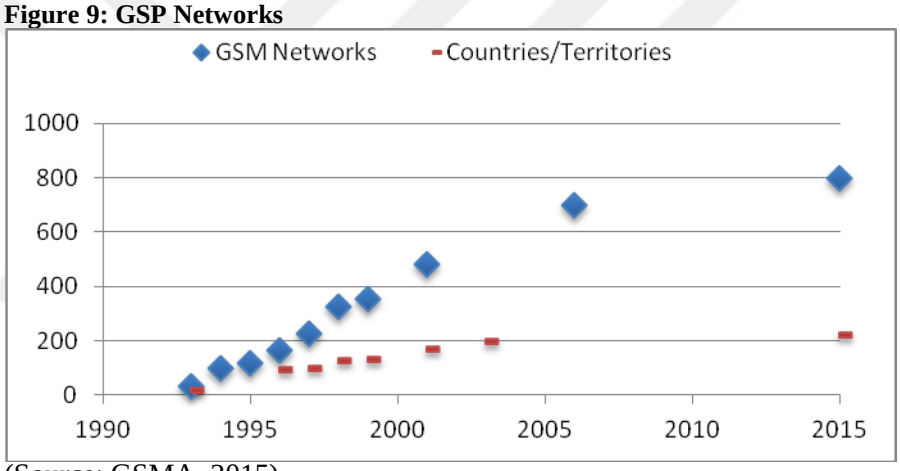
Within these 220 countries, there are 800 current operators. Of these, 100 became members in 1994, 227 in 1997 and 480 in 2001. Thus, although the number of new GSM subscriptions (new subscribers and/or handsets) kept rising sharply, in terms of operators and countries, the steepness of growth in the 1990s started to flatten after 2001.

Figure 8: GSP Subscriptions



(Source: GSMA, 2015)

Figure 9: GSP Networks



(Source: GSMA, 2015)

The three key players in the mobile communication sector dominated by the GSM standard were Ericsson from Sweden, Nokia from Finland and the governments of the European countries. Nokia and Ericsson both produced infrastructure, equipment and handsets. Ericsson benefitted greatly from the GSM because they were able to supply everything from A to Z. Siemens and Alcatel played roles as well, but Ericsson was more prepared, because they were even providing the handsets. As a former executive from Ericsson explains:

> Handsets were very important and at the beginning, there was no one to provide handsets. For a while, Ericsson had 100% market-share on handsets. In fact, Ericsson left other standards very quickly and suddenly entered into GSM and took off from there. Nokia followed behind and all other player followed as well. But meanwhile most of them lost something like 2-3 years, while Ericsson was taking off. (interview)

A key characteristic of GSM was the capacity for data communication, initially as a supplement to voice communication. This was another reason for Ericsson's success in the sector.

> In Ericsson data and sound existed as two separate lines. In other words, the sound was the telephone system and the data was the pager system. The two systems were working on separate frequency ranges. For Ericsson, serving to GSM became like some sort of a mash. Because it was a mash, for sure Ericsson gave a very fast service in this matter and it took up the pioneer role in the formation of the GSM market. (interview)

The European governments allocated important resources to support the invention of mobile communication, co-operating on a Pan-European standard, as well as privatizing the mobile communications sector by licensing the frequencies needed for the operation. Thus, as GSM operators were created, they bought the licenses and started increasing the mobile communications services in a regulated but also protected market with relatively high profit margins. The initial set-up of the mobile communications sector thus looked like Figure 7. Mobile operators were created in many countries, to which these key players supplied infrastructure, equipment and handsets, creating a network of operators,

many of which became important revenue generators in their countries. Ericsson and Nokia became the key spokespersons for the expansion, and the governments of the new member countries supported the development as the sector brought in significant funds through licenses and taxes. When the sector arrived in a new country, the government auctioned mobile communication licenses to one or more operators. The operators then obtained the necessary infrastructure from the infrastructure producers and the handsets from handset producers. Most of the time, operator-selected or -approved distributors would release handsets to market and operators would sell the SIM cards that enabled using the mobile communications services through the handsets. The technological improvements in this period were limited to infrastructure improvements, SMS and miniaturization of handsets. The former CTO of a major mobile communications company explains the developments in mobile handsets:

> Ericsson was very strong in technology and business foresight. There were people who could speculate for 10 years into the future. For instance, even when they had 100% market share on handsets that were telling that they will not be able to compete in the handset market as they say handsets are consumer products and they are strong in engineering but not in consumer products. In contrast Nokia believed that it could be successful in handsets, which is a consumer market and developed strategies that would take away Ericsson's 100% market share and create world dominance in the handsets markets. Ericsson share had already dropped to 65-70% in 1993 that continued to decline until they sold the business line to Sony. (interview)

This system created only a limited group of gamers. In this setup, a game developer could enter the system either via a handset manufacturer or a mobile operator. As shown in Figure 1, the limited points of entry made the

bridging actors such as distributors or decision-makers at the handset manufacturers very powerful compared to an outside actor.

4.1.1 The four moments of translation

A young computer programmer who was into games since his childhood, Nikas Hed was the key developer behind Rovio. In early 2000s, Finland was one of the key countries in the mobile communication sector thanks to Nokia. Nokia was producing infrastructure as well as handsets for mobile communications, and was also developing and supporting complementary technologies and services. In this environment, Hed started to show interest in developing games for mobile phones.

This constituted the beginning of Hed's translation of mobile phones. The translation process in the first period of Novio's existence was a long one. It extended over 5 years, during which Hed was a primary mover of the story from the start.

Problematization or how to become indispensable

In 2003 Hed was a student at Helsinki University of Technology (currently Aalto University School of Science). He wanted to develop games for mobile phones. The general question Hed set forth to answer was simple: "Can mobile gaming be a scalable business?" Mobile games in those days were usually followed by small, enthusiastic communities. Scaling up mobile games would mean either expanding these gamer communities or being able to charge high fees to the existing gamers.

As a student, Hed had an initial mini-problematization, which was how to be taken seriously as a game developer. He joined forces with Jarno

Väkeväinen and Kim Dikert, also students from the same university. He started seeking advice from his network. He went to meet Peter Vesterbacka from Hewlett-Packard (HP), who advised Hed and his collaborators to go to the Assembly Demo Party, which was a very large yearly demo-scene and gaming event sponsored by HP and Nokia; Vesterbacka was on the organizing committee. The three developers decided to take part in the event and developed a mobile game called the King of the Cabbage World. This was a multi-player mobile game produced on one of the first smart phones. With this game they won the competition in their category. The title from this event served as verification and transformed the group from a bunch of young enthusiasts to potential actors in the mobile gaming arena. It was again Vesterbacka who suggested that these three developers should start their own company and produce games. They took his advice and founded Relude in 2003. The existence of the company, although it did not have any products or revenue yet, was another artifact that symbolized the seriousness of the three actors.

The interdefinition of the actors

As mentioned in the methodology section, Hed's question led to the definition of two sets of actors. The first set was related to the company and the second to mobile gaming. The definition of actors within the company related to several events:

The manager

A manager was needed to figure out how to make money with games. As a coincidence, Niklas' cousin Mikael Hed, who had been studying and working in France and the United States, came back to Finland after 8 years abroad and was looking for business opportunities. Mikael had a background in business management. Niklas approached Mikael about leading the company. Mikael recalled:

> It was one of the most intriguing options for me at the time. Me and my cousin had always been close and even as kids, when we got together, we would play games. Later, we would talk about what kind of games we would make if we could, but we never really thought we would actually end up doing it to be honest. But then Niklas did start a gaming company, and I thought, you know, why don't I help these guys out a bit and set it up as a proper business while I look for other opportunities.(Cheshire, 2011)

In 2004 Mikael invested a few thousand euros of his own, arranged the first office space for Relude, became the CEO of the company and started the tough job of thinking about how to make money in the gaming business.

The investor

Another key ingredient for the company was financial resources, which Niklas and his friends had little of. The investor they sought would eventually come from the Hed family as well. However, the team needed to show more proof that their business was worth an investment. They needed to show that they could execute well and generate income.

The perception of the first set of actors influenced the focus of the second set of actors related to mobile gaming:

The game

As described in the previous chapter, there are many decisions that must be made in game development regarding the game play and style, as well as the manner of distribution and monetization. Niklas Hed had a liking for games that involve physics. His award-winning game, King of the Cabbage World, was a multi-player game. The initial decisions Hed made were successful in attracting interest in his work as a mobile game developer.

The handset

As a key device by which a game becomes operational, the handset has unique features compared to the other game play interfaces like PCs or consoles. There was no media inlet in handsets in the early 2000s, which made it challenging to get a game onto a mobile device. Hed and his friends had the advantage of being close to Nokia, one of the major global handset developers. They were able to have the manufacturer embed their games into the handset. However, even if the game was stored in the handset by the manufacturer, profitability remained an issue. The consumers would not pay for the game, so the game producer had to be paid by the manufacturer, which obviously gave significant bargaining power to the manufacturer. It was hard for the game producer to link the material gains of the game to the number of handsets sold by the manufacturer. A game needed to have highly demanded features that were hard to replicate in order to give the game producer the upper hand in negotiations with the handset manufacturer.

The second way to get onto a handset at that time was to have the game downloaded from the internet. In early 2000s this was possible but quite challenging. Data communications were in their infancy in early 2000s; this changed dramatically in the mid 2000s with the introduction of 3G. Additionally, not all handsets were capable of receiving data. Moreover, when a game is received through air it needs to be paid for by the gamer. Thus, a payment system needs to enable funds to be transferred from the gamer to the game producer. In early 2000s such payment systems were very limited. Most of the time, the only viable way was through the mobile operators, so the game would be purchased from the mobile operator upon download. This, however, created two challenges. First, there were two to four operators in each market and hundreds of operators globally. This made the global mobile gaming market very fragmented. Thus, thinking about mobile gaming globally would require an advanced sales organization. The

second challenge was that mobile gaming was not considered as a core business but rather a value-added service by the mobile operators, so most operators did not bother to manage it themselves but rather tended to outsource it to content distributors. As a result, the revenue was shared not only by the game producer and the operator but also a middleman, lowering the margins for the producer. Regardless of whether the producer would approach a distributor or an operator, in both cases, he would be in a weak position for bargaining, as the other party had a bridging position between the game and the gamer.

Another consideration about the handset is its technological capabilities, including the capabilities of the operating system and compatible software, the graphical and user interfaces, memory and processor capabilities. All these aspects set limits on the possibilities of the mobile gaming.

It is important to note one major feature of the handset: it accompanies its user constantly throughout the day. This represents a significant advantage in terms of accessibility compared to other gaming interfaces, which usually become operational only when the gamer intentionally wants to spend his time gaming. Mobile phones offer the possibility of having games available during any short breaks a person may have, be they on the metro, while waiting for a meeting or on a coffee break, and so on.

The gamer

During this first period under investigation, mobile phones were poised to dramatically expand the number of people who participated in digital gaming. The ready availability of mobile phones made them interesting for casual gamers. A key question was whether the casual gamers were interested in downloading games or would only use the games the handsets offered to them. There was also a niche group of gamers who followed gaming blogs and went to the trouble of purchasing and downloading new

games online. They seemed to be influential in gamer communities and tended to set the trends in mobile games. One of the key questions was how big this niche group was. Hed and his friends needed to determine the market size and find the right target segment for their games. Then, they need to figure out how to reach that target segment. They also needed to understand who represented these segments and whether they could test their products with these representatives.

The definition of obligatory passage points (OPPs)

Callon (1986) explains how actors can determine their identities and those of other actors in a way that makes them indispensable. By doing so, they become obligatory passage points (OPPs). What were the key strategies by which Hed and his friends made themselves indispensable? With the actors defined, a few events needed to happen for them to create an alliance that would allow them to have an impact on the game-handset-gamer triangle.

First, a clear business vision and proof of execution capabilities had to be presented to potential investors so that they could be convinced to invest, and second, a strategic plan needed to be drafted with specific targets for the game-handset-gamer triangle defined in such a way that the team could place a bet on success with the existing resources. This plan would make the problematization tangible and effective. Finally, the necessary resources needed to be acquired and mobilized according to the plan.

The devices of ‘interessement’ or how the allies were locked in

This is the part of the story where the envisaged relationships were built and tested. This process entailed a series of discussions, negotiations and trials of strength through which Hed’s initial question was put to the test.

Mikael Hed had several other opportunities available to him when he returned to Finland and eventually took on the role of manager. Most of these competing choices were much less risky, and probably offered better pay, than a new company with almost no capital. Niklas managed to persuade him by appealing to his history with his cousin, talking to him about the games, his vision of mobile gaming and finally the promise of fun. There was not, however, a concrete roadmap to success. Mikael admitted, "I couldn't see how that company could make money. But I felt this is what I wanted to do."(Cheshire, 2011).

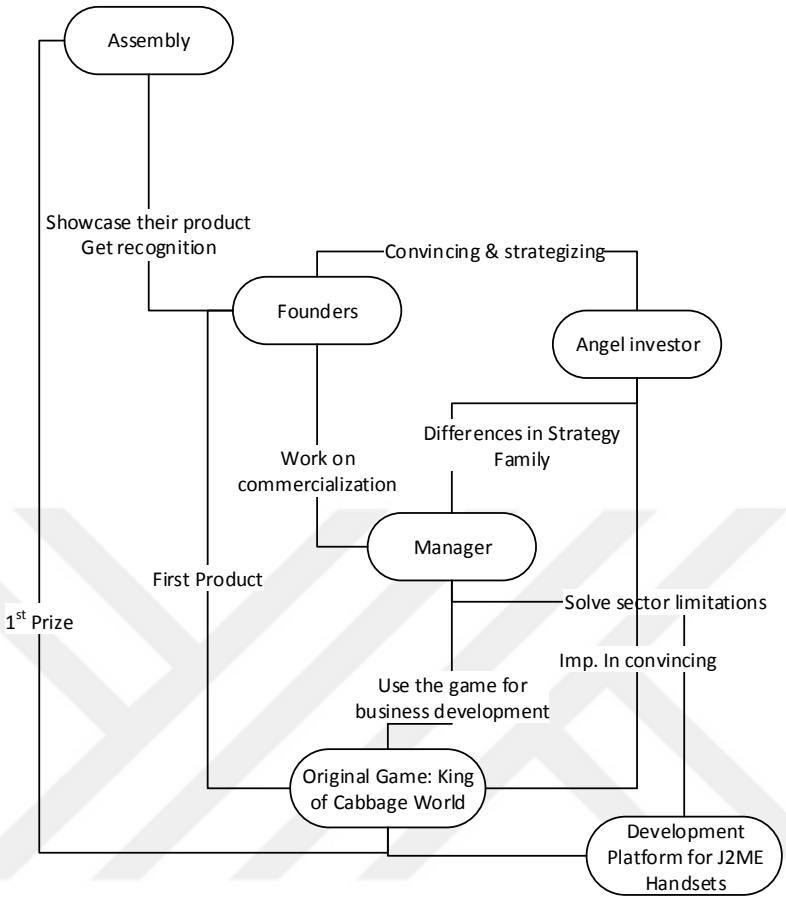
After joining the company, Mikael started contributing to translating the company and locking in allies. Mikael and the team looked into ways of using existing resources to build business relations. They wanted to capitalize on the game they created for the demo event, so they established relations with Sumea, an important Finnish game producer, which would later be acquired by Digital Chocolate, a global player in social games. Sumea had experience in interactive games. They started cooperating, resulting in an innovative outcome. The teams together produced a game called Mole War based on the game from the demo event. This was the world's first commercially launched real-time multiplayer mobile game. It was the first time that people in different locations could play against each other through their mobile phones on a real-time basis.

In this endeavor, they cooperated with Terraplay Systems, an advanced technology developer from Sweden. They used Terraplay MOVE, a network solution for mobile multiplayer gaming, to enable Mole War. Although the technology was cutting-edge for its time, it was quite primitive compared to today's technological capabilities. Thus, the team had to work hard to make the original game into a multiplayer one. Rovio's official comment on a YouTube post about Mole War was that "Making a real-time multiplayer game for J2ME phones was not a picnic back in the day,

because of limits imposed by the multiplayer platforms of the time and the network latency. The platform problems were fixed by tons of workarounds....”

Mikael and the team started interacting with a potential investor by the end of 2004. This investor also came from the family; he was Mikael's father, Kaj Hed, a serial entrepreneur who had already founded several companies. One of his ventures, Trema, a financial software business, had just been sold to a private equity firm for $150 million and Kaj had taken his stake. Thus, this actor had capital and several options in the market. Through their cooperation with Sumea and selling their first product, Niklas and Mikael were able to encourage Kaj to invest in their company. In January 2005, the team received an investment of €1 million from Kaj in return for 80% of the company. Introducing Kaj into the alliance would change the company and its approach to the problematization drastically. Kaj was not just a financial investor, he was quite hands-on. He wanted to see where the company would go and how to capitalize on the investment. Together, the team worked on a strategic plan that was a distillation of the negotiations and all parties’ views and choices concerning the game-handset-gamer triangle. The team also changed the name of the company to Rovio (which translates to ‘bonfire’), grew the staff to 20 people, and made a public launch via a press release issued on 9 March 2005. The strategy documents issued at this time represented what the company stood for.

Figure 10: The Relation Map at the Foundation of Rovio



The strategic plan revealed several choices about the game, handset and gamer, summarized as follows.

Game

- Focus on games with novel stories and uniquely innovative game-play
- Development of games of strategy, role-playing, adventure and fierce action
- More depth-in games and a far grittier visual style
- 3D as middle-term focus

Handset

- Flexible corporate partnership understanding
- Creation of a game development platform for third-party developers

The choices made regarding the handset seem a bit less defined than those made regarding the games. This reflects the team's recognition that game developers need a platform to make a game compatible with multiple handsets. The inconsistency in handset production and relative infancy of computing capabilities of handsets were significant issues. The flexible corporate partnership understanding, on the other hand, relates to solving game distribution challenges. It also implied that the team was willing to develop games for other distributors for short-term financing.

Gamer

- Focus on European market
- Effort to differentiate itself from generic games
- Nothing pink and fluffy

The team clearly identified advanced gamers as their target. They did not yet consider generic free-time gamers or younger children as their target. The strategy for tackling the game-handset-gamer triangle was therefore defined, the obligatory passage points werepassed, and the actors were locked into place in their efforts towards solving Niklas' problematization.

Interessement derailed

A significant contradiction arose right at this point in the story. The conflict arose between father and son, Mikael and Kaj. Although the family ties may suggest viewing the conflict from the emotional angle, the differences of opinion were deeper than this. The source of the conflict lay in whether to use an exit as a way of scaling the business. Kaj wanted to develop the

business in such a way that it would become attractive to a potential buyer. Mikael wanted to grow the business independently over a longer period of time. The strategic plan seemed to favor Kaj's interests more. What Mikael seemed to get from the strategic plan was the development platform, which would also benefit Niklas' development efforts.

This conflict was one of Mikael's core considerations when, only a few months after the plan was released and the company launched, he decided to leave the company. Niklas mentioned that it was a sore spot in the story of the company, especially because they were also family. Mikael simply could not see how the company would scale without giving more consideration to the handset and gamer aspects of the business. He had to choose between accepting a plan he didn't believe in or leaving. From this perspective, his action was not so surprising.

With Mikael out of the picture, the rest of the team kept aligned with the strategic plan, which served as an interessement device, and started defining their specific roles and executing on the plan.

Enrollment

Niklas started developing games with more depth and novel stories in the strategy, role-playing, adventure and fierce action genres. The highlights of these games were two trilogies, namely War Diary and Darkest Fear. Niklas produced two sequels after the original game release in both cases. The War Diary trilogy consisted of war combat and strategy games in different settings and with different scenarios. For instance, War Diary Torpedo was a submarine warfare game. Reviewers differentiated these games from other war games in that they focused more on strategy rather than testing quick reflexes. The games were also praised for their sophistication in graphics and game design. They were, however, criticized for being rather slow-

paced. In contrast, the Darkest Fear trilogy was a set of horrifying puzzle/adventure games:

> You step into the shoes of Mr. Thomas Warden, a self-professed 'history researcher' who has received a phone call from his wife, Susan, a doctor at Grim Oak's Hospital. Turns out she wants you to search the hospital for your daughter, apparently a patient there. The atmosphere is immediately eerie, featuring some of the creepiest music you're likely to hear in a mobile game. A film noir ambience permeates the frequent cut-scenes, maintaining a bleak sense of despair as you traverse each level, searching for the exit (Turton 2006).

The Darkest Fear games were praised for their game environment, with dark graphics, impressive light effects and creepy music. Elements like easy-to-use controls and engaging characteristics of the story also impressed reviewers. On the other hand, the ease of the puzzles and lack of replay value were the main criticisms. No replay value means that once a player reaches the end of the game, he/she may not want to play the game again, making the useful life of the game rather short. This is an important criterion in the commercial value of a game.

Rovio developed other games internally during this time, like Desert Sniper (war game) and Paid to Kill (adventure game). As indicated in the strategic plan, the team was not against commissioning for other firms as well, so they developed a few commissioned games like Playman Winter Games (ski-game for Real Networks) and Marine Sniper (war game for Abandon Mobile).

Rovio also started to receive awards from various game magazines, portals and communities. These entities represented mostly the advanced gamers

who followed them to keep up with the latest news on gaming. Some highlights of these awards are:

- July 2005 - Darkest Fear receives an Airgamer Award. Airgamer was the leading online magazine for mobile games in Germany. (www.airgamer.de)
- December 2005 - Darkest Fear wins first prize in Airgamer's most popular mobile game 2005 competition.
- January 2006 - Darkest Fear receives Best Sound Award in Mobile Game Faqs Awards 2005. Mobile Game Faqs was the UK's only site dedicated to mobile game reviews.

Other awards came from Midlet Review, one of the leading mobile game reviewers; IGN (www.ign.com), a leading game website; and Pocket Gamer, one of the Europe's leading sources of news, reviews and features on the world of mobile and handheld games (www.pocketgamer.co.uk).

Niklas also focused on developing a platform for multi-handset game development. This platform was aimed at shortening the development cycles for game production. This addressed a problem with early stage mobile phones, which later on was solved by Apple and Google to a large extent. In September 2005, Rovio received funding for this platform from the National Technology Agency of Finland (TEKES). Tekes is governmental organization with a budget of approximately €7 billion to fund innovative activities in Finland. With the funding from TEKES, Rovio released the second version of the platform in January 2006. The platform supported 330 different devices and offered localization opportunities for multiple languages.

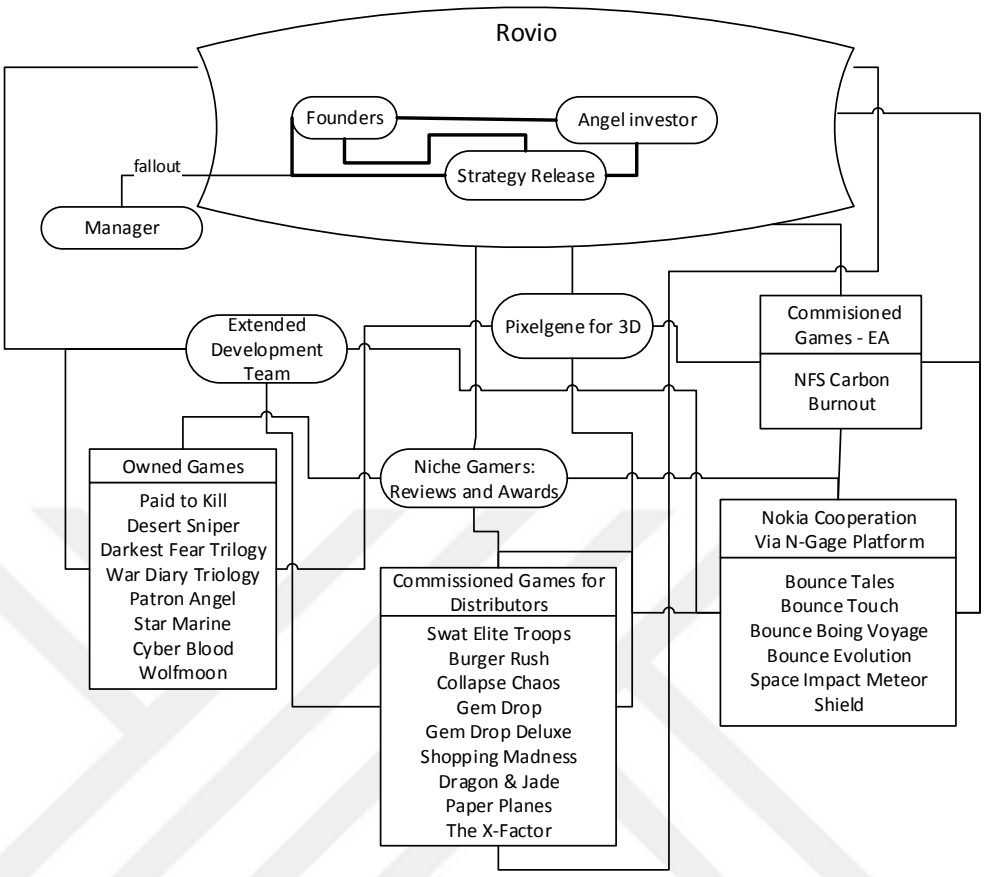
Kaj also started executing on his roles and made important contributions to the company. In December 2005, Kaj enabled the company to have a second financing round to support its rapid growth. The amount of second-round financing raised was not disclosed. Tuomas Kosonen, CFO of Rovio at that

time, explained the vision of this financing round as: “This second financing round enables us to continue developing our leading edge, modular mobile game development platform, as well as to introduce 10 new titles in 2006. Simultaneously, we will keep expanding our distribution reach, and recruit more talented people.” An important portion of this financing was used to acquire a 3D software developer for portable gaming devices called Pixelgene in January 2006. Pixelgene's proprietary game development platform was specially tuned for mobile 3D, and supported Java, BREW, and Symbian. This acquisition accelerated the company's mid-term target of developing 3D games. In parallel to the acquisition, the company agreed to work with Electronic Arts (EA) on a mobile version of the popular car race game Need for Speed. The company thus took on a challenge to adapt a highly popular PC game to mobile. The resulting game Need for Speed: Carbon was released in October 2006. This game became a milestone in the company’s history as a serious showcase of its skill set. This line of work-for-hire helped Rovio acquire additional know-how in game design, sales strategy and technology.

Kaj also supported the company in terms of management resources. There were some top-level human resource acquisitions. For instance, Mr. Pertti Miettunen joined Rovio's board and became a shareholder in the company in August 2005. He had over 20 years of experience in information communications technologies (ICT), mobile gaming, and engineering businesses including cross-border mergers, acquisitions and strategic alliances, project and corporate finance as well as private equity and venture capital management.

The following figure encapsulates the key relations during the enrollment.

Figure 11: Network of Actors, Period 1



To sum up, this network has the founders and angel investor aligned with the common strategy, and an extended development team and Pixelgene serve as enablers. The EA relation and the related games serve as accelerators. The network has three parallel lines: Rovio's own games that establish its reputation, cooperation with distributors that provides cash flow and cooperation with Nokia for futuristic game development. The blockmodel below shows that the relations are relatively dense, although not fully connected between the parallel lines:

Figure 12: Blockmodel, Period 1

	Rovio	Extended Development Team	Pixelgene	Commisioned Games - EA: 1-NFS Carbon 2-Burnout	Niche Gamers: Reviews and Awards	Owned Games	Commisioned Games for Distributors	Nokia
Rovio		1	1	1	1	1	1	1
Extended Development Team	1		1	1		1	1	
Pixelgene	1	1		1		1	1	1
Commisioned Games - EA: 1-NFS Carbon 2- Burnout	1	1	1		1	1	1	1
Niche Gamers: Reviews and Awards	1			1		1	1	1
Owned Games	1	1	1	1	1		1	1
Commisioned Games for Distributors	1	1	1	1	1	1		1
Nokia	1		1	1	1	1	1	

The mobilization of allies

Since the moment of strategy creation in early 2005, the key actors in the company mobilized several allies and undersigned significant achievements. The resulting network consisted of Rovio at the core, strengthened by a larger team, acquisition of a company specializing in 3D, distributors that marketed mobile games and Nokia advancing technology in mobile games.

Main operations of this network on the game-handset-gamer triangle included:

Game

After the cooperation with EA, the company signed more business deals with bigger game distributors. Among these were Real Networks, Mr. Goodliving, Namco Bandai Networks Europe and Sumea/Digital Chocolate. Each cooperation gave the company versatility in game development know-how and some income. The money earned, however, did not justify engaging in larger projects.

Handset

Nokia was a great ally to Rovio with respect to the handset part of the triangle. In August 2005, Rovio became a member of Forum Nokia PRO, a program that provided advanced technical, business development and marketing support to selected mobile software companies. This membership helped Rovio to further strengthen its relationship with Nokia, gain early access to Nokia technology and take advantage of specialized service and support provided by Nokia. In return, Rovio ensured the close integration of its software with Nokia's devices. The relationship deepened after the acquisition of the 3D company Pixelgene and the successful release of Need for Speed Carbon for EA. Rovio's cooperation with this group led to joint technology development and showcased what could be done on Nokia phones, especially with respect to Nokia's new N-gage gaming platform. The main work was done on the further development of Nokia's successful game, Bounce. Rovio developed four different versions of Bounce games, three of which were in 3D. However, this major endeavor with Nokia did not lead to a solution of the problematization either.

Gamer

The company did not consider the gamer thoroughly enough after Mikael left, and seemed to be stuck with a limited segment of the gamer community, the adventure-horror-war lovers. The games produced for the distributors somewhat enlarged the gamer community without adding a second focus group.

Towards the end of 2008, this network started to be challenged. Rovio was not acquired by a bigger player, which was its exit strategy. Furthermore, the operations did not generate enough cash to create a scalable business and the network was financially challenged. Rovio not break even, so the capital infused into the company by the two consecutive funding rounds was almost depleted. It did not look possible for the company to continue

following the plan much longer. Thus, the choices they made concerning the game-handset-gamer triangle did not suffice to achieve a scalable business. In this respect the changes in the mobile sector that led to the second, more successful period of Rovio's history were important.

4.1 PERIOD 2

By the late 1990's and into the early 2000's, the GSM sector was still growing heavily in subscriptions but started to stagnate in terms of new potential operators and countries (Figures 9 & 10). By 1997, the sector had already enrolled half of the countries and about one third of the operators that exist today. The sector had become a global giant, but signs of stagnation were apparent as its geographical expansion reached some natural limits. As further expansions continued, the later-enrolling regions had weaker economies and thus smaller profit margins, so they demanded cheaper infrastructure.

4.2.1. VAS Era in Mobile Communications

Once the geographical expansion and market penetration reached a certain stage, the growth rates on profits started to slow down, which affected the demand for infrastructure and handsets. The saturation of basic mobile communication services was discussed not only by Nokia and Ericsson but also by the government agencies, research and innovation centers in Finland and Sweden. The former CEO of a cluster-building organization explains:

> Culminatum was established in 1995 to promote university and knowledge based industries. I was CEO during 2001-2005. The biggest driver was ICT cluster as you know and led by Nokia, who became a world leader in its field and huge growth of Nokia and ICT

> cluster. As Culminatum we realized we can't be dependent only on ICT cluster in the future, you never know how long is this success story and now we know, it was not that long and what Culminatum started was to strengthen other clusters in the region which were research based and organization cluster development programs and projects within the other clusters. Software industry was the number one, maybe the most important cluster we were organizing at Culminatum because many kinds of software industries were close to the huge ICT cluster. (interview)

One solution was combining Internet, local telephone and TV services with mobile communications. This solution was applied in Finland and Sweden but it was hard to apply to other countries, as all these sectors were regulated differently by the governments. As an alternative solution, the sector introduced the "Value Added Services" (VAS) concept to reignite growth (i. The idea of VAS was to make a handset more than just a phone. Any new service that was operational on a handset would bring in more revenue to the operators, so more and more operators started demanding these new technologies.

VAS had two main streams The first one related to adding new features to handsets, such as cameras, music players, etc. Nokia was leading this stream. By the late 1990s and early 2000s, Nokia was producing phones like the 3310 and 1100 (Appendix 1.1), which became the most popular devices of all time. Nokia widened the spectrum of devices with N-gage, a combination of a mobile phone and a game console. The first phone with a built-in camera was the Nokia 7650, which had an unusual design (Appendix 1.1). The 7650 was the first smartphone featuring a 1-megapixel camera and a mobile web browser, and was also the first business-optimized smartphone (Nokia Communicator Series) with a QWERTY keyboard and a LCD screen.

The second stream of VAS was related to data usage, sharing music, photos etc. and especially surfing the Internet, as explained by an Ericsson executive:

> At Ericsson we worked hard on data usage. Well, for example in Turkey, we made something called GPRSLAND; and received the best application of the world award by the GSM Association. Ericsson was also establishing experience centers, innovation hubs, and content development companies to sell data. We established Makko. Its sole reason was to make the data usable (interview).

The Internet is a technological, or a techno-social actor that emerged in 1990s and started affecting many actor networks, including that of mobile communications. The Internet became a very big force that influenced how people live by changing their relationship to information.

The availability of the Internet provided a world of reasons for people to want data connectivity. Data connectivity in turn created new areas for infrastructure and handset demand that kept the sector growing. Ericsson was one of the key actors in this very promising stream. In 2003, Ericsson introduced EDGE, an improvement to the GPRS system that increased the speed of data communication. When the first EDGE network was commercially launched in the USA, it was already clear that EDGE would be insufficient to create a revolution in the mobile Internet. However, another technology was being developed by the International Telecommunication Union (ITU). The ITU was formed in 1865 at the International Telegraph Convention and became a UN specialized agency in 1947. Their new technology was called 3G. In 1996, Ericsson started working on 3G, pushing the version based on the GSM standard (the

wideband CDMA or WCDMA), and formed an alliance with a Japanese operator, NTT DOCOMO. The operator launched a pre-commercial network in 1998 and the first commercial 3G network in 2001. This also represented the finalization of GSM's victory over Qualcomm's CDMA, even though 3G was actually based on CDMA technologies. As the former executive of a key mobile communications company explains:

> Still GSM won the war, but then what happened with the 3G was that 3G was an advanced version of CDMA, it was W-CDMA and it was a new network. So when operators built 3G they built a W-CDMA network on top of a 2G network. Also CDMA networks, when they switched to 3G it was in fact easier for them as W-CDMA was actually an advanced version of CDMA. (interview)

This also facilitated the switchover of existing CDMA operators to 3G. The reason why some operators initially wanted to try EDGE rather than 3G was mostly economic. 3G required a different frequency range, for which the operators needed to get licenses from the government. For this reason, when operators built 3G, they actually built a WCDMA network on top of a 2G network. As governments observed the tremendous growth in GSM subscribers, they demanded extremely high sums for the 3G licenses. The preparation processes for auctioning off these frequencies in different countries also took time. Additionally, 3G required operators to build totally new networks, which was great for infrastructure providers like Ericsson but a very serious concern for operators. The third concern was that the existing handsets did not support 3G. Thus, customers needed new handsets if they wanted to use 3G. The first 3G-capable phone came from Nokia in 2002. These obstacles to adopting 3G started to resolve by late 2003.

Although 3G was a costly operation, it had many advantages. 3G networks supported a data transfer rate of at least 200 Kbit/s. This enabled surfing the

Internet very smoothly and also allowed applications like Global Positioning System (GPS) and associated location-based services, mobile TV, telemedicine, video conferencing, video on demand etc. Even if they were initially reluctant, many mobile operators found themselves being pushed into investing in 3G, especially by competitive forces. In 2004, the number of 3G operators launched was 50, which more than tripled in 2005 and then more than doubled again in 2006. The new wave of 3G helped Ericsson to make a strong recovery after the slowdown of GSM expansion. Once an operator started to invest in 3G, they needed to justify that investment, so VAS became a major focus; simple content and games were not enough. They needed full-album music, high-resolution video, heavy Internet browsing and advanced games to be transferred through mobile networks. In short, they wanted to replicate the PC experience on mobile phones. 3G succeeded in accomplishing what EDGE failed to do, namely starting the real mobile Internet era, a radical innovation that changed the shape of the mobile communications sector. Additionally, Ericsson worked hard on data development by finding applications that would encourage 3G usage, as explained by a former Ericsson executive:

> Ericsson was also establishing experience centers, innovation hubs, and content development companies to sell data. We tried to make a lot of applications. Whatever is being used today we worked on in those days (interview).

The developments in the telecommunications technology in the early 2000s made the initial black box of the mobile communications sector unsustainable. 3G provided a big enough motivation for players from the computer and software sectors to take actions in the mobile area. Initially, actors in the mobile communications, computing and software networks were loosely connected. 3G became a transforming force that pushed these networks closer and tried the strength of the black boxes in each network.

The data speed enabled by 3G for the first time convinced computer and software developers of the possibility of creating mini computers for the mobile sector that could replace the existing handsets.

Figure 13: Merger of mobile communication and software sectors

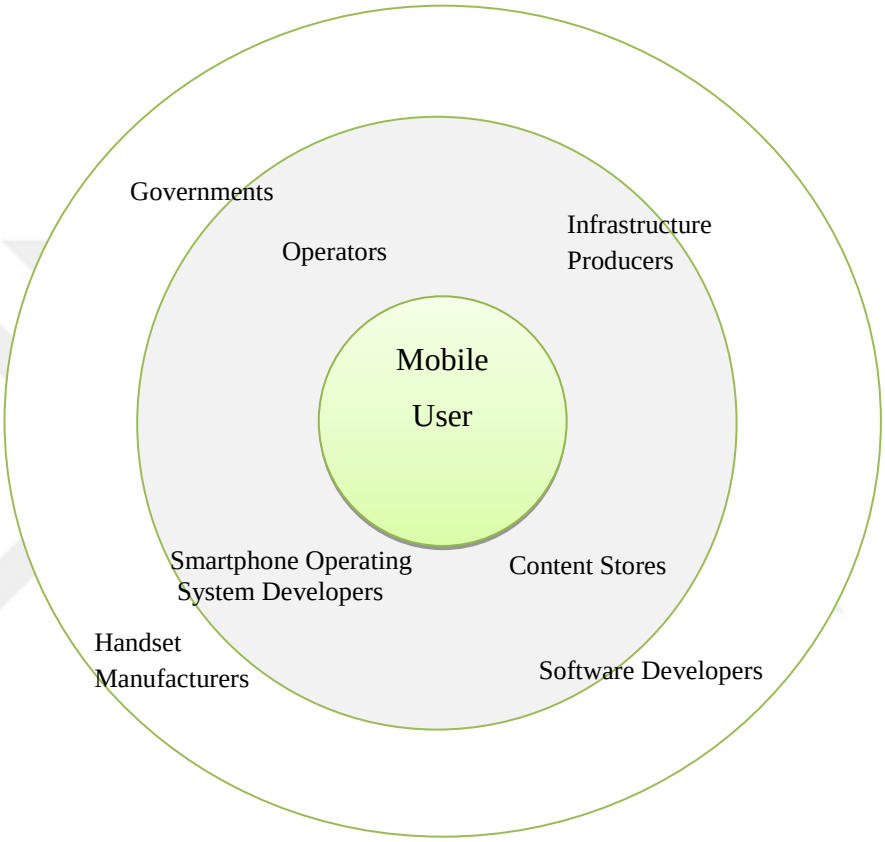


Figure 13 depicts the mobile communication sector after the initial black box was shattered. With the introduction of 3G, in combination with improvements in processing and battery technologies for handsets which allowed more computing power and better graphics, handsets were significant candidates for becoming mini-computers. Notice that new actors like operating system developers and content stores assumed strategic roles in the mobile communications sector, with closer affinity to game producers

in changing the relations of the mobile gaming business. Important actors in the computer and software industries started innovating in the mobile communications sector, again explained by an Ericsson executive:

> In the 3G-era, telephones were getting smaller, the screen getting bigger, data being included to it and the processing capacity was increasing. This started to open up a wide range of new possibilities. This enabled many activities to be processed through the mobile device without connecting to any fixed computer. These are the most important milestones for mobile communication to change shape (interview).

The actor that changed the sector most drastically was Apple. When Apple decided to enter the mobile sector, it took a much more serious and well-structured approach than prior entrants. As a former Turkcell executive explains:

> We were talking constantly for many years how to increase value added services (VAS) and use of data. We were talking about many alternatives. What we considered most probably that there would be strong content distributors who will create and drive the market or operators like us would do the job. We have also started many initiations at Turkcell for this purpose. Then came Apple and later Google and changed the market (interview).

Apple saw the limitations of the mobile device as challenges and treated them seriously. In 2007 Apple launched the iPhone (Appendix 1.2), which represented a big leap forward in the user experience. The first iPhone was a very user-friendly device and enabled users do both serious and fun things. It had its own usage rules that made the device intuitively usable. Even kids and elderly people could learn to use an iPhone relatively quickly. It was a

smart device that had Internet and computing abilities in a small package and looked very simple. It had innovative features like an advanced touch screen that could be operated with fingers rather than a pen, and a gravity sensor that understood whether the device was being used horizontally or vertically.

Along with the iPhone, Apple contributed to the convergence between the mobile and software sectors with several groundbreaking innovations. The first innovation was the high-quality graphical interface of the iPhone, with a new code infrastructure called Objective C that made it far more efficient for others to develop high-quality software. Apple kept improving the software architecture, enabling developers to use more and more advanced features. The innovation on the business side, however, was far more important. Apple had previously enabled its computer users to make easy credit card payments through a program called iTunes. iTunes was a radical innovation in the music sector. As Apple enabled iTunes on the iPhone, it solved the payment challenge for all iPhone users. Additionally, Apple came up with another key innovation called the AppStore in 2008 (Appendix 1.3), which was an online application store for all Apple users worldwide.

AppStore was factory-installed on all of Apple's iPhones, iPods and (later) iPads. The success in sales of these products created a huge global market in which software developers, including game producers, did not need distributors anymore. They could publish their products globally by paying a standard 30% commission to Apple. This was a disruptive innovation that changed the power relations in the mobile gaming sector. As the former executive of a mobile communications operator explains:

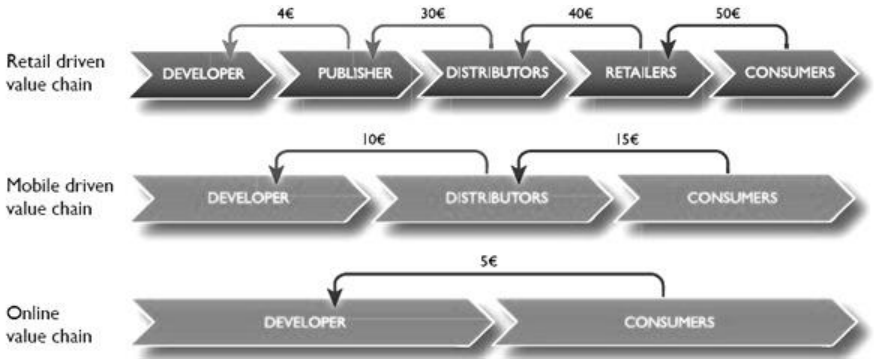
> Apple made better [handsets] that are similar to the existing things and put a business platform on top of it. The biggest

> difference that Apple made there was this. As I said before, the processing capacity, the memory capacity, the size getting smaller, and the screen getting larger. What do you start doing with the four of these? You for example become able to make Angry Birds. Why? The screen is larger, and there is process capacity. You are able to add 'color' you are able to make processes on it, etc... Therefore, all of a sudden you make it become achievable. It is not enough for it to only become achievable. Secondly it should become sellable. Those two are very important. If it did not become achievable it would not be sold. What difference would it make if was made but not sold? (interview)

Now the game producers were finally able to sell their games worldwide, without paying unfair commissions to middlemen. The iPhone and the AppStore introduced a very large community of software developers to the mobile sector. De Prato et al. (2014) describe the situation as follows:

> Online digital distribution has affected the value chain structure, resulting in a convergence of the roles of the distributor and of the retailer under the range of activities of the publisher. A whole part of the core business involving publishers, distributors and retailers has basically disappeared as there is no longer any need to duplicate physical products because these can be distributed over the network. The publisher, in many cases, directly distributes games, without the need for a distributor to act as intermediary between the publisher and the retailer: i.e. "disintermediation" is taking place, cutting out the role of the distributor. By the same token, it creates opportunities for developers to circumvent existing intermediaries and to sell directly to the end customers (De Prato, et al., 2014).

Figure 14: Changes in the value chain by mobile and online content (De Prato, et al., 2014)



Source: EGDF (2011)

AppStore enabled the real merger of the mobile and software sectors. Apple offered a worldwide market to software developers and the new applications developed by thousands or millions of software developers significantly enhanced the perceived value of the iPhone for the end-users. The rise of the iPhone and AppStore was dramatic:

> A simple figure displays the absolute success of the mobile applications: within five years (July 2008-October 2013) the number of apps available for download in the Apple platform has grown from 500 to more than 1,000,000 with 60 billion downloads in total (De Prato, et al., 2014).

Like PC manufacturers before it, Apple created a closed system for its mobile devices where the operating system was designed for its own hardware. In contrast, Google entered the market with a distributed operating system that could be sold to various handset producers. In 2007 Google launched the Android operating system together with a consortium called the Open Handset Alliance that included HTC, Sony, Samsung, wireless carriers such as Sprint Nextel and T-Mobile, and chipset makers such as Qualcomm and Texas Instruments. The first commercial Android

smartphone was the HTC Dream, released in 2008. Google developed Android as open source, in contrast to Apple's closed system, so developers could freely use the Android code base to check the technology and even try some alternatives. As the former executive of a mobile communications operator explains:

> By the way, we should not forget about Google. Google developed Android as open source, while Apple has a totally closed system. So you can never buy apple operating system, even if you are willing to pay a lot. But you can freely use the Android code base to check the technology and even try some alternatives yourself. Of course if you decide to use the Android platform you start to pay to Google for many applications separately. (interview)

Android made an impact through achieving high market penetration in smartphones. Apple did not have quite the same effect, as the iPhone was a rather premium product. Together with Android, Southeast Asian electronics producers such as HTC, Samsung and LG produced very competitively priced handsets, leading to very strong entries into the market. The combination of strong software and cheap handsets made life very challenging for the former leader in handsets, Nokia. Nokia resisted using Android and insisted on developing its own operating system. However, it could not keep up with the functionalities offered by the Apple or Google operating systems. In this sense, Nokia lost the competition in handset operating systems rather than handset manufacturing. With these changes in the sector, Nokia started to become less and less of a global player, making the alliance with Rovio less effective for the company.

The content stores create by Apple and Google successfully turned many mobile users into mobile gamers. The games became easier to download, more fun and interesting, and gamers could pay for them easily, enabling

the producers to capitalize on their developments. Several network operators tried to open their own stores and provide some extra advantages, but these efforts were relatively insignificant compared to the growth of the global markets created by Apple and Google. The state of affairs was such that

> The top grossing iOS and Android apps generally came from games. In September 2012, games accounted for 64% of the combined total, a year later; this had increased to 77%. The iOS market (iPad, iPhone and iPod Touch) generates 89% of its revenues from mobile gaming (Newzoo, 2012 quoted by SNJV, 2012). Also games were the most downloaded apps across the iPhone (33%), iPad (48%), from Google Play (37%) and the Amazon Appstore (a remarkable 63%) in 2013, according to a study from Distimo (De Prato, et al., 2014).

As an experienced early entrant into the mobile gaming sector, Rovio was capable of seeing the changing trends at the right time and acting on them in an effective way.

4.2.2 Four moments of Translation

Interessement renewed

As the company's future became more and more questionable, there was an inevitable need to reevaluate the process of translation that had transpired so far. The actors did not change the problematization. The question "Can mobile gaming be a scalable business?" was still very relevant for the actors. However, the planned strategy as an interessement device lost its relevance and strength. There were significant changes in the mobile

communications sector and Rovio needed to adapt itself to these changes. It was evident that the approach to solving the problematization needed to change. At this point Niklas started looking for alternative ideas and got in touch with Mikael again. Their interactions and ideas about alternative solutions proved interesting enough that Niklas convinced Kaj to welcome Mikael back to the team as the CEO. Because Kaj had already executed his strategy without significant return and spent a significant amount of capital, he did not have much reason to resist an alternative approach to the problem. But on Mikael's part, a new strategy that put the gamer first was key in his new alliance with the company. The new strategy targeted Apple's AppStore.

Enrollment renewed

Rovio had created an iPhone game called Totomi for a customer called Connect2Media. That was their first trial of the ObjectiveC development language. However, the actors did not have deeper relations with Apple or Google. Mikael and Niklas started analyzing the AppStore. Because the newly launched AppStore was already a competitive environment, the game needed to appeal strongly to users. This time it was end-user focus that fully guided the development strategy. This was a choice in line with the direct link Apple created between the developer and the end-user. The team worked on profiling the typical iPhone user and realized that the user base encompassed a very wide range of segments. Thus, they realized that the game needed to be for everybody. This was a challenge for Rovio as they were used to making their own games for a specific segment of gamers. They came up with other criteria as well: the whole game should be playable on the iPhone, but should be expandable to other platforms; it should be a physics game; there should be no tutorial before playing; the loading time should be minimal, so it could be played anytime, anywhere; and it needed an icon which would stand out in the App store.

These criteria were the foundation of the concept design. They kept searching for a concept that fit the = criteria. Jaakko Lisalo, Rovio's principal designer, would develop and pitch ideas and Mickael and Niklas would listen and evaluate these ideas. Jaakko had to pitch over a hundred ideas, sometimes 10 at a time, until he presented a drawing of birds in March 2009, two months after they defined the criteria. The birds were not only cartoonish, which helps with mass-market appeal as several mass-market producers use cartoons, but they were also interesting. As Mikael Hed would put it:

> There was something about those characters. These birds have no feet and can't fly. And they're really angry. We all started thinking about why they are so angry. For such simple characters, they made us think so much. There was some magic to it (Cheshire, 2011).

When the team selected the characters, they didn't solidify any idea about the game design. They let it evolve over time. There were some initial ideas which were very far from the final game. They built the story around the characters, developing a story about pigs stealing the birds' eggs and making them angry, as well as the gameplay with the catapult and many other character-centered aspects. One important criterion was the use of physics. Game physics was Rovio's strong suite, so they wanted to differentiate themselves using this know-how. As a former Rovio executive explains:

> They had this idea from the one big bird kind of draw; it was part of the design. Yak, the original designer of the game would draw the picture where there was a wall, different type of cubes and then there are birds, different color of birds. You're supposed to

> shoot– not shoot but throw the birds against the wall. People said, "No we love the characters of the birds because they're the round and different shapes." So they said, "We love these characters, but we don't like the game mechanics." (interview)

The team prioritized the characters over the game mechanics as a reflection of their focus on casual gamers. The characters had general appeal, which was an important feature. The team challenged itself to develop the game around the characters. As a former Rovio executive explains:

> So they had this kind of big bird evening, where they started to innovate and started to think what really makes the fan? They talk to customers like fans. Said hey, what makes the fan laugh? How should they make the game? They innovated that hey it needs to have more stories. They invented stories around good versus evil and the three eggs. There was a war and the three eggs left and the birds are protecting those three remaining eggs and pigs a lot. The birds used to be friends with pigs but then king pig became hungry and he started to crave for the eggs. So it's like a great fairytale. So the birds are typically happy, only angry when their eggs are stolen. So it's like a motivation. Also the name's catchy, Angry Birds, normally birds are happy so you are kind of intrigued to why are they angry (interview).

So, even before they figured out the game play, they worked on creating depth around the characters. Again, the focus on achieving mass appeal was visible in these choices. As a former Rovio executive explains:

> They try to kind of motivate the player to be engaged and high graphics, high sounds. So they really worked every single area

> of the game and they were very, very detailed at how it's supposed to be looking and feeling (interview).

Thus, the team was aware of the entertainment function of the game, which could be omitted by the niche players if the game mechanics were intriguing enough. But while trying to attract a mass audience that was necessarily good at playing games, they wanted to make sure that everyone could have a good time. Then they added their knowhow in game mechanics as a key ingredient that tied all these pieces together. These mechanics revolve around slingshots by which the birds are catapulted. As a former Rovio executive explains:

> They kind of discovered the slingshots. Sling shot everybody knows in this planet how the sling shot works, at least all the young players. Older guys who have been young and been in the forest, they know how this works. So it's like intuitive. At the same time, it's a pure physics game. Velocity, power and speed were put together with thought. It was not by accident. Then it was tested and tested until it came the final version of the Angry Bird Classic what is the largest game in the world (interview).

Another key challenge for scaling the game was the expandability of it. Their earlier games were interesting to play the first time, though there was little fun left once the challenges were resolved. Rovio adopted the Real Networks strategy of having many levels in a simple puzzle game for the masses, and also introduced a three-star system. Stars were awarded upon completion of each level, with more stars for a better performance. Getting the first star was rather easy so a free-time player could succeed, but achieving three stars was quite hard, something a heavy gamer would be willing to aim for. This was a neat way of enabling different types of gamers to enjoy the same game. These techniques had been added to the

toolbox of the company as tacit knowledge after working hard in the industry for six years.

After coming up with the main characters, it took about six months for Rovio to release Angry Birds. Careful attention to many aspects of game development went into the final product. Engagement was a key to success because mobile gamers tend not to be loyal. The developers wanted to create a game that was fun to play for a long time. Therefore, they placed importance on the music, which was recorded by a talented musician. They put in a strong graphics team onto the project. They worked hard on the story of the game and settled on a plot involving good versus evil. In the world of the game, pigs and birds used to be friends but then the pigs got hungry and greedy, and they loved eating the birds' eggs. Thus, there was a justification for why the birds were angry at these docile-looking pigs. They tried to make the story universal by minimizing the use of language and making everything understandable through graphics alone. They made understanding the use of the catapult easier by providing guide lines showing the trajectory to create intuitive game play.
The team also considered technical capacity issues that they could face in case of success. They developed the whole game in the cloud, so when demand increased rapidly they could handle it.

Re-mobilization of allies: are the spokesmen representative this time?

Angry Birds was released in the AppStore in December 2009. Apple's AppStore was definitely an actor that was strongly representative of the mass of mobile gamers. Moreover, it could also mobilize gamers effectively. Effective tools like charts of top downloads and featured game sections in the AppStore significantly impacted gamer behavior. However, the AppStore was a very competitive arena and Rovio had to work hard to make it an ally. They realized early on that it would be difficult to reach the

top of the charts in the English-speaking world, but they planned accordingly. Quoted by Cheshire (2011), Matt Wilson, the head of marketing at Rovio at the time, explained that "We realized very early on it would be tough to break those markets. So we tried to get a following in the smaller nations." They attacked markets like Finland, Sweden, Denmark, Greece and the Czech Republic, where a small number of downloads could get them to the number one position in the charts. The AppStore made it possible to ally with gamers in markets with less competition through a small effort. The success in the smaller markets showed that the users liked the game and it had a certain potential. Additionally, Angry Birds was a very good vehicle for demonstrating the quality of games that could be created in this new mobile gaming sector.

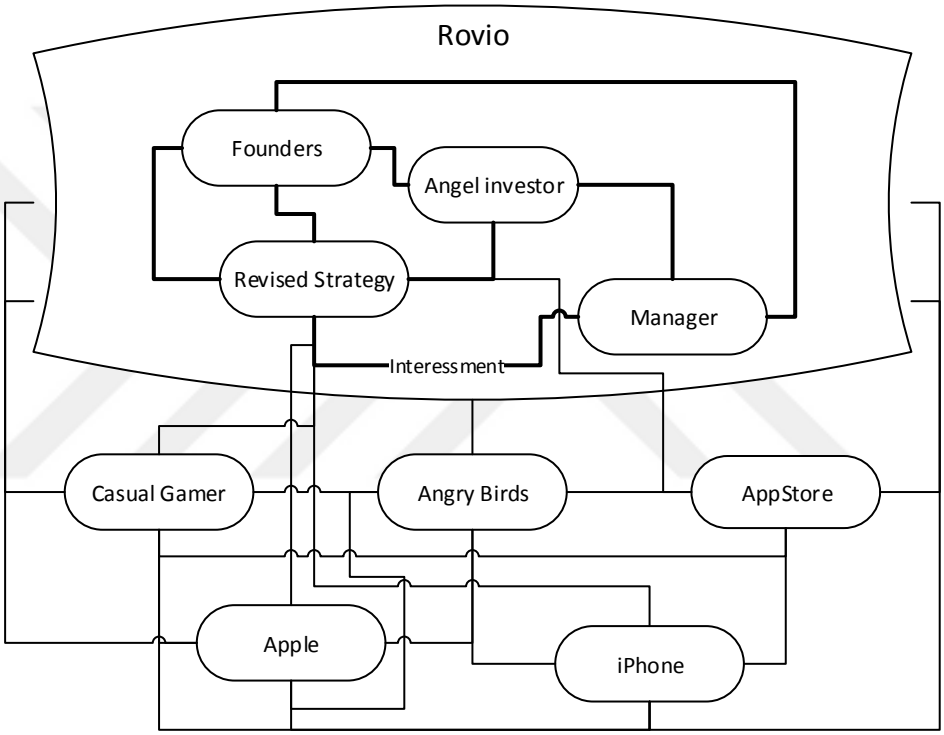
To achieve alignment with Apple, Rovio needed a liaison, or another actor who already had a deeper relationship with Apple and could capture Apple's attention while lending Rovio credibility. With this in mind, Rovio published the game with Chillingo in the larger markets. Chillingo was an independent publisher with some successful games and good relations with Apple. Then they went together to Apple to say 'We've got something here.'" This interessement strategy got a response, and on February 11, 2010, Apple featured Angry Birds on the UK AppStore as game of the week. The feature was the official declaration of the alliance between Apple and Rovio. Apple was communicating to its gamers in the UK market that they should try Angry Birds. Rovio supported this communication by creating a YouTube video trailer, which showed the story behind the game and helped convince gamers to try it out. As a former Rovio executive explains:

> Additionally, they got some publicity when Anja Pärson, a famous skier, was interviewed at the 2010 Winter Olympics in Vancouver and said, “You know I’ve been playing the whole night

Angry Birds." There was lots of kind of hidden marketing stuff and its encouragement AppStore needed the success and that's why they featured the Angry Birds because they found out that actually there is something in this thing (interview).

Thus, the following network crystallized:

Figure 15: Network of Actors, Period 2



One main difference between this network and the one in Period 1 is that all the individual actors in this network seem to reinforce each other. AppStore reinforces iPhone; iPhone reinforces casual gamer; Apple reinforces Angry Birds, which in turn reinforces AppStore. This picture is clearer in this blockmodel:

Figure 16: Blockmodel, Period 2

	Rovio	Manager	Revised	Casual Gamer	Apple	iPhone	Angry	Appstore
Rovio		1	1	1	1	1	1	1
Manager	1		1	1	1	1	1	1
Revised Strategy	1	1		1	1	1	1	1
Casual Gamer	1	1	1		1	1	1	1
Apple	1	1	1	1		1	1	1
iPhone	1	1	1	1	1		1	1
Angry Birds	1	1	1	1	1	1		1
Appstore	1	1	1	1	1	1	1	

After the UK AppStore feature, Angry Birds moved from 600th to 1st in the AppStore. In April, Angry Birds was number one in the US store. After that, its growth was phenomenal. In the first five months of its inception, the game sold 4 million units. Rovio responded to this growth with strategies that would take the company to even more interesting places. The core of the period's strategy can be summarized as connectivity. Rovio expanded its network of influence very rapidly. In return, all the new connections changed the company to become something bigger. As Angry Birds became a worldwide hit, it made the company a global player in both the mobile gaming and entertainment sectors. Thus, the problematization was resolved: mobile gaming could in fact be a scalable business.

4. DISCUSSION

As shown in the previous chapter, Rovios's case spans more than one cycle of four moments. In fact, it is best understood through dividing its history into two periods. During the first period, the mobile communications sector consisted of a closed cycle of relations. Within this circle, the mobile operators, handset producers and infrastructure producers had the upper hand. In the second period, however, the initial black box was shattered. With changes in technology like improvements in the processing power, battery life and storage capacity of handsets and the involvement of Apple with its status-quo-changing innovations, Rovio's translation was reloaded with new thinking, strategies and relations. It is therefore helpful here to treat Callon's (1986) four moments as a process that is not always linear but sometimes repeats and restarts. Such an approach provides flexibility to this research as certain periods in this case were characterized by fallouts which later restarted in a different setup. Considering the uncertain characteristics of innovation, these disruptions and renewals of the four moments may happen more often than one can imagine. At this point, let me reflect on my findings from the first period:

Niklas Hed and his friends problematized the question "Can mobile gaming be a scalable business?" This question was intriguing enough in their environment to attract resources to answering the question. Why was the question intriguing? First, the actors were in an environment with a heavy influence from Nokia. For this reason, any good question concerning mobile communications had a chance to become intriguing. Another interesting part of the question was scaling. Because the Finnish domestic market is small, it has always been a challenge for Finnish companies to scale up. This is one of the key reasons for the extensive emphasis on innovation in Finland. Innovations provide an advantage for Finnish firms

that they can leverage to expand internationally. Thus, the problematization was promising in encouraging the actors to move on to further moments in innovation. However, how would they ensure that they would continue to be significant when the game evolved? When Niklas and his friends embarked on the problematization, they determined some actors and started to build relations, while at the same time they defined some obligatory passage points. These passage points would help them keep their significance in the actor network. For instance, the formation of the company of which they were the founders was such point. As the founders, they would remain relevant as long as the company was relevant.

The interdefinitions of actors both helped move the problematization further while keeping the key actors centered in the problematization. Niklas' question led to the definition of two sets of actors. The first set related to the scalable business part of the question, and thus to the company. Niklas defined the two key actors related to the company, who were the manager (Mikael Hed) and the investor (Kaj Hed). Once these actors were defined and became attracted to the problematization, they dynamically negotiated with the founders regarding the position of the company. This in turn determined how the company was entangled with the second set of actors, related to mobile gaming part of the question. Three key actors in this latter set were the product (game), the handset (mobile phone), and the gamer.

In a case like this one, the game is a key actor in the sense that it defines its audience and may also define its channels of distribution. The gamer is especially important in making all the purchasing decisions that will ultimately determine what kind of business mobile gaming becomes. The gamer can be conceived of as a crowd that can be analyzed in segments, or clusters of people with similar behavioral traits. The handset is a tricky actor in this area in the sense that it was not initially designed with the aim of gaming. Gaming was introduced as a value-added feature to make the

handset more interesting. This makes the work of creating games especially challenging as it creates many difficulties that are not initially game-related.

When the actors related to a company are defined, the interests of these actors need to be aligned as well. The manager's interest lies in creating and executing a strategy that will prove successful and serve his reputation and finances. The investor's interest lies in capitalizing on his investment in both these senses as well. An investor who successfully invests in an early mover in a new business area earns a reputation as a visionary who has foresight into the future of business. The founders want to produce something exciting, in this case games, and at the same time they want to solve for the problematization. The key artifact where all these elements meet is the strategic plan, on which all these interests are reflected. The plan should also convince all parties that their interests can be met to an acceptable extent.

In the process through which Niklas attracted Mikael to the company, offering him the title of CEO carried weight, but the idea of working together with a dear relative on a fun project that they had dreamt about when they were younger was a unique attribute that was not available in other options open to Michael. Sentimental reasons for his joining the company should therefore not be ruled out. Callon (1986) suggests that the range of possible strategies and mechanisms that are adopted to bring about interessement is unlimited.

Sentimental factors also played a role in attracting Kaj Hed, the investor, as he was Michael's father. However, he needed a bit more convincing about the company's execution capabilities. The cooperation with Sumea was significant here in several ways. First, the young company took part in a project that produced an innovative product, which could be called the first in the world of its kind. Second, they cooperated with Terraplay Systems, an

advanced technology developer from Sweden. This work was a contribution to the handset technology, a small step into translating handsets into better game devices. However, the biggest benefit of this project was that they made a sale on their first product, which was a significant proof of business execution capabilities. This enabled them to dissociate Kaj from competing investment projects and convince him to fund Niklas' efforts to resolve his problematization.

The inclusion of Kaj in the actor network caused many changes, through which the previous relations were redefined, new relations were introduced and the devices of interessement were reshaped. The actors were not fully aligned in their views on how to take the company forward. These views competed with each other to come to a momentary point of consensus, which became an object in the form of a strategy document. This document was an interessement device that aligned the actors around the goals of the company. The strategy signified a choice to develop advanced games for advanced gamers rather than generic games, and in doing so, the team choose to be recognized as high-end and innovative game developers. They also wanted to create 3D games because they envisioned being the first to do so. These choices reflected the boundary-challenging character of Niklas although there was a question of how well these choices about the game would fit the gamer & handset realities of mobile gaming.

Although the strategic plan momentarily locked the actors into place, translation is a process. As the process continued, conflicts and contradictions arose and dissolved, stimulating change. Mikael was more concerned about the challenges and limitations with the handset and gamer part of the triangle, whereas Kaj would focus on the game and encouraged the team to develop games that were as innovative and interesting as possible. He planned to leave the potentially more expensive challenges of the handset and gamer to the company's potential acquirers. The plan

negotiated in March 2004 seemed to favor Kaj, since most of the points related to developing advanced games for advanced gamers. Niklas was aligned with Kaj in this regard as he also wanted to develop such games. This gave Niklas leverage: he was the key person to make the calls on game choices that would be the most innovative. Overall, the implications of this difference of approaches were significant, especially in the long run. In fact, we cannot say that Mikael was fully aligned with the plan, although he seems to have approved the strategy. He foresaw that the problematization would fail, so he decided to look for other options before waiting the failure to happen. Callon (1986) suggests that no matter how constraining the trapping device, no matter how convincing the argument, success is never assured. In this case, the intriguing vision and the close family ties were not constraining enough as trapping devices.

The long process of negotiations between the actors and the strategic plan as an interessement device did in fact lead to the successful enrollment of Niklas and Kaj, leaving Miklas out of the problematization. The actors thus redefined their roles and the managerial roles previously held by Mikael were shared among the other actors as they put the strategic plan into action.

The games were developed according to the strategy and the initial focus of these games on advanced gamers became visible in a series of awards given to Rovio by various gaming magazines, portals and communities. The fact that Rovio received funding from the National Technology Agency (TEKES) also reflected their position as an advanced game developer that innovated game technology. Additionally, an important portion of Kaj's financing was used to acquire Pixelgene, a 3D software development company, which reflected an innovative angle in the strategy. The 3D game Rovio developed for EA was an important step in establishing its name. Consequently, the company started cooperating with many key players in the gaming sector. The company grew to 50 people, which was sizeable for

the sector. This considerable enrollment activity resulted in creation of the network shown in Figure 9. This network was developing independent games, commissioned games and "high-tech" games. Nevertheless, it was questionable how close this network came to resolving the problematization. Was mobile gaming a scalable business? It was not clear whether this scale was sustainable. This network could not attract a big investor to acquire Rovio, nor was the cash flow sustainable. In this respect there was also a question of how much representative power the network gained within the triangle of game-handset-gamer.

The key question of representation is whether the masses will follow their representatives (Callon,1986). Expanding on this, several other follow-up questions arise, such as who do the allies actually represent; do those who are represented form a critical mass; even if they represent masses, are these masses relevant in impacting the triangle of game-handset-gamer; if yes, do the representatives lead these masses effectively? All these questions are important in this moment of mobilization of allies.

Considering the game as an actor, there were two different types of games that can be distinguished: games for distributors and Rovio's own games. Although the business producing games for distributors seemed to grow, it was not profitable, or at least not enough to pay the bills. There were two major reasons for this: first, the distributors held significant negotiating power as the distribution channels were hard to get into; second, the mobile gaming industry in its infancy did not generate too much income anyway, so on top of the company's slice of the pie being small, the entire pie was not too big. Because it was relatively inexpensive to have a game produced by Rovio, the distributors were not strongly incentivized to acquire the company because the games did not constitute a strategic resource with value for these distributors. Thus, these allies did not lead to the exit Kaj had hoped for. Meanwhile, Niklas continued to develop own games but they

were always in the same adventure, horror and fighting genres, which were attractive only to a niche gamer crowd. The company made hardly any effort to target other segments of the gaming community. Kaj was more involved in the games that he thought would lead to the desired exit, so Niklas was not challenged much in the production of his own games, in the absence of Mikael, who may have pushed him more. As a result, the impact of these games on the company's financials as well as on its visibility to potential acquirers was limited.

Rovio had a great ally in the handset part of the triangle, Nokia. Rovio had early access to Nokia technology and in return Rovio ensured the close integration of its software with Nokia's devices. Rovio was able to deepen the relationship, leading to joint technology development.

However, this major endeavor with Nokia did not lead to a solution of the problematization either. The first issue was that Nokia was inserting the games into the phones but not monetizing the games prior to the launch of the Ovi Store in late 2009. A second and related issue was the major translation occurring during this period in the mobile communications sector. Initially, the sector was a strong clique with handset manufacturers, infrastructure producers, network operators and governments. These four actors formed a self-sufficient system with little room for outsiders. In this setup, Nokia, Rovio's strong ally, was a key handset manufacturer. Therefore, it was a powerful actor. However, had little influence on the creation of gamers or on making the production of games into a scalable business. Thus, Nokia was a representative of a mass of handset users, which was however not a relevant mass for Rovio, as only a small portion of this mass consisted of gamers. Furthermore, Nokia was not effective enough to affect its mass (handset users) and persuade them to become gamers.

The gamer aspect of the triangle was probably the one the company neglected the most. Mikael was interested in gamers, but after he left the company little attention seems to have been paid to this part of the equation. Although the company had clients that offered games to different gamer segments, its core business stayed loyal to the same gamer segment, the adventure-horror-war lovers. The gamer segment of the mobile communications sector was small, and the company did not even address all of it. Furthermore, when the mobile communications sector started to change, the gamer crowd expanded but mostly in the segment interested in generic free-time games, which the company failed to address.

Therefore, the first period can be regarded as a case of failure, where the problematization remained unresolved. However, important changes occurred both within the social fluid as well as in the actor network that set the second period apart.

The changes made by Apple and Google to the handset and to the means of distributing software, including games, were so significant that Rovio needed to restart a new translation process and the former moments mostly lost their validity. In this second period, the problematization did not change. It was still about making mobile gaming into a scalable business. However, the planned strategy lost its relevance and strength as an interessement device. It was evident that the approach to solving the problematization needed to change, which motivated Mikael return to Rovio. In fact, the strategy was more important than the title of CEO; the new strategy was the key interessement device that enticed Mikael to come back to the company and even to invest €100K of his own money. The strategy was simple: Target Apple's AppStore by analyzing and understanding its customers, then building a game tailored to this customer base. Therefore, this time, the gamer, which was the lowest priority during the first period, was of the upmost importance.

In the early days of the AppStore, Apple was looking for hits to promote the AppStore. This offered Rovio the opportunity to enroll Apple as an ally if they could play their cards right. As part of this effort, they came up with many criteria that their new game would have to meet in order to appeal to AppStore customers: the whole game should be playable on iPhone, but the title should be extensible to other platforms; it should be a physics game; there should be no tutorial; loading times should be minimal, so that it could be played anytime, anywhere; and it should have an icon which would stand out in the App store. Rovio wanted to leverage their know-how in physics games but build a game for the masses. Another key challenge for scaling a game was its replay value. Rovio's earlier games were interesting the first time, though there was little fun left once the challenges were resolved. This time, Rovio implemented many tactics to make their new game fun for a long time. With this focus on the gamer, during the enrollment phase of the second period, all resources were aligned with the goal of making Apple an ally and succeeding in the AppStore. The team believed that the combination of iPhone and AppStore would provide the most scalable approach to the game-handset-gamer triangle and worked hard to solve for this triangle.

The huge success of Angry Birds is a reflection of the representativeness of Apple's AppStore. Not only was it representative, it could also mobilize gamers effectively. Moreover, it could significantly affect gamer behavior. Rovio's strategy of gaining records of accomplishment from smaller markets was a key action in their approach to AppStore success. They used the success of Angry Birds in smaller markets as a demonstration of its potential to get Apple mobilized. Rovio was smart in using a liaison to build credibility with Apple. One might say the interessement strategy resembled one of a hard-working student who did his homework, and after having done this, used networking to get appreciation. This interessement strategy got a response and Apple featured Angry Birds on the UK App Store, which

also signified the solution of the problematization. Mobile gaming could be a scalable business, and Niklas, Kaj and Mikael showed that their company was the right actor to verify this question. Thanks to Apple, the power structure in the market was changed and Rovio was the actor that became the spokesperson of this change. Rovio showed that now the creative minds had the upper hand, though they may still need some support in visibility.

Recalling Figures 13 and 14, the density of the clique that this network created was a very important factor. There were no conflicting interests among the individual actors, unlike in the first period. In the second period, the AppStore's interests were in alignment with Rovio's, with iPhone's, with those of casual gamers, Apple and so on. All the collective effort was focused on growing mobile gaming. Additionally, the growth of mobile gaming benefitted all the individual actors: It helped sell more iPhones, generate more Angry Birds downloads, and create more interest in different applications available through the AppStore as well. Thus, the network as a whole benefitted from the mobilization.

Once Niklas' problematization was resolved, Rovio's question evolved as well. Two competing problematizations arose: one, could the success be repeated, and two, how could they capitalize on the huge success of Angry Birds? It turned out that Rovio was more successful solving the second question by becoming an entertainment and licensing company as well as a mobile gaming company. However, the deepening of the AppStores made it more and more challenging to solve for the first question in a consistent way. The translations related to these new problematizations are very good candidates for further research.

This account of translation is evocative of the relevance of the relation between the actor network and the social fluid in which it evolves. The actor network evolves within the four moments of translation; however, these

moments should not be considered linear. In this case, iterations of certain moments depended on the changes in the social fluid. Thus, the social fluid is an important factor that researchers need to pay attention to when analyzing accounts of translation. A good analogy to this significance could be an ocean and a boat traveling on it. On a calm day, the properties of the ocean may not play a role in where the boat is traveling and how long its journey may take. On the other hand, if the ocean conditions change and there are massive waves or unforeseen currents, it may change the whole trajectory of where the boat is going and how long it takes to get there. Thus, in most accounts the social fluid may be easily neglected, but in some accounts it becomes an obligatory factor in the analysis, without which it can be very hard to understand how the actor network is evolving.

The account presented here was mainly developed around a single mobile game developer. This enabled deep qualitative research on this one account, whereas ANT typically relies on the multiplication of accounts to deepen understanding of social translation. This thesis offers findings and insights into innovation processes on a more granular level than a quantitative analysis can provide. It enables capturing the many changes occurring with the innovation process rather than testing a given hypothesis. The uncertain nature of innovation is well suited for a qualitative research. It could be interesting, however, to test some of the findings of this thesis with quantitative methods to give them better validity. Currently, it does not offer generic findings, which could be considered as a limitation. Thus, the thesis can be considered strong in reliability but limited in validity. Through the use of different data collection methodologies such as archival data, interviews and use of a questionnaire, some triangulation was achieved, but validity was not the primary objective of the account.

This account reveals that the innovation framework helps to create a concise representation of the innovation process, where allowing reoccurrence or

"looping" of the moments keeps the actor network connected to its social fluid. It may be considered as a reflection of the changes in the social fluid. Additionally, using the framework with the concept of black boxes and trials of strength creates a strong formulation for understanding innovation. Innovations change the way we live and in a way can be seen to demolish a small or big black box, in one way or another. Thus, always keeping in mind the existence of black boxes and how they can be reformed or demolished while moving along the innovation framework happens to be a very strong analytical tool.

The case in this thesis seemed resistant to the more frequently used social research methodologies. The questions of what happened with Rovio during the times of limited success or even failure seemed to be explained only from a heroic agent perspective (i.e., the impact of the return of the former CEO) or by chance, as the company had a large number of products on the market so one of those would eventually be successful. The deeper insights drawn here were enabled by Actor Network Theory (ANT). Developed by French academics inspired by semiotics, ANT is a difficult field to enter. The amount of initial intellectual investment is quite high and there are hardly any easy guidelines unless the fundamental ideas of the approach are grasped.

Flattening the social network was a key to unlocking aspects of the case, such as betting on numbers or the super entrepreneur who had the vision to create the innovation. The flatness enabled discovery of new relations that provided the explanatory power to the questions that resisted explanation in other approaches. These relations involved much larger actors, ones from different institutional environments and even non-human but technological actors that were easy to ignore when viewed through the lenses of the more conventional social theories.

One distinguishing characteristic of this case is that it focuses on a moment at the breaking of a black box and shortly afterwards, rather than focusing on the black box itself. This moment is one of significant change in which former relations may lose relevance and new relations can re-center the actor network. Therefore, it is very fruitful research, especially for implementing the methods of ANT. The analysis of such moments requires tracing the relations in the black box, as well as the actors that make the black box redundant. Here we can trace technological actors such as mobile internet speed and processing capability of handsets as well as focused efforts of an actor like Apple, which had the intention of expanding the space of computers into mobile communications. Once a former black box like this one is redundant, there will be voids. The voids are especially important for innovation research as they will be often filled with startups or smaller firms like Rovio that are close to the actor network, such that they can understand the dynamics, but are not located centrally, and thus are looking for ways to become more prominent in the actor network.

It is interesting to consider the question of whether Rovio could have achieved its success if the iPhone revolution had happened when the company was in its infancy. Although this is a question open to speculation, there seem to be several fairly important reasons why they might not have succeeded in this hypothetical scenario. Rovio gained significant game development experience over the early years of its operations. It also came to an understanding that making games just for the sake of developing a quality game is not enough. One should really study the customer base at which the game is targeted. It can also be easily suggested that through being in the sector for a few years, Rovio learned the shortcomings of mobile gaming well and assessed the significance of the changes Apple was making before many others. Thus, the experience in the sector gave Rovio the ability to assess the opportunity of the void created by Apple and also the skills to react to the opportunity in an impactful way. It can be suggested

that the readiness of the company in terms of experience and skill set had an impact on its capacity to absorb the opportunities created in the actor network.

CONCLUSION

In this thesis I created an account of the sociology of translation in mobile games, where I used Actor Network Theory (ANT) as the theoretical background and implemented Callon's (1986) four moments of translation to a mobile game producer, Rovio. This company developed Angry Birds, a game that created the first global boom in mobile gaming in 2009. This boom changed mobile gaming from a side activity to a serious sector which started receiving big investments. In fact, according to Venture Beat, mobile games hit $34.8B in 2015, taking 85% of all app revenues, up from Gartner's estimate of slightly more than $4B in 2008. Thus, Angry Birds ushered in this era of almost tenfold growth in seven years.

One major topic to consider in the innovation of Angry Birds was the timing. This case can be divided into two parts: first a failure, and subsequently a major success. Rovio began developing games in 2003, but in the period of 2003-2008 they did not create any game that came close to the market success of Angry Birds, which was launched in 2009. What was the significant change that changed the trajectory of the company from bankruptcy to a global player? This question is particularly well suited to Actor Network Theory. I reviewed a large literature on innovation that includes theories of clustering, venture funding, knowledge creation and other environmental factors in explaining innovation, and found that this literature did not seem to provide the answer to why Rovio was so unsuccessful at first before scoring their big hit. Rovio was founded in

Finland, one of the top countries in innovation. According to the Innovation for Development Report (López-Claros & Mata, 2011), Finland ranks fourth globally in the Innovation Capacity Index (ICI), second in Research and Development, and ninth in Institutional Environment. The business environment in the 2000s was heavily influenced by Nokia, one of the biggest handset developers in the world. Moreover, the founders of Rovio graduated from a university which was renowned for its contribution to innovation. The company was in proximity to some clusters, although it was not itself in one. Rovio also received two rounds of angel financing before 2008. It can be concluded that none of these factors are sufficient to explain the massive success of the company, since they were present when Rovio was almost bankrupt as well.

The ANT framework provided additional tools to shed light to this case. The two aspects of ANT that were particularly important for this case were the breadth of the definition of actors and the flatness of the levels of analysis. In ANT, an actor can be a human, an animal (Callon, 1986), a non-living object, a technology or a company. ANT is an action-based approach that prioritizes subjects that act, and objects that move and change. Thus, I added actors like the game, gamer and handset into my analysis. The game is what drives the mobile gaming industry. It is a technological object that builds real relations with people and drives a business. Once it has been released, it can drive the market on its own and can in a sense be disentangled from its developers. Especially since the advent of global content stores like the AppStore, a game can enter markets its developers never even thought of. The handset is also a technological object. It was originally part of the mobile communications business and came to enable mobile gaming. It is an actor that changed drastically over the course of the case. Being able to define the handset as an actor was a significant part of understanding the case. The third important actor in this triangle, the gamer, is not a specific person but a community of people who belong to

certain segments, some of which can be influenced by spokespeople. Seeing the connections between these three actors and defining Rovio's relations to them offered great insight into this case.

The flatness of different levels of analysis was also important for this case. This may be counter-intuitive, as sociologists typically like to work with multiple levels, such as micro-macro, local-global and small-big. The mobile communication sector could be categorized as belonging to the macro level and this case study could be seen as micro. Then the sector could be analyzed at a different level to provide a background for the case. Viewed in this way, a very critical turning point for the case could be missed. In fact, the transformation of the mobile communications sector was highly important to the case. It transformed from a black box of limited players with the goal of global expansion and a set of offerings in voice communications and limited data to a data-heavy system that merged with the computer-software industry. Big software players like Apple and Google started to dominate the sector with their operating systems and content stores, which in turn transformed the capabilities of the handset. The transformation of the handset made it a very good gaming interface, among other things. However, when these technologies were launched there was little good content to take advantage of their new capabilities. Thus, in a sense this transformation created voids or gaps in the sector that needed to be filled. Johanna Mair and Ignasi Marti define institutional voids as the "inchoate nature of the institutional fabric" (2007). Mair and Marti (2007) claim that in such voids, social entrepreneurship could fill the gap of an institutional actor. In a similar sense, when a void appears in the internal functioning of a sector, early adopters can fill the void through impactful innovations. Thus, such voids pose significant opportunities for such innovations. In this particular case, in the second round of interessement and enrollment, Rovio was able to make the right choices to benefit from this void. They managed to develop a product that Apple, the actual creator of

the void, wanted to promote because the product was a reflection of Apple's vision of what the new handset and the new global store could offer. Rovio was so involved in mobile gaming it was able to recognize the opportunity. The leadership at Rovio recognized that Mikael Hed, who had previously left the company due to his differing strategic view, was offering them an effective strategy to capitalize on the opportunity.

From an analytical point of view, keeping the social factors flat and knitting the transformed mobile communications sector into the relations of the actor network provided an answer to the question of timing, or why Rovio succeeded when it did. The success happened in 2009 because that was when Rovio could fill a big gap. Through its success, Rovio became a role model for other players that wanted to join the early adopters in filling the void. In fact, many companies entered into mobile gaming and significant investments were made. Being a pioneer in mobile gaming, Rovio capitalized greatly on Angry Birds, but it also transformed itself into an entertainment company. This can be read as a response to the opportunities that the success of Angry Birds offered, or as a response to the fact that the mobile gaming void was reasonably filled so it became harder to grow in this space, even for the pioneer of the field. Rovio's transformations in the aftermath of Angry Birds' success offer a fruitful area for further research.

ANT reviews the networks created around the leading actors, which act collaboratively. This network-as-an-actor is the result of a temporary coalition, which can be formed by conscious or random events, and can in fact change the environment around it significantly. Thus, the differences in the networks between the two periods of Rovio's development tell us a lot about why Angry Birds worked so well. The network in the first period was not as dense as the one in the second period. During the first period, Rovio was trying to create quality games, whereas Nokia was promoting technological advancement to create brand awareness and the distributors

wanted to source mobile games with low enough prices that they could make a profit by distributing them, Thus the actors in the network had similar but not fully aligned objectives.

In comparison, the network in the second period was much more focused as a collective actor. It was focused on advancing mobile games, and making mobile gaming a big sector. The individual actors reinforced each other's alignment with this focus. For example, the AppStore encouraged Angry Birds to create a strong mobile gaming category in its market, which would increase the demand for the AppStore. The success of the AppStore would enforce the success of iPhone. Selling more iPhones would bolster Apple and also draw more users into the ecosystem of AppStore. This would increase the casual gamer base, which was targeted by Angry Birds. To sum up, there was a great deal of overlap in the individual actors' objectives that helped the network act more effectively as a collective actor and successfully impact the behavior of masses, which in this case meant that the masses started using communication devices as mobile gaming devices. This change in behavior is the core of today's massive mobile gaming sector.

This account contributes to the ANT topology in a very fast-developing sector. This is a sector mainly based on a device, the handset, which is increasingly becoming an integral part of the way we live. In this account, I combined the innovation framework from ANT with concepts like social fluid and black boxing, also from ANT, and kept the levels of analysis flat such that the macro and micro levels of conventional social analysis could interact with each other. I expect that in the age of digitalization and information technology, this interaction of elements that could be considered as belonging to different levels of analysis will be especially relevant as the borders of what is big or small, local or global are becoming increasingly blurred. I believe that this research has implications in terms of

strategizing in this field as well. Taking a network perspective provides the ability to combine Porter's (1996) focus on business environments with Barney's (2001) resource-based view. The network is key aspect that helps the individual resources make an impact in a business environment and even change it. The network plays an important role in reaching the right market segment, creating a kind of flow from the producers of products, services and technology to users. Thus, I believe network research strategies can provide very interesting insights into innovation in different areas of information technology.

Considering its limitations, this research strategy requires a substantial amount of relational data to generate a clear map of the relations around the actor network, which may be challenge for some sectors. As it is a type of qualitative research, the validity will increase with the abundance of similar research results, pointing to some common findings.

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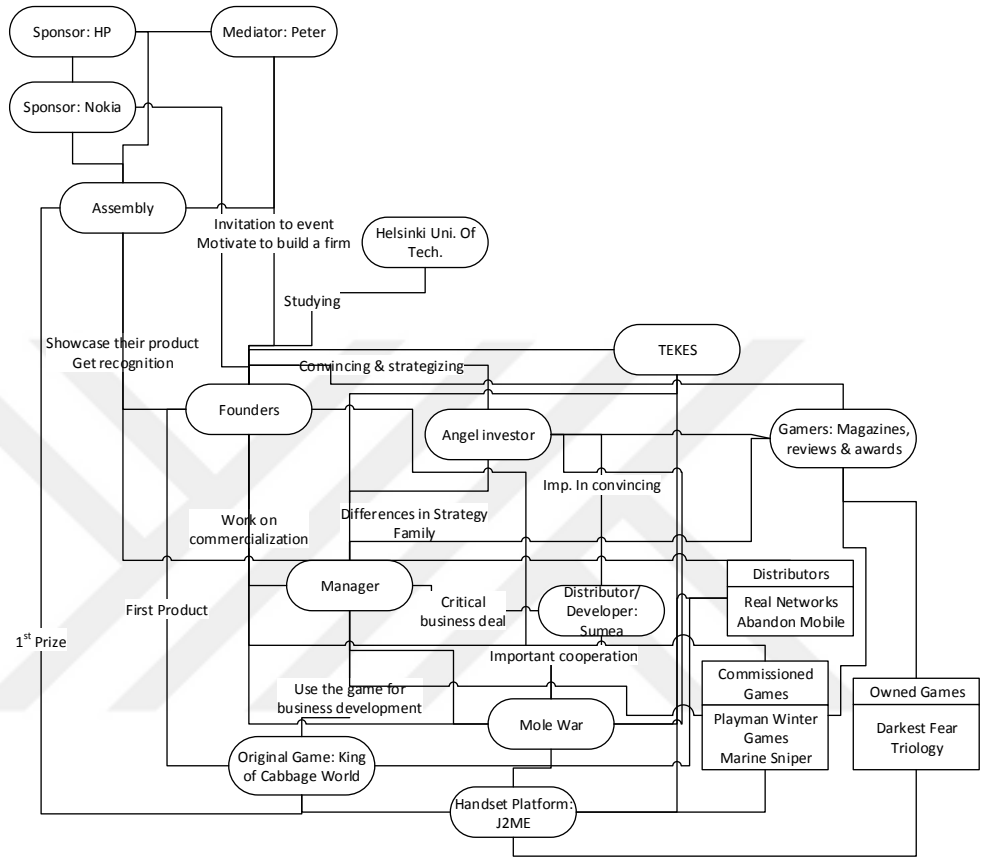
APPENDIX

1. DETAILED RELATION MAPS AND BLOCKMODELS

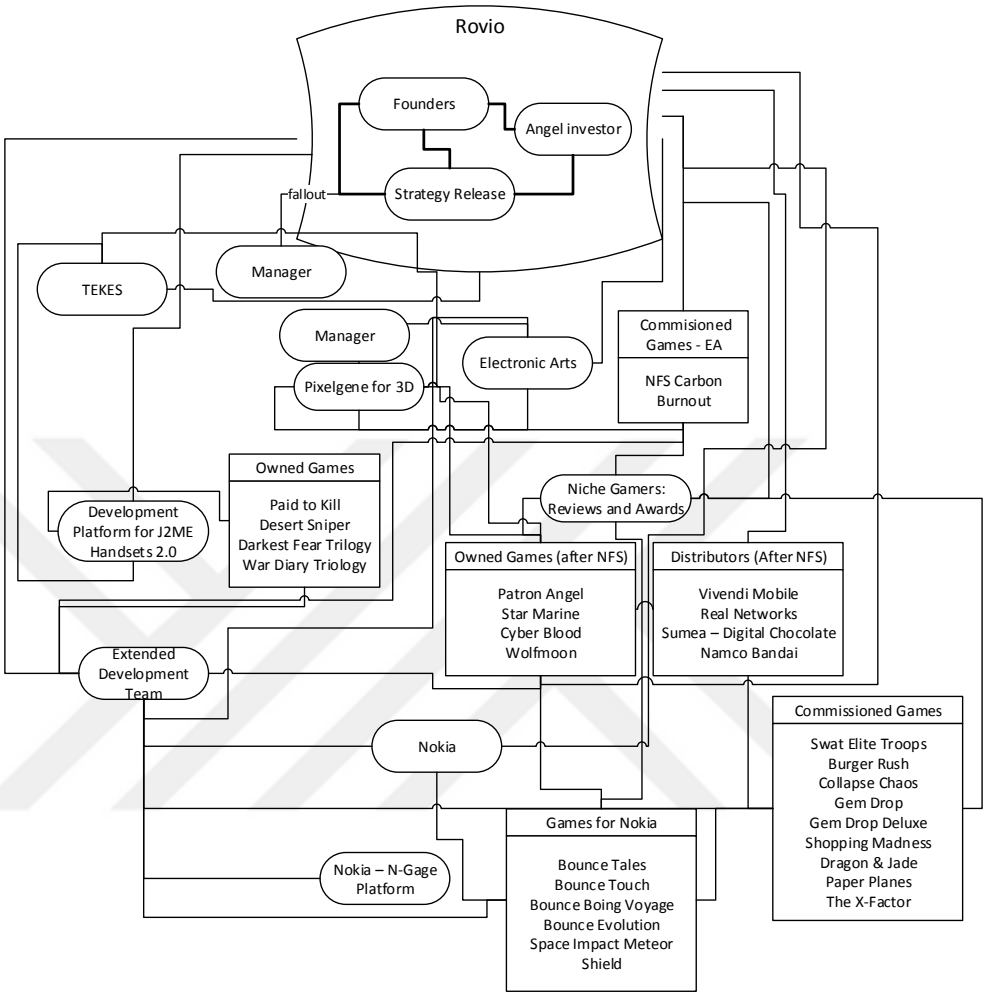
1.1 Foundation, Relation Map



1.2 Foundation, Blockmodel

	Founders	Manager	Event: Assembly	Original Game: King of C.W.	Angel Investor	Development Platform for J2ME Handsets	Mole War	Mediator: Peter	Sumea	Distributors: 1 - Real Network 2- Abandon Mobile	Commitioned Games: 1- Playman Winter Games 2- Marine Sniper	Owned Games: Darkest Fear Triology	TEKES	Gamers: Magazines, reviews & awards	Sponsor: Nokia	Sponsor: HP
Founders	`	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Manager	1		1	1	1	1	1		1	1	1	1	1	1	1	
Event: Assembly	1	1		1	1		1	1	1	1	1		1		1	1
Original Game: King of C.W.	1	1	1		1	1	1	1	1	1		1	1			
Angel Investor	1	1	1	1			1		1			1		1	1	
Development Platform for J2ME Handsets	1	1		1			1				1	1	1	1	1	
Mole War	1	1	1	1	1	1			1							
Mediator: Peter	1		1	1					1	1					1	1
Sumea	1	1	1	1	1		1	1								
Distributors: 1 - Real Network 2- Abandon Mobile	1	1	1	1				1			1			1		
Commitioned Games: 1- Playman Winter Games 2- Marine Sniper	1	1	1			1				1			1	1		
Owned Games: Darkest Fear Triology	1	1		1	1	1							1	1		
TEKES	1	1	1	1		1					1	1				
Gamers: Magazines, reviews & awards	1	1			1	1				1	1	1				
Sponsor: Nokia	1	1	1		1	1		1								
Sponsor: HP			1					1								

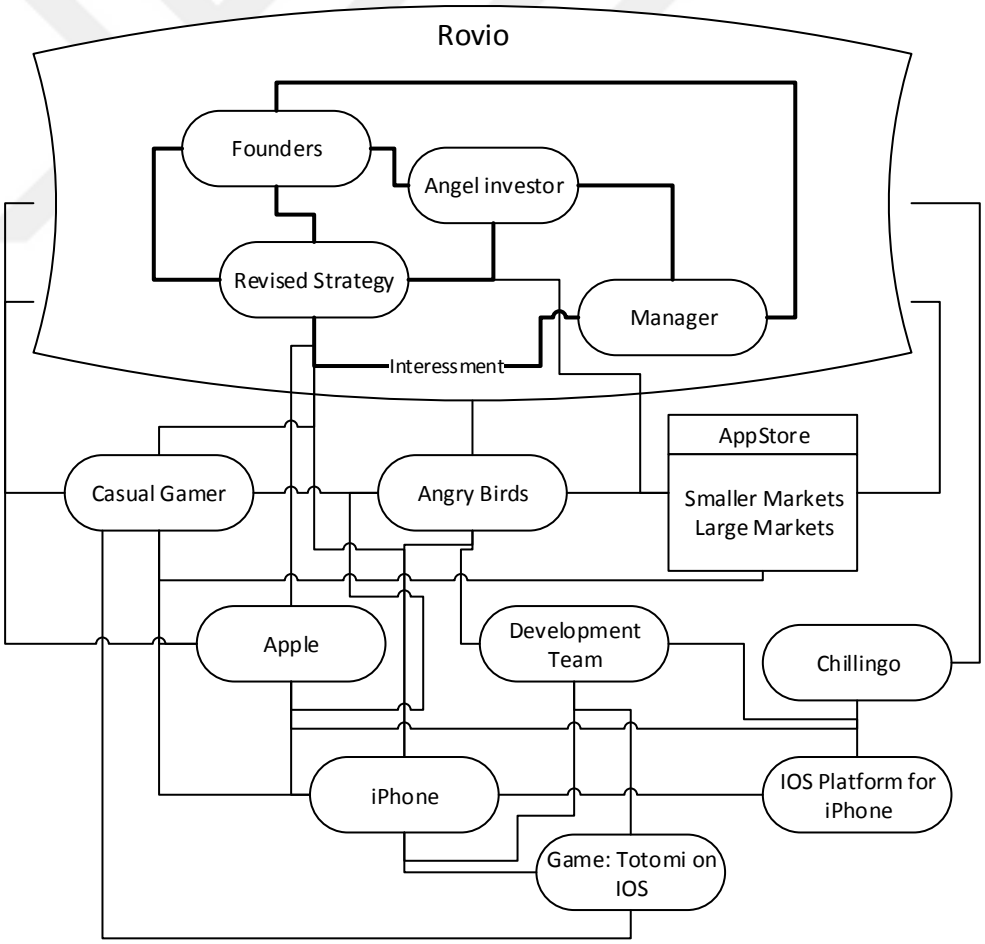
1.3 Period 1, Relation Map



1.4 Period 1, Blockmodel

	Rovio	Extended Development Team	Pixelgene	Owned Games	Electronic Arts	Commisioned Games - EA: 1-NFS Carbon 2-Burnout	Niche Gamers: Reviews and Awards	Owned Games after NFS	Commisioned Games	Nokia	N-Gage Platform	Games for Nokia	Column1	Development platform for J2ME	TEKES
Rovio		1	1	1	1	1	1	1	1	1	1	1		1	1
Extended Development Team	1		1	1	1	1		1	1		1	1		1	
Pixelgene	1	1			1	1		1	1	1	1	1			
Owned Games	1	1					1	1	1					1	
Electronic Arts	1	1	1			1	1		1	1					
Commisioned Games - EA: 1-NFS Carbon 2- Burnout	1	1	1		1		1	1	1	1				1	
Niche Gamers: Reviews and Awards	1			1	1	1		1	1	1		1			
Owned Games after NFS	1	1	1	1		1	1		1	1				1	
Commisioned Games	1	1	1	1	1	1	1	1		1				1	
Nokia	1		1		1	1	1	1	1		1	1			
N-Gage Platform	1	1	1							1		1			
Games for Nokia	1	1	1				1			1	1				
Development platform for J2ME	1	1		1		1		1	1						1
TEKES	1													1	

1.5 Period 2, Relation Map



1.6 Period 2, Blockmodel

	Rovio	Manager	Revised Strategy	Casual Gamer	Apple	iPhone	Development Team	Angry Birds	Game: Totomi on IOS	IOS Platform for iPhone	Appstore (smaller markets)	Appstore (large markets)	Chillingo
Rovio		1	1	1	1	1	1	1	1	1	1	1	1
Manager	1		1	1	1	1	1	1		1	1	1	1
Revised Strategy	1	1		1	1	1	1	1		1	1	1	1
Casual Gamer	1	1	1		1	1	1	1	1		1	1	1
Apple	1	1	1	1		1		1		1	1	1	1
iPhone	1	1	1	1	1		1	1	1	1	1	1	
Development Team	1	1	1	1		1		1	1	1			
Angry Birds	1	1	1	1	1	1	1			1	1	1	1
Game: Totomi on IOS	1			1		1	1			1			
IOS Platform for iPhone	1	1	1		1	1	1	1	1				
Appstore (smaller markets)	1	1	1	1	1	1		1				1	
Appstore (large markets)	1	1	1	1	1	1		1			1		1
Chillingo	1	1	1	1	1			1				1	

2. CHRONOLOGY OF GAMES DEVELOPED BY ROVIO

Year	Game	Platform	Game Elements	Partner / Distributor	Partner Resources
2004	MOLE WAR	J2ME	first real-time multiplayer mobile game	Sumea - Digital chocolate	cross-platform social games
2005	DARKEST FEAR	J2ME ,Nokia Game N70	puzzle		
2005	PLAYMAN WINTER GAMES	J2ME	ski games, ease of use & challenges	Real Networks	Sales & Distribution
2006	DESERT SNIPER	J2ME	isometric graphic, enemy AI, aiming&shooting		
2006	DARKEST FEAR 3: NIGHTMARE	J2ME ,Nokia Game N70	light effects, puzzle		
2006	DARKEST FEAR 2: GRIM OAK	J2ME ,Nokia Game N70	light effects, puzzle		
2006	MARINE SNIPER	J2ME, NOKIA S60	adventure type and aiming shooting	Abandon Mobile & projectnext	Sales & Distribution
2006	Need For Speed: Carbon	J2ME	3D, canyon racing & falling, night racing, career mode,	EA	Game pool & distribution
2006	PAID TO KILL	J2ME	easy to use controls, upgrades of skills and guns		

2006	WAR DIARY BURMA	J2ME	strategy and combat		
2006	WAR DIARY CRUSADER	J2ME	strategy and combat		
2006	WAR DIARY TORPEDO	J2ME	torpedo shooting, strategy and combat		
2006	Dragon and Jade	J2ME	strategy and combat	Namco Bandai Networks Europe	Japanese group, presence in Asia, India, EMEA,Europe and America
2007	BURGER RUSH	J2ME, Windows	Arcade, strategy, quick desicisions	Real Networks	Sales & Distribution
2007	BURNOUT	J2ME	car race, hitting, turning etc.	EA	Game pool & distribution
2007	Collapse! Chaos	J2ME (maybe android & iphone)	block building, strategy, bombs	Real Networks	Sales & Distribution
2007	PATRON ANGEL	J2ME	shooter protects another, innovative: shooter&being shot at are different		
2007	STAR MARINE	J2ME	alien characters		
2007	SWAT: ELITE TROOPS	J2ME	swat team of 3 officiers	Vivendi Games Mobile	money? Part of vivendi games - France until 2009
2007	WOLFMOON	J2ME	music, detailed graphs, strategy & combat		

2007	CyberBlood	J2ME	simple moving & figthing (god music)		
2008	BOUNCE TALES	Nokia Game	moving, jumping, hitting ball 2D	Nokia	N-gage infrastructure
2008	Bounce Touch	Nokia Game	moving, jumping, hitting ball 2D, touch base directing	Nokia	N-gage infrastructure, new phone functionalities
2008	Bounce Boing Voyage	Nokia Game	first motion controlled n-gage game	Nokia	N-gage infrastructure, new phone functionalities
2008	GEM DROP	J2ME	bejeweled type	Real Networks	Sales & Distribution
2008	GEM DROP DELUXE	J2ME	bejeweled type, increasing challenges, different scenarios	Real Networks	Sales & Distribution
2008	PAPER PLANES	J2ME	wind, angles, trowing, flying, innovative idea	Namco Bandai Networks Europe	Japanese group, presence in Asia, India, EMEA,Europe and America
2008	SHOPPING MADNESS	J2ME	innovative idea, plenty of tasks and game options	Sumea - Digital chocolate	cross-platform social games
2008	SUMEA SKI JUMP	J2ME	ski jumping	Sumea - Digital chocolate	cross-platform social games
2008	TOTOMI	Flash, J2ME	puzzle	Connect2Media	GLOBAL PUBLISHER
2008	TOTOMI - IPHONE	IOS	puzzle		
2008	THE X FACTOR 2008	J2ME	tv show adaptation, career building	Namco Bandai Networks Europe	Japanese group, presence in Asia, India, EMEA,Europe and

					America
2009	Bounce Evolution	Ovi Store (for N900 through N-gage & OpenGL ES 2.0 rendering)	intuitive motion control with 3D	Nokia	N-gage infrastructure, 3D rendering, new phone functionalities
2010	Space Impact Meteor Shield	Ovi Store (for N97 through N-gage)	360' real shooting through compas, 3D	Nokia	N-gage infrastructure, new phone functionalities
2010	ANGRY BIRDS	IOS	catapult,destroying different structures, gravity, flying, speeding etc.	Chillingo	Relations with Apple

3. SIGNIFICANT PHONES AND INNOVATIONS IN MOBILE COMMUNICATION

3.1 Nokia's Phones

Nokia3310:

Nokia1100:

Nokia7650:

3.2 iPhone 1

3.3 AppStore

4. FULL LIST OF SECONDARY DATA SOURCES

Entity	Use of Data
Entertainment Software Association (esa)	Statistics - Essential Facts about The Computer And Video Game Industry 2013
Christina Liu & Yanting Li(Liu & Li, 2012)	Paper: Rovio and Angry Birds
Business2Community	Article on Rovio's expansion into entertainment sector
Techninasia	Interview with Rovio's Senior VP Henri Holm on Rovio's business model
Venturebeat	Rovio's $42M financing
PCWorld	The interview with Mikael Hed
Wired Maganize	In depth article on Rovio's story with an interview with Mikael Hed
Wired Magazine	The article about Android payment methods and Angry Birds

Pocketgamer	Interview with Mikael Hed
The Atlantic	Story on Rovio with 51 trails before Angry Birds
Techcrunch	Article on Angry Birds' success
Techjuice	Article on Rovio story
Variety	Rovio's ventures in the entertainment sector
Bloomberg	Article on Angry Birds's success
Bloomberg	2011 funding negotiations
Geek.com	Article on Rovio addressing Android problems
Geek.com	Article on Angry Bird expansion into board games
Jost	
PcMag	Article on Angry Birds Rio
PcMag	Rovio's retail expansion
PcMag	Rovio's expansion into animation
TheNextWeb (TNW)	Angry Birds Seasons Review
Cnet	Interview on Peter Vesterbacka on new projects
Wall Street Journal	Article on Angry Birds
BBC News	Rovio's expansion in China
Phandroid	Review of free Angry Birds for Android
Joystiq.com	Angry Birds Halloween review
Technology Digital	Rovio's retail expansion
uSwitch	Angry Bird expansion into new platforms
Social Times	Angry Bird features review
Social Times	Rovio's Facebook expansion

5. LIST OF INTERVIEWEES

Rank in Relevance	Interviewee	Position
1	Harri Koponen	COO and Senior Advisor Rovio Entertainment Ltd. (2011-2013)
2	Ersin Pamuksüzer	CEO Ericsson Turkey & Middle East (1990s - 2006)
3	Ruhi Doğusoy	CTO Turkcell (1999-2006)
4	Eero Holstila	CEO Culminatum Ltd Oy (2001-2005)
5	Aape Pohjavirta	Coach, Official Uncle Startup Sauna (2010-2016)
6	Pauli Kuosmanen	CEO DIGILE (current)
7	Tommy Jacobson	CEO CLEEN Oy (current)
8	Jukka Rantala	Director, Sales Development Nokia (current)
9	Kalevi Ekman	Professor Aalto University School of Engineering Factory manager Aalto Design Factory (current)
10	Kari Pehkonen	Head of Systems Research Nokia Mobile Phones (2001-2010)
11	Jouni K. Juntunen	Manager, Industry Analyst

		Relations Nokia (2003-2009)
12	Risto Huvila	Chairman, President, Board Member Enfucell, Inc. (2007-2013)
13	Oleg Podsechin	Founder StartHQ (2012-2014)
14	Suvi Häkämies	Managing Director Green Net Finland
15	Kauko Huhtinen	Project Manager Culminatum Innovation Oy Ltd (2000-2014)
16	Leigh Ewin	Innovation and Technology Development Otaniemi.Fi (2009-2015)
17	Antti Sipilä	CEO & Founder OneMinStory (current)
18	Lotta Väinölä	Communications Coordinator Vantaa Innovation Institute Ltd (2011-2013)

6. QUESTIONAIRE QUESTIONS & ANSWERS

Number of records in this query:	30		
Total records in survey:	30		
Percentage of total:	100,00%		
What is the name of the cluster in which your company is			

located (or has cooperation with)?			
Answer	10	71,43%	
No answer	4	28,57%	
In which region is your cluster located?			
Answer	Count	Percentage	
Uusimaa (A1)	7	50,00%	
Varsinais-Suomi (A2)	1	7,14%	
Pohjois-Pohjanmaa (A3)	1	7,14%	
Pirkanmaa (A4)	0	0,00%	
Päijät-Häme (A5)	0	0,00%	
Other	1	7,14%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to Helsinki]			70,00%
Answer	Count	Percentage	
Not important at all (1)	1	7,14%	
Not so important (2)	2	14,29%	
Undecided (3)	0	0,00%	
Important (4)	4	28,57%	70,00%
Very important (5)	3	21,43%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close large corporations]			60,00%
Answer	Count	Percentage	

Not important at all (1)	1	7,14%	
Not so important (2)	3	21,43%	
Undecided (3)	0	0,00%	
Important (4)	2	14,29%	60,00%
Very important (5)	4	28,57%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to small companies]			40,00%
Answer	Count	Percentage	
Not important at all (1)	1	7,14%	
Not so important (2)	4	28,57%	
Undecided (3)	1	7,14%	
Important (4)	3	21,43%	40,00%
Very important (5)	1	7,14%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to universities and research centers]			70,00%
Answer	Count	Percentage	
Not important at all (1)	1	7,14%	
Not so important (2)	2	14,29%	
Undecided (3)	0	0,00%	
Important (4)	6	42,86%	70,00%
Very important (5)	1	7,14%	
No answer	4	28,57%	

How important are the advantages of this location for your company? [Close to various information networks in your sector]			60,00%
Answer	Count	Percentage	
Not important at all (1)	2	14,29%	
Not so important (2)	0	0,00%	
Undecided (3)	2	14,29%	
Important (4)	3	21,43%	60,00%
Very important (5)	3	21,43%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to other clusters]			40,00%
Answer	Count	Percentage	
Not important at all (1)	2	14,29%	
Not so important (2)	1	7,14%	
Undecided (3)	3	21,43%	
Important (4)	3	21,43%	40,00%
Very important (5)	1	7,14%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to government bodies]			30,00%
Answer	Count	Percentage	

Not important at all (1)	2	14,29%	
Not so important (2)	4	28,57%	
Undecided (3)	1	7,14%	
Important (4)	3	21,43%	30,00%
Very important (5)	0	0,00%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Close to financing organizations or investors]			50,00%
Answer	Count	Percentage	
Not important at all (1)	2	14,29%	
Not so important (2)	2	14,29%	
Undecided (3)	1	7,14%	
Important (4)	4	28,57%	50,00%
Very important (5)	1	7,14%	
No answer	4	28,57%	
How important are the advantages of this location for your company? [Tax benefits]			10,00%
Answer	Count	Percentage	
Not important at all (1)	5	35,71%	
Not so important (2)	3	21,43%	
Undecided (3)	1	7,14%	
Important (4)	1	7,14%	10,00%
Very important (5)	0	0,00%	
No answer	4	28,57%	

How important are the advantages of this location for your company? [Low rents]			20,00%
Answer	Count	Percentage	
Not important at all (1)	6	42,86%	
Not so important (2)	2	14,29%	
Undecided (3)	0	0,00%	
Important (4)	2	14,29%	20,00%
Very important (5)	0	0,00%	
No answer	4	28,57%	
What other locational advantages are important?			
Answer	3	21,43%	
No answer	11	78,57%	
Please answer these questions on relation frequency: [How frequently you interact with other companies in the same cluster for business related issues?]			100,00%
Answer	Count	Percentage	
Very rarely (Less than once in 2 months) (A1)	0	0,00%	
Rarely (Once in 2 months) (A2)	0	0,00%	
Sometimes (Once a month) (A3)	0	0,00%	
Often (At least twice a month) (A4)	1	14,29%	100,00%

Very often (More than 4 times a month) (A5)	6	85,71%	
No answer	0	0,00%	
Please answer these questions on relation frequency: [How frequently you interact with companies in the other clusters for business related issues?]			57,14%
Answer	Count	Percentage	
Very rarely (Less than once in 2 months) (A1)	0	0,00%	
Rarely (Once in 2 months) (A2)	0	0,00%	
Sometimes (Once a month) (A3)	3	42,86%	
Often (At least twice a month) (A4)	2	28,57%	57,14%
Very often (More than 4 times a month) (A5)	2	28,57%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Networking for project opportunities]			85,71%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	
Undecided (3)	0	0,00%	

Somewhat effective (4)	5	71,43%	85,71%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Advertising]			0,00%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	3	42,86%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	0	0,00%	0,00%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Joint branding]			0,00%
Answer	Count	Percentage	
Ineffective (1)	2	28,57%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	0	0,00%	0,00%
Very effective (5)	0	0,00%	
No answer	0	0,00%	

In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Joint sales and marketing campaigns]			42,86%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	3	42,86%	42,86%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Market creation]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	1	14,29%	28,57%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with.			85,71%

[International relations building]			
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	
Undecided (3)	0	0,00%	
Somewhat effective (4)	3	42,86%	85,71%
Very effective (5)	3	42,86%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Project Support]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	
Undecided (3)	4	57,14%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Joint project coordination]			42,86%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	

Undecided (3)	3	42,86%	
Somewhat effective (4)	3	42,86%	42,86%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Multi-discipline project management]			0,00%
Answer	Count	Percentage	
Ineffective (1)	2	28,57%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	0	0,00%	0,00%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Lobbying]			57,14%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	1	14,29%	
Somewhat effective (4)	4	57,14%	57,14%
Very effective (5)	0	0,00%	
No answer	0	0,00%	

In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Facilitation of bureaucracies]			28,57%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Legal services]			28,57%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	2	28,57%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or			28,57%

cooperate with. [Financial services]			
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	3	42,86%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Investor relations]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Access to funding]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	

Needs improvement (2)	0	0,00%	
Undecided (3)	5	71,43%	
Somewhat effective (4)	1	14,29%	28,57%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Research & Development]			57,14%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	1	14,29%	
Somewhat effective (4)	2	28,57%	57,14%
Very effective (5)	2	28,57%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Sourcing of researchers]			42,86%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	42,86%
Very effective (5)	1	14,29%	

No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Know-how transfer]			42,86%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	42,86%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following issues in the cluster you operate in or cooperate with. [Protection of intellectual property]			42,86%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	2	28,57%	42,86%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
What other issues do you observe being			

executed in the cluster?			
Answer	0	0,00%	
No answer	7	100,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Financial resources]			42,86%
Answer	Count	Percentage	
Very little availability or unavailable (1)	1	14,29%	
Limited availability (2)	2	28,57%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Suppliers of key inputs]			57,14%
Answer	Count	Percentage	
Very little availability or unavailable (1)	1	14,29%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	4	57,14%	57,14%
Abundant (5)	0	0,00%	

No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Research equipment]			42,86%
Answer	Count	Percentage	
Very little availability or unavailable (1)	2	28,57%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Educated labor force]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	2	28,57%	
Undecided (3)	0	0,00%	
Available (4)	4	57,14%	71,43%
Abundant (5)	1	14,29%	
No answer	0	0,00%	

In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [High quality training opportunities for employees]			28,57%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	2	28,57%	
Available (4)	2	28,57%	28,57%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [High quality researchers]			57,14%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	2	28,57%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	57,14%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the			85,71%

following resources (or capabilities) are available in your cluster? [Talented engineers]			
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	0	0,00%	
Available (4)	4	57,14%	85,71%
Abundant (5)	2	28,57%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Talented designers]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	4	57,14%	71,43%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster?			85,71%

[Know-how to develop new products]			
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	0	0,00%	
Available (4)	5	71,43%	85,71%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Opportunities to develop prototypes]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	71,43%
Abundant (5)	2	28,57%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Opportunities to access and use valuable research results]			57,14%
Answer	Count	Percentage	

Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	2	28,57%	
Undecided (3)	1	14,29%	
Available (4)	4	57,14%	57,14%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Support for getting patents and copyrights]			57,14%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	2	28,57%	
Undecided (3)	1	14,29%	
Available (4)	4	57,14%	57,14%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability of technological know-how to develop innovative products or services]			42,86%
Answer	Count	Percentage	
Very little availability or	0	0,00%	

unavailable (1)			
Limited availability (2)	1	14,29%	
Undecided (3)	3	42,86%	
Available (4)	2	28,57%	42,86%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Multi-disciplinary work environment]			57,14%
Answer	Count	Percentage	
Very little availability or unavailable (1)	1	14,29%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	4	57,14%	57,14%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability of companies for joint projects]			85,71%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	

Undecided (3)	0	0,00%	
Available (4)	6	85,71%	85,71%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Existence of companies or governmental organizations that demand our products or services]			28,57%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	2	28,57%	
Available (4)	1	14,29%	28,57%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Companies or organizations with marketing know-how]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	

Available (4)	5	71,43%	71,43%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [People equipped with high sales capabilities]			42,86%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [People equipped with good deal making capabilities]			28,57%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	2	28,57%	
Available (4)	2	28,57%	28,57%
Abundant (5)	0	0,00%	

No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Opportunities to export products or services.]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	5	71,43%	71,43%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Opportunities to import inputs cheaply.]			28,57%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	4	57,14%	
Available (4)	2	28,57%	28,57%
Abundant (5)	0	0,00%	
No answer	0	0,00%	

In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Internationalization capabilities]			71,43%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	1	14,29%	
Available (4)	5	71,43%	71,43%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Opportunities to cooperate with international firms]			42,86%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the			42,86%

following resources (or capabilities) are available in your cluster? [Availability of talented entrepreneurs]			
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	3	42,86%	
Available (4)	2	28,57%	42,86%
Abundant (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability of government subsidies]			57,14%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	1	14,29%	
Undecided (3)	2	28,57%	
Available (4)	2	28,57%	57,14%
Abundant (5)	2	28,57%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster?			0,00%

[Availability of tax reductions]			
Answer	Count	Percentage	
Very little availability or unavailable (1)	2	28,57%	
Limited availability (2)	3	42,86%	
Undecided (3)	2	28,57%	
Available (4)	0	0,00%	0,00%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability government supported research projects]			28,57%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	2	28,57%	
Available (4)	2	28,57%	28,57%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability of partnerships with governmental agencies]			42,86%
Answer	Count	Percentage	

Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	3	42,86%	
Undecided (3)	1	14,29%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, which of the following resources (or capabilities) are available in your cluster? [Availability of organizations with project coordination capabilities]			42,86%
Answer	Count	Percentage	
Very little availability or unavailable (1)	0	0,00%	
Limited availability (2)	2	28,57%	
Undecided (3)	2	28,57%	
Available (4)	3	42,86%	42,86%
Abundant (5)	0	0,00%	
No answer	0	0,00%	
Field summary for CR_5			
What other resources and capabilities do you have in your cluster?			
Answer	0	0,00%	
No answer	7	100,00%	

In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Cluster Management Organization(s)]			28,57%
Answer	Count	Percentage	
Ineffective (1)	2	28,57%	
Needs improvement (2)	1	14,29%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
Field summary for CR_6(2)			
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Cluster Marketing Organization(s)]			14,29%
Answer	Count	Percentage	
Ineffective (1)	2	28,57%	
Needs improvement (2)	2	28,57%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	1	14,29%	14,29%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with.			42,86%

[Cluster Development Organization(s)]			
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	3	42,86%	42,86%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Regional Marketing Organization(s)]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Project Coordinating Organization(s)]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	3	42,86%	

Undecided (3)	2	28,57%	
Somewhat effective (4)	2	28,57%	28,57%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Fund Raising Organizations]			57,14%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	1	14,29%	
Somewhat effective (4)	4	57,14%	57,14%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Consortium]			28,57%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	2	28,57%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	1	14,29%	28,57%
Very effective (5)	1	14,29%	
No answer	0	0,00%	

In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Research Center(s)]			71,43%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	1	14,29%	
Undecided (3)	1	14,29%	
Somewhat effective (4)	5	71,43%	71,43%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Universities]			71,43%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	0	0,00%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	4	57,14%	71,43%
Very effective (5)	1	14,29%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the			14,29%

cluster you operate in or cooperate with. [Municipalities]			
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	3	42,86%	
Undecided (3)	3	42,86%	
Somewhat effective (4)	1	14,29%	14,29%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In supporting the innovativeness of your business, how effective do you find the following organizations in your region, or in the cluster you operate in or cooperate with. [Government Agencies]			42,86%
Answer	Count	Percentage	
Ineffective (1)	1	14,29%	
Needs improvement (2)	1	14,29%	
Undecided (3)	2	28,57%	
Somewhat effective (4)	3	42,86%	42,86%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
Field summary for CR_7			
What other organizations do you find effective in the cluster?			
Answer	0	0,00%	
No answer	7	100,00%	

From the people below, how frequently do you get the useful ideas for your business? [My co-workers]			83,33%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	4	66,67%	83,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [My boss]			16,67%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	4	66,67%	
Often (4)	0	0,00%	16,67%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [Researchers]			33,33%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	1	16,67%	

Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [Consultants]			0,00%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	1	16,67%	
Sometimes (3)	5	83,33%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [Cluster management]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you get the useful ideas for your business? [People from cluster support organizations]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [My friends in other companies in this cluster]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	3	50,00%	50,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [My friends in other companies that operate in other clusters]			66,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	

Sometimes (3)	0	0,00%	
Often (4)	4	66,67%	66,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you get the useful ideas for your business? [Owners of other companies]			66,67%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	4	66,67%	66,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
Field summary for PR_1(10)			
From the people below, how frequently do you get the useful ideas for your business? [Government officials]			0,00%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	3	50,00%	
Sometimes (3)	0	0,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you get the useful ideas for your business? [My international connections]			50,00%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	3	50,00%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [My co-workers]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	2	33,33%	
Sometimes (3)	0	0,00%	
Often (4)	3	50,00%	50,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [My boss]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	

Rarely (2)	1	16,67%	
Sometimes (3)	2	33,33%	
Often (4)	0	0,00%	16,67%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [Researchers]			50,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	0	0,00%	
Often (4)	3	50,00%	50,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [Consultants]			33,33%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	2	33,33%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	33,33%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you learn about new production methods? [Cluster management]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	1	16,67%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [People from cluster support organizations]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [My friends in other companies in this cluster]			33,33%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	

Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	0	0,00%	33,33%
Very Often (5)	2	33,33%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [My friends in other companies that operate in other clusters]			50,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	50,00%
Very Often (5)	2	33,33%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [Owners of other companies]			66,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	
Sometimes (3)	0	0,00%	
Often (4)	3	50,00%	66,67%
Very Often (5)	1	16,67%	
No answer	0	0,00%	

From the people below, how frequently do you learn about new production methods? [Government officials]			0,00%
Answer	Count	Percentage	
Very rarely (1)	5	83,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	0	0,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new production methods? [My international connections]			33,33%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [My co-workers]			33,33%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	

Rarely (2)	1	16,67%	
Sometimes (3)	3	50,00%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [My boss]			33,33%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	3	50,00%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [Researchers]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	2	33,33%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you learn about new markets? [Consultants]			16,67%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	1	16,67%	
Sometimes (3)	4	66,67%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [Cluster management]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [People from cluster support organizations]			33,33%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	

Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	33,33%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [My friends in other companies in this cluster]			33,33%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	1	16,67%	
Sometimes (3)	3	50,00%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [My friends in other companies that operate in other clusters]			50,00%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	1	16,67%	
Sometimes (3)	2	33,33%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	

From the people below, how frequently do you learn about new markets? [Owners of other companies]			66,67%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	66,67%
Very Often (5)	2	33,33%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [Government officials]			0,00%
Answer	Count	Percentage	
Very rarely (1)	4	66,67%	
Rarely (2)	1	16,67%	
Sometimes (3)	1	16,67%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you learn about new markets? [My international connections]			50,00%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	

Rarely (2)	2	33,33%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [My co-workers]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	
Sometimes (3)	3	50,00%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [My boss]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	1	16,67%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	

From the people below, how frequently do you find the right connections to access new markets? [Researchers]			0,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	3	50,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [Consultants]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [Cluster management]			33,33%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	

Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	33,33%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [People from cluster support organizations]			0,00%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	3	50,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [My friends in other companies in this cluster]			16,67%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	2	33,33%	
Sometimes (3)	2	33,33%	
Often (4)	0	0,00%	16,67%
Very Often (5)	1	16,67%	
No answer	0	0,00%	

From the people below, how frequently do you find the right connections to access new markets? [My friends in other companies that operate in other clusters]			33,33%
Answer	Count	Percentage	
Very rarely (1)	4	66,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	0	0,00%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [Owners of other companies]			50,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [Government officials]			0,00%
Answer	Count	Percentage	
Very rarely (1)	6	100,00%	

Rarely (2)	0	0,00%	
Sometimes (3)	0	0,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections to access new markets? [My international connections]			50,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	0	0,00%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	50,00%
Very Often (5)	2	33,33%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [My co-workers]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	2	33,33%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you find the right connections for new business opportunities? [My boss]			50,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	0	0,00%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [Researchers]			0,00%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	3	50,00%	
Sometimes (3)	1	16,67%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [Consultants]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	

Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [Cluster management]			16,67%
Answer	Count	Percentage	
Very rarely (1)	3	50,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [People from cluster support organizations]			16,67%
Answer	Count	Percentage	
Very rarely (1)	2	33,33%	
Rarely (2)	1	16,67%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	16,67%
Very Often (5)	0	0,00%	
No answer	0	0,00%	

From the people below, how frequently do you find the right connections for new business opportunities? [My friends in other companies in this cluster]			33,33%
Answer	Count	Percentage	
Very rarely (1)	0	0,00%	
Rarely (2)	3	50,00%	
Sometimes (3)	1	16,67%	
Often (4)	1	16,67%	33,33%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [My friends in other companies that operate in other clusters]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	2	33,33%	
Sometimes (3)	0	0,00%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [Owners of other companies]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	

Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	1	16,67%	50,00%
Very Often (5)	2	33,33%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [Government officials]			0,00%
Answer	Count	Percentage	
Very rarely (1)	6	100,00%	
Rarely (2)	0	0,00%	
Sometimes (3)	0	0,00%	
Often (4)	0	0,00%	0,00%
Very Often (5)	0	0,00%	
No answer	0	0,00%	
From the people below, how frequently do you find the right connections for new business opportunities? [My international connections]			50,00%
Answer	Count	Percentage	
Very rarely (1)	1	16,67%	
Rarely (2)	0	0,00%	
Sometimes (3)	2	33,33%	
Often (4)	2	33,33%	50,00%
Very Often (5)	1	16,67%	
No answer	0	0,00%	

Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They tell the truth in negotiations]			83,33%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	1	16,67%	
Undecided (3)	0	0,00%	
Slightly agree (4)	3	50,00%	83,33%
Strongly agree (5)	2	33,33%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They meet their negotiated obligations]			83,33%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	0	0,00%	
Undecided (3)	1	16,67%	
Slightly agree (4)	4	66,67%	83,33%
Strongly agree (5)	1	16,67%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s):			100,00%

[They are reliable]			
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	0	0,00%	
Undecided (3)	0	0,00%	
Slightly agree (4)	4	66,67%	100,00%
Strongly agree (5)	2	33,33%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They succeed by stepping on other people]			33,33%
Answer	Count	Percentage	
Strongly disagree (1)	3	50,00%	
Slightly disagree (2)	1	16,67%	
Undecided (3)	0	0,00%	
Slightly agree (4)	2	33,33%	33,33%
Strongly agree (5)	0	0,00%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They try to get the upper hand]			16,67%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	4	66,67%	

Undecided (3)	1	16,67%	
Slightly agree (4)	1	16,67%	16,67%
Strongly agree (5)	0	0,00%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They take advantage of others problems]			0,00%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	4	66,67%	
Undecided (3)	2	33,33%	
Slightly agree (4)	0	0,00%	0,00%
Strongly agree (5)	0	0,00%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They negotiate honestly]			83,33%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	1	16,67%	
Undecided (3)	0	0,00%	
Slightly agree (4)	3	50,00%	83,33%
Strongly agree (5)	2	33,33%	
No answer	0	0,00%	

Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They keep their word]			83,33%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	0	0,00%	
Undecided (3)	1	16,67%	
Slightly agree (4)	2	33,33%	83,33%
Strongly agree (5)	3	50,00%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They don't mislead others]			66,67%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	1	16,67%	
Undecided (3)	1	16,67%	
Slightly agree (4)	2	33,33%	66,67%
Strongly agree (5)	2	33,33%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your			0,00%

cluster(s): [They try to get out of their commitments]			
Answer	Count	Percentage	
Strongly disagree (1)	2	33,33%	
Slightly disagree (2)	3	50,00%	
Undecided (3)	1	16,67%	
Slightly agree (4)	0	0,00%	0,00%
Strongly agree (5)	0	0,00%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They negotiate joint expectations fairly]			66,67%
Answer	Count	Percentage	
Strongly disagree (1)	0	0,00%	
Slightly disagree (2)	0	0,00%	
Undecided (3)	2	33,33%	
Slightly agree (4)	3	50,00%	66,67%
Strongly agree (5)	1	16,67%	
No answer	0	0,00%	
Please provide your opinion about the following questions about the people in other organizations who you cooperate with in your cluster(s): [They take advantage of people who are vulnerable]			16,67%
Answer	Count	Percentage	
Strongly disagree (1)	2	33,33%	

Slightly disagree (2)	3	50,00%	
Undecided (3)	0	0,00%	
Slightly agree (4)	1	16,67%	16,67%
Strongly agree (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Cluster Management Organization(s)]			33,33%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	2	33,33%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	2	33,33%	33,33%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Cluster Marketing Organization(s)]			16,67%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	3	50,00%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	1	16,67%	16,67%
Very effective (5)	0	0,00%	
No answer	0	0,00%	

In building trust in a cluster, how effective do you find the following factors? [Cluster Development Organization(s)]			16,67%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	2	33,33%	
Undecided (3)	2	33,33%	
Somewhat effective (4)	1	16,67%	16,67%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Regional Marketing Organization(s)]			16,67%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	3	50,00%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	1	16,67%	16,67%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
Field summary for WR_2(5)			
In building trust in a cluster, how effective do you find the following factors? [Project Coordinating Organization(s)]			33,33%
Answer	Count	Percentage	

Ineffective (1)	1	16,67%	
Needs improvement (2)	2	33,33%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	2	33,33%	33,33%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Fund Raising Organizations]			33,33%
Answer	Count	Percentage	
Ineffective (1)	0	0,00%	
Needs improvement (2)	4	66,67%	
Undecided (3)	0	0,00%	
Somewhat effective (4)	2	33,33%	33,33%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Consortium]			16,67%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	4	66,67%	
Undecided (3)	0	0,00%	
Somewhat effective (4)	0	0,00%	16,67%
Very effective (5)	1	16,67%	
No answer	0	0,00%	

In building trust in a cluster, how effective do you find the following factors? [Research Center(s)]			33,33%
Answer	Count	Percentage	
Ineffective (1)	2	33,33%	
Needs improvement (2)	1	16,67%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	1	16,67%	33,33%
Very effective (5)	1	16,67%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Universities]			33,33%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	2	33,33%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	1	16,67%	33,33%
Very effective (5)	1	16,67%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Municipalities]			0,00%
Answer	Count	Percentage	

Ineffective (1)	1	16,67%	
Needs improvement (2)	3	50,00%	
Undecided (3)	2	33,33%	
Somewhat effective (4)	0	0,00%	0,00%
Very effective (5)	0	0,00%	
No answer	0	0,00%	
In building trust in a cluster, how effective do you find the following factors? [Government Agencies]			33,33%
Answer	Count	Percentage	
Ineffective (1)	1	16,67%	
Needs improvement (2)	2	33,33%	
Undecided (3)	1	16,67%	
Somewhat effective (4)	1	16,67%	33,33%
Very effective (5)	1	16,67%	
No answer	0	0,00%	
What other factors do you find effective in trust building?			
Answer	0	0,00%	
No answer	6	100,00%	
[Name]			
Answer	6	100,00%	
No answer	0	0,00%	

[Surname]			
Answer	6	100,00%	
No answer	0	0,00%	
Gender			
Answer	Count	Percentage	
Female (F)	0	0,00%	
Male (M)	5	83,33%	
No answer	1	16,67%	
[Your Email:]			
Answer	6	100,00%	
No answer	0	0,00%	
[What is the name of the organization you work for?]			
Answer	5	83,33%	
No answer	1	16,67%	
Field summary for PP_3 [What is the website of the organization you work for?]			
Answer	5	83,33%	
No answer	1	16,67%	
What is your role in your			

organization?			
Answer	Count	Percentage	
Founder (1)	3	50,00%	
Member of BoD (2)	1	16,67%	
CEO (3)	0	0,00%	
Manager (4)	2	33,33%	
Specialist (5)	0	0,00%	
Researcher (6)	0	0,00%	
Other	0	0,00%	
No answer	0	0,00%	
Calculation	Result		
Count	6		
Sum	12017		
Standard deviation	14,42		
Average	2002,83		
Minimum	1973		
1st quartile (Q1)	1991		
2nd quartile (Median)	2011		
3rd quartile (Q3)	2012,25		
Maximum	2013		
Null values are ignored in calculations			
Q1 and Q3 calculated using minitab method			
many employees does your company have?</p>			

Calculation	Result		
Count	6		
Sum	2067		
Standard deviation	740,46		
Average	344,5		
Minimum	4		
1st quartile (Q1)	4,75		
2nd quartile (Median)	9		
3rd quartile (Q3)	530		
Maximum	2000		
Null values are ignored in calculations			
Q1 and Q3 calculated using minitab method			
In which region is your company located?			
Answer	Count	Percentage	
Uusimaa (1)	4	66,67%	
Varsinais-Suomi (2)	0	0,00%	
Pohjois-Pohjanmaa (3)	1	16,67%	
Pirkanmaa (4)	0	0,00%	
Päijät-Häme (5)	0	0,00%	
Other	1	16,67%	
No answer	0	0,00%	
Do you want to be informed about the results of the survey?			

Answer	Count	Percentage	
Yes (Y)	4	66,67%	
No (N)	2	33,33%	
No answer	0	0,00%	