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How does the management team within clusters facilitate and sustain ambidexterity in the cluster?

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Abstract

Organizational ambidexterity is a thoroughly researched topic within organizational literature. However, studies on ambidexterity in more complex organizational contexts, and the role of the manager in achieving ambidexterity, are under researched areas in this context. This thesis aims to address these under researched areas by addressing the research question *How does the management team within clusters facilitate and sustain ambidexterity the cluster?*

In order to properly address this research question the author has conducted a literature review on the topics of clusters, ambidexterity, and knowledge exchange intermediaries. This review led to the development of an analytical model which states that exploration efforts are based on technology push programs started by cluster management, and that the management team takes an activist role in order to succeed with these programs. The model also states that exploitation efforts are started as a result of market pull requests from cluster members, which leads to the management team taking on the role of broker in order to fulfill the request.

The analytical model is tested against primary data collected from 6 Norwegian high-tech clusters operating within the industries of oil and gas, alternative energy, medical technology, and oncology. The primary data were collected through semi structured interviews with members of the management team within each of these clusters.

Through analysis of the primary data the author found that exploration efforts can be started by either technology push or market pull requests, and that the management team can take on the role of broker or activist depending on the situation. Exploitation efforts usually start as a result of market pull requests that, depending on the request lead the management team to take on the role of activist or broker as a response.

The author also finds that the external environment has a mitigating effect on the ability a cluster has to achieve ambidexterity through balancing exploration and exploitation. This finding could lead to further studies on how to minimize this mitigating effect.

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Introduction

The goal of this thesis is to discover how the management team within clusters can facilitate and sustain ambidexterity in the cluster, and what tools they have available to them in order to do this. In the first part of the thesis I will review the existing literature on ambidexterity, clusters, and knowledge exchange intermediaries. I will then present the methodology I used to develop this thesis, as well as the analysis process, finally I will present my results, and discuss these results.

Backdrop for the study

When I set out to find members of cluster management teams to interview for this thesis I did so based on a set of criteria for the size, industry and scope of the cluster. I did not give much thought to the external factors that influence the industry each cluster was operating within. Quite by coincidence I ended up with 3 clusters facing an unstable external environment due to a sharp decrease in oil prices, and 3 clusters that were operating in a much more stable environment. I wrote this thesis from January-May of 2016, *Figure 1* shows a graph of the oil price from 1995-2015.

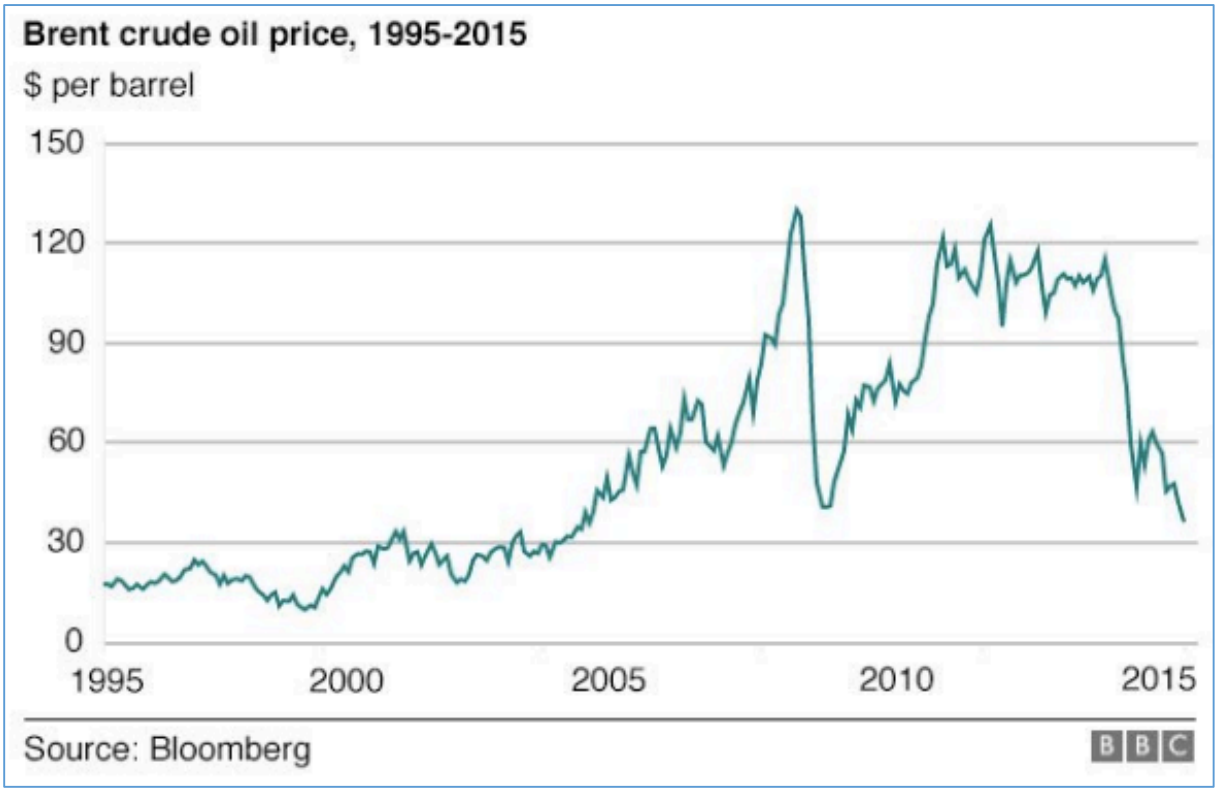

Figure 1: Oil prices from 1995-2015, source: www.bbc.co.uk

As is evident from looking at *figure 1* the price of oil has fallen sharply in the last few years, this has led to what many commentators are calling a crisis in the oil and gas industry. As reported by leading Norwegian newspaper Dagbladet on Friday, April 22nd, 2016 this crisis has led to 35,000 job cuts in the Norwegian oil and gas industry[1]. According to a new report from The Norwegian Oil and Gas Association this downturn will continue until 2018 and lead to the loss of 50,000 jobs by that time[2]. Meanwhile, the med-tech and alternative energy industries that the rest of the interview subjects for this thesis operate within are relatively stable and experiencing growth. With this situation as a backdrop my thesis led to some interesting and unexpected findings.

Problem formulation

The term ambidextrous comes from the Latin word *ambidexter* literally meaning "*right handed on both sides*"[3]. In modern English, the meaning of ambidexterity is to be equally skilled at the use of both the left and the right hand, and to use them simultaneously (Wikipedia, 2016). The concept of ambidexterity can also be applied to organizations.
In an organizational context the term ambidextrous does not refer to the use of ones' hands, but to the balancing of two types of activities; exploitation and exploration activities. Exploitation refers to incrementally modifying strategies and tactics based on experience, previous projects and client feedback, by utilizing and modifying project processes and lessons learned. Exploration refers to drastically modifying or creating brand new strategies based on new knowledge gained from exposure to newly conducted research projects (Hine et al. 2010).

".. it is widely recognized that organizations need to offer a mix between innovation and sustainable products/services and that a reliance on one product or a reliance on one type of product is a narrow strategy which involves the inevitability of the organisational life cycle following that of the product life cycle. Accordingly, if the product life cycle is short, the organization's life is short." (Hine et al. 2010, p.723)

1 http://www.dagbladet.no/2016/04/22/nyheter/arbeidsliv/arbeidsmarked/olje_og_energi/oljekrise/43976488/

2 https://www.norskoljeoggass.no/Global/2015%20dokumenter/Konjunkturrapporten%202015.pdf

3 http://www.etymonline.com/index.php?term=ambidextrous

There is a vast amount of literature on ambidexterity and how organizations can achieve ambidexterity. To a large extent there is agreement on March's (1991) definition of ambidexterity as the ability to engage in both exploration and exploitation activities, and that the ability to do this will aid the longevity of an organization. The ability to successfully balance exploration and exploitation activities enables organizations to compete in mature markets that require cost efficiency and incremental innovations, while at the same time innovate and succeed in emerging markets (March, 1991).

Raisch & Birkinshaw (2008) show that the learning categories of exploration and exploitation mirror other dichotomies from the organizational learning literature; such as double-loop vs. single-loop learning, generative vs. adaptive learning, local search vs. long jump, product innovation vs. product-oriented learning, adaptability vs. alignment. What all these dichotomies have in common is that the scholars agree on the fact that in order to achieve long term success there is a need to balance the two types of learning. Since I am writing about ambidexterity I will only be concentrating on the exploration-exploitation dichotomy.

Most of the literature on ambidexterity concentrates on how a single organization can achieve different types of ambidexterity through organizational design, two areas that are lacking in research is how ambidexterity within more complex organizational settings can be achieved, and the role the management team plays in achieving ambidexterity. The following excerpts showcase this gap in the research; "*The role of the manager is also poorly understood, and the identification of specific managerial practices (explaining the 'how') is lacking within the literature, and therefore this is an area likely to benefit from further research*." (Turner, 2011). Benner and Tushman (2003) argue for lower-level analysis of ambidexterity, where "*ambidextrous organizations are composed of multiple tightly coupled subunits that are themselves loosely coupled with each other. Within subunits the tasks, culture, individuals, and organizational arrangements are consistent, but across subunits tasks and cultures are inconsistent and loosely coupled*." (2003: p.242). This description by Benner and Tushman is the description of a business network. Over the last decades there has been a rapid evolution in the number, and complexity of business networks. Halinen & Törnroos (2005, p.1285) argue that this development is driven by the increased importance of "*knowledge, technological innovation, competitive forces, globalization, and availability of information technology*". In the same way that a network of employees within an organization can store more knowledge than any single employee, so can a network of organizations harness more

knowledge than any single organization. One type of business network that has gained a lot of attention during this period is *clusters*. Since Porter's (1990) seminal book popularized the term, cluster research has shown the formation of clusters to have a positive impact on innovation and competitive advantage in the effected areas and industries (Okamuro & Nishimura, 2011). This has led to increased pressure on governments to facilitate the formation of clusters, most developed countries now have national programs in place to foster and develop clusters within different industries.

Given the focus governments give to cluster development, the under researched state of managements role in achieving ambidexterity, and the importance of ambidexterity in order to ensure long and short term survival. I have developed the following research question:

How does the management team within clusters facilitate and sustain ambidexterity in the cluster?

By addressing this question I am contributing to two under researched areas; the role the manager plays in achieving ambidexterity, and achieving ambidexterity within complex organizational structures such as clusters. Most of the existent literature on cluster management focuses on how we can evaluate the effectiveness of cluster management, and what constitutes excellence in cluster management (PWC, 2011). This study will contribute to this stream of literature by researching how to *achieve* ambidexterity in clusters, not just how to *evaluate* it.

I will take a knowledge-based view of clusters, saying that the main task of the cluster is to create, integrate, and apply knowledge. Therefore, I argue that ambidexterity can be achieved through knowledge management, making sure that both new, external, and existing, internal, knowledge in member firms is spread to other firms within the cluster that could benefit from it. How knowledge is managed within the cluster depends on the firms that make up the cluster and what their needs are. By moving the level of analysis from the organizational level to the cluster level it lessens the problem of separating exploration and exploitation activities within a single organization, since the cluster members are already structurally separated from one another.

In order to determine how the management team attempts to achieve cluster ambidexterity I conducted qualitative interviews with members of the management team of six different high-tech industry clusters in Norway. These clusters were: GCE NODE, Oslo Cancer Cluster, Oslo Medtech, GCE Blue Maritime, Windcluster Norway and NCE Instrumentation.

The next chapter will review the existent literature on clusters, ambidexterity, and related streams of literature like knowledge exchange intermediaries. After the literature review I will present the methodology used to develop my study, and finally present and discuss the results.

Literature review

When selecting what streams of literature to base my review on I started out by doing broad searches for "ambidexterity" and "clusters" on Google Scholar and Oria in order to find commonly cited works on these topics. By using the reference lists from these works I found other relevant literature.

Clusters

There is some ambiguity within the literature on exactly how to define what a cluster is. St. John & Pouder (2006) point out that it is not clear within the literature what distinguishes a cluster from related terms such as industrial districts and innovative milieu. Maillat's (1998) discussion of the early formations and definitions of innovative milieus and industrial districts shows that there are indeed several key similarities between these terms. They are all made up of organizations that each play a key part in their common value chain, and are linked to each other either vertically or horizontally within that value chain. There is usually a high degree of both competition and cooperation between the organizations; producers might cooperate in order to drive down production costs as much as possible, and then compete with each other to sell their goods in the market place.

In this literature review I will show the evolution from Marshall's early definition of industrial districts through the literature on innovative milieu, and finally to the knowledge-based view of clusters that I will be applying in this thesis.

Industrial Districts

The earliest contribution to, and starting point of, the literature on clusters was Alfred Marshall's *Principles of Economics* (1920) which coined the term *industrial districts.* Marshall described an industrial district as an area with "*the concentration of specialized industries in particular areas*" and where "*the secrets of industry are in the air*". The development of an industrial district, according to Marshall (1920), can be based on natural resources, climate, or availability of specialized labor and knowledge within a region. The districts are usually made up of several small-scale producers and suppliers with a high degree of interaction and employee turnover between firms, the loyalty of the employees is to the

district, not a single firm. The high degree of inter-firm employee turnover leads to *knowledge spillovers* which facilitates new innovations.

The idea of knowledge spillovers driving innovations was also illustrated by Jane Jacobs in *The economy of cities* (1969). Jacobs showed that a high degree of interaction between people in cities would lead to new innovations. By comparing Manchester and Birmingham she also showed the importance of knowledge heterogeneity. Manchester was heavily focused on the textile industry, and very efficient in that regard. Birmingham was comprised of several small firms, was not dominated by a single industry, and constantly fostered spin-offs from established firms. A century later Birmingham had surpassed Manchester and was one of Britain's most prosperous cities. Jacobs attributes this turn of events to the heterogeneity of knowledge and high degree of interaction between firms in Birmingham which led to knowledge spillovers and new innovations. Manchester was caught in the success trap of the textile industry and therefore had a lower degree of innovation in other areas.

The Italian District School

The period following Marshall's introduction of *industrial districts* was dominated by the Fordist model and its focus on hierarchies, mass production, and economies of scale. Economists at the time argued that a region made up of small and medium sized firms could not be successful and that any exception to this was just a statistical anomaly. This view prevailed until the 1970's and 80's when a world wide recession hit, and the emergence of the Italian district school of thought began. Italian scholars began to notice that there were some districts of Italy that became, and remained, successful within certain industries despite the recession that was affecting the rest of the world. Giacomo Becattini re-applied Marshall's notions of industrial districts to the Italian situation, he argued that scholars must change the unit of analysis from a single firm or industry to clusters of interacting firms within a geographic area. Lazerson's (1990, 1993) description of the knitwear district in northern Italy added some new characteristics to Marshall's notion of industrial districts. Lazerson focused on the importance of the community structure in maintaining the district, the small firms shared a value system, were loyal to the community and would cooperate in order to maintain their competitive advantage while at the same time competing with each other for resources. The second contribution of the Italian district school was the presence of institutions and rules within the community that help support and develop the district. The main contributions to cluster theory from the Italian district school were to extend Marshall's theory of industrial districts by changing the unit of analysis from a single firm or industry to the district itself,

realizing that the districts both have a social and economic value, and showing that firms within a district could both compete and cooperate simultaneously.

GREMI

The next major contribution to cluster theory came in the 1980's from the field of economic geography. The GREMI research group founded by Philippe Aydalot focused their attention on how innovations were achieved and what impact they had on industrial change (Aydalot & Kebble, 1989). Much like the Italian district school GREMI argued that in order to understand the innovation process we must look at the organization and the milieu around the organization, not the organization as a stand-alone actor (Aydalot, 1986). This led to the introduction of the term *innovative milieu* which is defined as:

"*a multi-dimensional reality which links a collective of players for the dynamic realization of productive systems, integrating at the same time the territorial dimension and the techno-industrial paradigms behind the structural changes of the productive apparatus."* (Quévit and Van Doren, 1997, p.345)

Much like the Italian district school, the GREMI research group focused on the importance of social interaction between the different actors in the innovative milieu. The multi-dimensional reality of innovative milieu covers a *cognitive dimension*, an *organizational dimension*, and a *territorial dimension*. The cognitive dimension is the learning that occurs within the milieu; the organizational dimension is the learning that governs the interaction between different actors in the milieu; the territorial dimension is the presence of spatial proximity within the milieu (Quévit and Van Doren, 1997). Quévit and Van Doren (1997) also highlighted the idea of a *network of innovation* where the attention is focused on the "*interaction between the innovative milieu's internal and external dynamic*" (p.345). In the case of a network of innovation the cognitive dimension of the innovative milieu refers to knowledge resources and know-how; while the organizational dimension refers to the ties and connections between internal and external actors in the milieu that facilitate the sharing of resources. By introducing the idea that an innovative milieu could benefit from interacting with external actors the GREMI group added a much more dynamic character to what would become the literature on clusters. Maillat et al. (1997) illustrated this point in the following quote:

A milieu is not immutable, it is not defined a priori, once and for all. On the contrary, it constitutes a dynamic complex which in the course of time has had to change and evolve through a continuous process of resource creation, innovation and adaption to external constraints" (p. 109)

The GREMI research group concluded that there are 5 key elements that are necessary in order for an innovative milieu to succeed; 1) know-how (the right knowledge), 2) standards, rules and values, 3) relational capital, 4) human and material resources, 5) interaction patterns with the environment external to the milieu (Maillat et al, 1997). The first 4 of these elements are also present in Marshall's and the Italian district theories, but the 5th element which introduced an external, social element to the innovation and learning process is the key contribution of the GREMI research group.

Porter

In 1990 Michael Porter published *The Competitive Advantage og Nations* (1990) where he tried to figure out why certain countries were dominating within certain industries. Porter argued that in order to understand the reasons behind this it is important to look not only at the country and its policies as the unit of analysis, but rather to focus on the specific clusters of firms that are successful within each country. Like the scholars on industrial districts, Porter argued that economies that succeed within a certain market are made up of groups of interconnected successful firms, not single, isolated actors (Porter, 1990).

Porter used the term *cluster* to describe the high concentrations of actors in an industry located within a limited geographic area, such as shoemakers in northern Italy, performance cars in southern Germany or technology companies in Silicon Valley (Porter, 1990). Porter defined clusters as "*geographic concentrations of interconnected companies and institutions in a particular field." (1998: 78).* This is a very vague definition, which may contribute to the problem of distinguishing it from other related concepts. Other definitions of clusters, such as Enright (1996) are very similar, and probably inspired by, the definition put forward by Porter.

Porter (1998) also states that clusters are a new type of organizational form in between markets on the one hand and hierarchies on the other. Thinking of a cluster as a mix between a free market and a hierarchical organization is very illustrative of how they operate. The members of the cluster have weak ties to each other and have to cooperate in order to drive down costs and innovate. While at the same time they must compete in order to foster innovation and keep the cluster competitive with, or ahead of the "outside".

What separates Porter's contribution to the cluster literature from the literature on industrial districts presented above, is that Porter was much more focused on how governments can foster and sustain successful clusters. He created what is known is the *national diamond model* in order to showcase the tools government has at their disposal in order to develop and

sustain successful clusters. The four pillars of this model are: 1) *factor conditions (skilled labor, infrastructure, etc.)*; 2) *demand conditions (an educated and demanding home market)*; 3) *development of relating and supporting industries*; 4) *firm strategy, structure and rivalry*. These factors are interrelated and can influence one another. For example, strong demand conditions can lead to increased focus on developing factor conditions as more people try to get into that industry. Porter argues that in order to be truly successful, all 4 of these factors need to be present, and that there are 2 unpredictable variables that can influence all 4 factors; chance (wars, radical political changes), and government.

The other way in which Porter separates himself from earlier scholars is that he mainly focuses on the economic features of clusters, he pays little attention to the social interaction aspect of clusters that is considered crucial in the other schools of thought. This has been one of the main criticisms aimed at Porter's work, in particular Rocha (2004) is very critical of Porter's lack of focus on the importance of social interaction.

Knowledge-Based view of Clusters

As a reaction to Porter ignoring the social interaction aspects of clusters and dissatisfaction with the prevailing economic theories, the last two decades have brought with them a view of organizations as knowledge creators (Bahlemann & Huysmann, 2008). In this view the main task of organizations is to create, distribute and manage knowledge within the organization in order to survive. This view is based on the GREMI and Italian district school of thought, where social interaction is a key driver in facilitating knowledge exchanges within and between organizations. This view of organizations as knowledge creators and managers can also be expanded to include clusters, the main task of a cluster then becomes to create, manage, and spread knowledge to the parts of the cluster where it is needed (Bahlemann & Huysmann, 2008).

Norwegian Cluster Research

In a Norwegian research context Porter and his book, "*The Competitive Advantage of Nations"* (1990) marked the starting point for research on clusters. Torger Reve, professor at BI Norwegian Business School, has been the most prolific researcher on this topic. Reve and his colleagues have published three main studies on Norwegian clusters in the time-period from 1992-2012. These studies have shaped Norway's public policy with regards to cluster development. Much like the literary tradition outlined above, the Norwegian literature has shown a steady progression from Porter's view of clusters, to a more knowledge based view in recent years.

The first study, "*A Competitive Norway*" (Reve et al., 1992), came about as a result of top executives in Norwegian industries requesting a similar study to "*Competitive Advantage of Nations"* (Porter, 1990). The study was a replication of Porter's study, and used the national diamond model to analyze the competitiveness of 15 different Norwegian industry clusters (Reve, Sasson, 2015). The results had a huge impact on public policy in Norway, and led to a strong focus on improving all aspects of the national diamond model in order to help foster the development of successful clusters.

The second study, "*A Value-Creating Norway*" (Reve & Jokobsen, 2001) focused on how the clusters that were identified in the first study could continue to develop and become more competitive on the global market. This study resulted in public policy programs aimed at stimulating and growing clusters, not just improving the demand conditions outlined in Porter's national diamond model. Specifically, it resulted in the creation of Innovation Norway, as well as the Arena and Norwegian Centres of Expertise (NCE) cluster programs (Reve, Sasson, 2015). This study also saw an increased focus on the social interaction benefits of clusters, that knowledge dissemination and absorption is more focused and quicker in clusters than in external organizations.

The third national study on clusters, "*A knowledge-based Norway"* (2012), adopted a knowledge based view of the clusters and focused on how the public and private sector can collaborate in order to create the right conditions for knowledge based industrial development. This was thought of as especially important to Norway since it is a high-cost location and therefore must focus on new knowledge creation in order to attract top talent in research heavy industries. This study resulted in the creation of the Global Center of Expertise (GCE) cluster program. A strong focus on coopetition, and not just physical proximity was evident in this study:

> *Cluster dynamics is the degree to which related firms compose their internal and external relationships to constitute an inter-related group of firms and institutions as oppose to an augmentation of isolated firms and institutions merely sharing a certain geographical space.* (Reve, Sasson, 2015 p.18)

Ambidexterity

The concept of ambidexterity was first introduced by Duncan (1976) who argued "…*the organization has to be strategically responsive in making major changes while at the same time it must be concerned with carrying out its activities in the most efficient manne*r" (Duncan, 1976: p. 172). Building on this, March (1991) introduced the distinction between exploration and exploitation activities. Inserting these terms into Duncan's (1976) argument; exploration activities are used when responding and adapting to major changes, while exploitation activities are used to optimize performance of current activities.

The difference between exploration and exploitation is illustrated in the following quote: "…*choices must be made between gaining new information about alternatives and thus improving future returns (which suggests allocating part of the investment to searching among uncertain alternatives), and using the information currently available to improve present returns (which suggests concentrating the investment on the apparently best alternative)*." (March, 1991: p.72). The former example illustrates exploration activities while the latter example illustrates exploitation activities.

Raisch & Birkinshaw (2008) show that the categories of exploration and exploitation mirror other dichotomies from the organizational learning literature; double-loop vs. single-loop learning, generative vs. adaptive learning, local search vs. long jump, product innovation vs. product-oriented learning, adaptability vs. alignment. In all these cases the scholars agree that in order to achieve long term success there is a need to balance the two types of learning. For this thesis I will only be focusing on exploration/exploitation, as these are the sub-units of ambidexterity.

March (1991) argued that short-term benefits could be gained from exploitation activities, while long-term benefits were only achieved through exploration. March (1991) also stated that exploration is more uncertain than exploitation and that these activities must be balanced within the organization. March expanded on his previous work in Levinthal and March (1993) where the terms *failure trap* and *success trap* were introduced. *Failure trap* refers to a situation where exploration drowns out exploitation and an organization is trapped in a circle of exploring new options that fail, which again leads to more unsuccessful exploration (Levinthal and March, 1993). The *success trap* refers to a situation where exploitation drowns out exploration and an organization relies on the short-term benefits gained from exploitation, this leads to the organization investing too little in exploration and leaves them in danger of being outcompeted by other innovative organizations (Levinthal and March, 1993). Following

this train of thought the authors suggest "*The basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and, at the same time, to devote enough energy to exploration to ensure its future viability* (Levinthal and March, 1993: p.105). While March (1991) argued that organizations must switch between exploration and exploitation activities depending on their environment, Levinthal and March (1993) propose that it is both possible and necessary for organizations to engage in both exploration and exploitation simultaneously. The discussion of whether organizations need to engage in both exploration and exploitation activities simultaneously in order to truly be considered ambidextrous is one that has persisted within the literature. As I will show later it has led to different conceptualizations of ambidexterity, and how to achieve it. Since I am looking at clusters in this thesis, I will discus the different models for division of exploration and exploitation activities within the cluster later.

Gupta et al. (2006) shows that there are disagreements within the literature on exploitation and exploration as to what activities are encompassed in each term. The central divide within the literature is between those who believe that exploration/exploitation is separated by different types of learning, and those who believe they are separated by the presence or absence of learning. Baum, Li, and Usher (2000), Benner and Tushman (2002), and He and Wong (2004) are examples of studies that claim both exploration and exploitation involve learning, but that they involve learning of different types. According to Baum, Li and Usher (2000) exploitation refers to learning through searching within the organization, reflecting on previous experiences and reusing or repurposing existing routines. Exploration refers to learning through variation, experimentation and play (Baum, Li and Usher, 2000). Benner and Tushman claim, "*Exploitative innovations involve improvements in existing components and building on the existing technological trajectory, whereas exploratory innovation involves a shift to a different technological trajectory*" (2002: p. 679). He and Wong define exploitative innovation as "*technological innovation activities aimed at improving current product-market domains"* and exploratory innovation as "*technological innovation aimed at entering new product-market domains"* (2004: p. 483).

On the other hand, Rosenkopf and Nerkar's (2001) study on the impact of knowledge search, local vs. non-local, and resulting patents exemplify the opposite view. Rosenkopf and Nekar treat all instances of learning and innovation as exploration and reserve exploitation for situations where an organization simply re-uses and re-combines existing knowledge and is not attempting to learn anything new. I agree with the school of thought that emphasizes the

difference between exploration and exploitation as the degree of learning, not the presence or absence of learning.

Gupta et al. (2006) brings up three other issues related to the literature on exploration and exploitation, *orthogonality vs. continuity, ambidexterity vs. punctuated equilibrium, duality vs. specialization.*

Orthogonality vs. continuity: Although March (1991) pointed out the benefits of achieving both exploration and exploitation, he also argues that the two concepts are mutually exclusive because they compete for scarce resources, and are iteratively self-enforcing as illustrated by the *failure* and *success* traps discussed by Levinthal and March (1993). This view represents the view of exploration and exploitation as two ends of a continuum, where the organization must make trade-offs between the two and place itself somewhere on that continuum. This view will lead to organizations pursuing *temporal* or *contextual ambidexterity (figure 2).* The orthogonal view of ambidexterity (Cao et al. 2009; Raisch et al. 2009) does not look at exploration and exploitation as mutually exclusive and proposes that they could have a positive effect on one another. This can be achieved through *structural ambidexterity.*

Ambidexterity vs. punctuated equilibrium: As shown in March (1991) and Levinthal, March (1993) the benefits of engaging in and balancing both exploration and exploitation are well documented, however there is still debate on what the best way to achieve this is. The ambidexterity view represented by Benner and Tushman (2003), and Levinthal (1997) argues that the best way to achieve this is to pursue both activities simultaneously. Benner and Tushman capture the idea behind this ambidextrous approach in the following excerpt: "*Ambidextrous organization designs are composed of highly differentiated but weakly integrated subunits. While the exploratory units are small and decentralized, with loose cultures and processes, the exploitation units are larger and more centralized, with tight cultures and processes. Exploratory units succeed by experimenting— by frequently creating small wins and losses (Sitkin, 1992). Because process management tends to drive out experimentation, it must be prevented from migrating into exploratory units and processes. In contrast, exploitation units that succeed by reducing variability and maximizing efficiency and control are an ideal location for the tight coordination associated with process management efforts.* (2003: p. 252). This is also related to *structural ambidexterity*.

The approach of punctuated equilibrium represented by (Burgelman, 2002; Levinthal & March, 1993; Romanelli & Tushman, 1994) argues, "*According to the punctuated equilibrium model, radical and discontinuous change of all or most organizational activities is necessary*

to break the grip of strong inertia. (Romanelli & Tushman, 1994: p.1143). In their study of 25 minicomputer producers in the United States, Romanelli & Tushman hypothesized that "*Organizational transformations will most frequently occur in short, discontinuous bursts of change involving most or all key domains of organizational activity"* (1994: p.1143). Their study found that revolutionary transformations outnumbered non-revolutionary transformations 6 to 1, supporting the idea that organizational transformations usually follow the pattern described by punctuated equilibrium. I see the model of punctuated equilibrium as having many similarities to Schumpeter's theory of long waves resulting from technological innovation, long periods of tranquility, where organizations focus on exploitation, are broken up by upheaval due to new innovations requiring organizations to invest more in exploration. This will result in organizations pursuing *temporal ambidexterity.*

Duality vs. Specialization: Gupta et al (2006) argue that there are cases where it is not necessary for an organization to be ambidextrous in order to be successful. It is argued that organizations who are part of a broader social system can specialize in either exploration or exploitation as long as they have connections to and exchange services with another organization that specialize in the opposite skill. Known as the specialization model, this model does not fit with those scholars (Gibson & Birkinshaw, 2004; Tushman & O'Reilly, 1996) who argue that ambidexterity is not the mere presence of exploration and exploitation, but that these activities must be addressed simultaneously and internally. Duality is the ability of one organization to successfully engage in both exploration and exploitation activities.

By combining these factors in different ways it is possible to conceptualize different types of ambidexterity, the literature has identified three different types of ambidexterity, these are discussed in the next section.

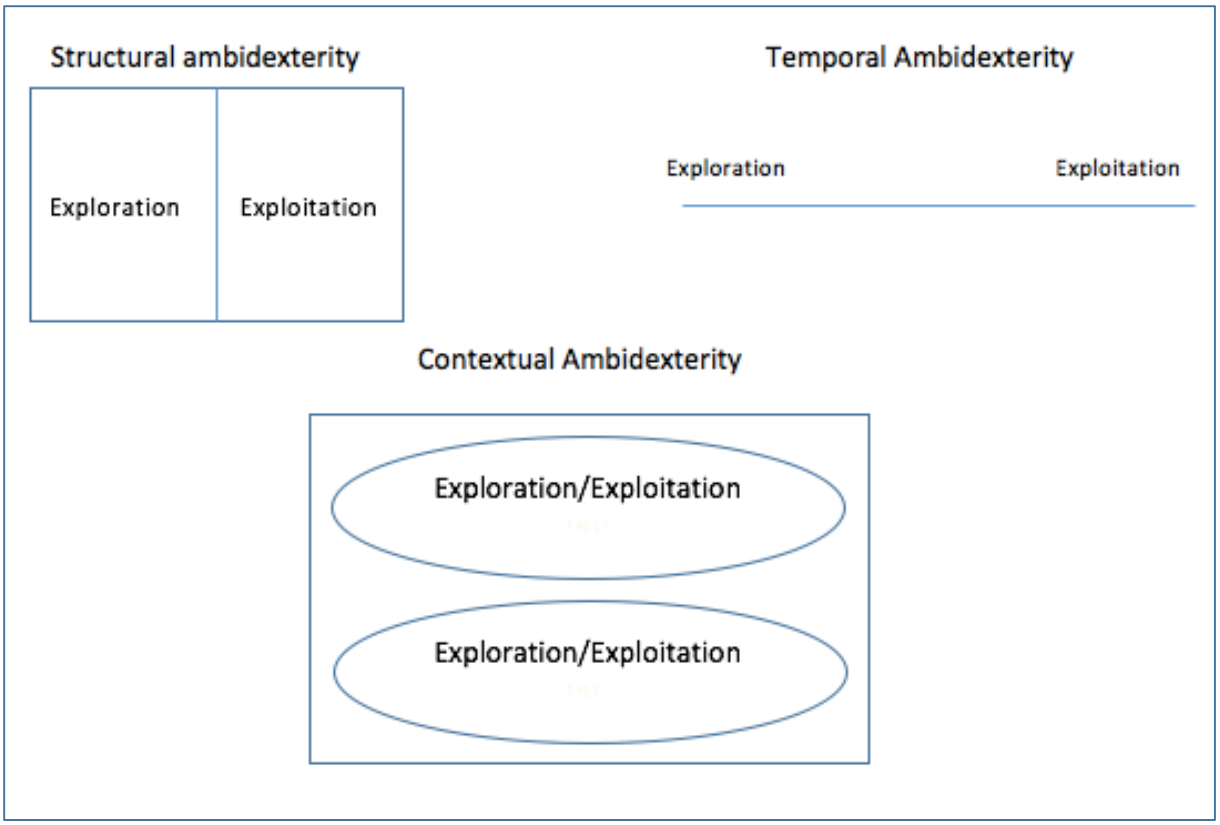

Figure 2: Types of ambidexterity

Types of ambidexterity

The literature has identified three models that enable organizations to become ambidextrous. *Temporal ambidexterity, structural ambidexterity*, and *contextual ambidexterity*.

Tushman & O'Reilly (1996) introduced *temporal ambidexterity* where exploration and exploitation activities are separated in time depending on the life cycle of the industry the firm is operating within. Temporal ambidexterity takes a continuum view of ambidexterity, and organizations adjust their position on the continuum between exploration and exploitation in order to adapt to their surroundings. Organizations who employ a temporal ambidexterity tactic are vulnerable to the *success* and *failure* traps discussed in Levinthal and March (1993).

O'Reilly & Tushman (2004) also introduced *structural ambidexterity,* this means that exploration and exploitation activities are structurally separated within the organization. There is one department dealing with exploratory activities, and one department dealing with exploitation activities. These departments should have very little direct interaction; it becomes the task of upper management to coordinate the work between these two and ensure that the organization maximizes benefit from both activities.

Gibson & Birkinshaw (2004) introduced *contextual ambidexterity;* in this case the organization relies on smart choices made by workers who have "*the behavioral capacity to simultaneously demonstrate alignment and adaptability*" (2004: p.209). In practice this means that they have the skills and attributes necessary to engage in exploitative activities when the environment is stable, and to rearrange these attributes to engage in exploratory activities when there is an abrupt change in the environment.

Ambidexterity models in clusters

As shown by Bocquet and Mothe (2015) ambidexterity within clusters can take two distinct forms, the two forms are in line with Gupta et al's (2006) distinction between dual and specialized models of ambidexterity. Either the cluster can achieve ambidexterity through being made up of firms that are specialized in either exploration or exploitation and they develop inter-organizational bonds to help fill the gaps in each others knowledge base; thereby making the cluster as a whole ambidextrous. This is known as the *specialization model*. The specialization model is in line with Tushman & O'Reilly's (1996) view of ambidexterity, where exploration and exploitation activities are separated.

The other view, called the *dual model,* is in line with Gibson and Birkinshaw's (2004) conceptualization of ambidexterity where an organization should engage in exploration and exploitation simultaneously. In this view each organization within the cluster engages in both exploration and exploitation, thereby making the cluster as a whole ambidextrous as well. It is unclear whether one of these models is more effective than the other one. Kauppila (2007) argues that the dual model is more effective in practice, while Ferrary (2011) shows that the specialization model also can be very effective.

The role of management teams in achieving ambidexterity

As mentioned in the introduction, most of the literature on management teams in clusters concentrates on how the effectiveness of cluster management can be measured, and not on the process of effectively managing the cluster. I decided not to include the literature on how to evaluate cluster management in this review, as I considered this as outside the scope of this thesis. I focused on the knowledge management literature because the cluster management has no real power over their members, so knowledge management becomes their most effective tool.

In the knowledge based view of clusters, the main tool management has at their disposal in order to achieve ambidexterity is knowledge management (Bocquet & Mothe 2015; Hine, et

al. 2010). The term knowledge management was introduced in the early 1990's, Albert's (1998) definition is still widely quoted; "*The process of collecting, organizing, classifying and disseminating information throughout an organization, so as to make it purposeful to those who need it*. ". When it comes to achieving ambidexterity within clusters the management team has been identified as an intermediary within the innovation system, specifically a knowledge exchange intermediary (KEI) which employs different knowledge exchange programs (KEP) to achieve ambidexterity (Bocquet & Mothe 2015; Hine, et al. 2010). The main purpose of KEI's is to take parties with different sets of knowledge and bring them together in order to enable them to cooperate effectively, and fill gaps in each others knowledge bases (Hine, et al, 2010). KEI's can act as a *broker* between firms within the cluster by using the knowledge base of one firm and pulling that knowledge into another firm who is in need of that knowledge (Bocquet & Mothe 2015). Or, they can act as an *activist* by actively searching for new knowledge that can solve a specific problem and pushing that knowledge into the relevant organization, this search can be both internal and external to the cluster (Bocquet & Mothe 2015).

The *activist* role is most often associated with a *technology-push* model. In a technology push model KEI's work with research institutions and innovative firms in order to complete research projects and *push* the knowledge gained from these projects into organizations in the cluster in order to solve an issue or open up a new market for that organization. If the KEI takes the role of *broker* a *market-pull* model is usually employed. In a *market-pull* model KEIs work with stakeholders within a specific market in order to identify valuable knowledge and pull this knowledge into the firms who need it (Hine, et al. 2010). Much like the distinction between exploration and exploitation activities; technology-push and market-pull generate outcomes that contain different degrees of innovation. Technology-push innovations can generate huge leaps forward in a market, these are the creative destruction, punctuated equilibrium type of innovations (Schumpeter 1949; Romanelli & Tushman, 1994). Market-pull innovations usually result in more incremental innovations that address a direct need, but don't generate any huge leaps forward in the market (Hine, et al. 2010). In the same way that the literature on ambidexterity argues that firms should strive to balance exploration and exploitation activities, it is argued that market-pull and technology-push programs should both be embraced, and balanced against one another:

"…. successful product innovation must not only rely on technical information but must also assess the needs of the market and users. Ideas are generated by the fusion of perceived needs and technical opportunity'. Rather than choosing between one or other direction, what would

be best for all stakeholders in the innovation system is for the major KEIs to consider the fusion approach, integrating technology and market-pull exchange programs to meet the needs of all stakeholders, latent and explicit". (Holt, 1975 p.24)

Another similar division within the research on innovation models is Jensen, et al. (2007) and their division between STI-mode and DUI-mode. STI-mode (science, technology, innovation) is related to exploratory projects, while DUI-mode (doing, using, interacting) is related to exploitation focused projects. Also in this case the research shows that firms that are able to effectively combine these two forms of programs are more innovative (Jensen, et al. 2011, p.683).

I will now present the process that led to developing the questions and propositions I attempt to answer in this thesis, as well as other methodological considerations.

Methodology

Yin (2014) states that a research design has five key components. The first three parts - defining your study's questions, defining your study's propositions, and defining your unit of analysis - helps guide you towards what type of data to collect. The last two – defining the logic that links data to the research question, and defining the criteria for evaluating it – helps guide the process after data collection is done.

In this section I will go through all of these components in order to give the reader insight into what questions came up during the process of this thesis, and what data were collected in order to answer these questions.

Questions and Propositions

As stated earlier, the literature on ambidexterity within clusters is fairly thin, and the role of cluster management is especially poorly understood. Therefore, I chose to base my research design on a 'how' research question in order to, through a qualitative study, shine a light on how the management team in a cluster can facilitate ambidexterity in the cluster.

These motivations drove me to develop the following research question for this thesis:

How does the management team within a cluster facilitate and sustain ambidexterity in the cluster?

METHOD	(1) Form of Research Question	(2) Requires Control of Behavioral Events?	(3) Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Figure 3: Matrix showing appropriate research methods for different questions (Yin, 2014)

Figure 3 (Yin, 2014) illustrates that when addressing a research question with a 'how' phrasing, that focuses on contemporary events, that does not require control of events, and where it is hard to separate the phenomena being studied form its context, it is appropriate to use a case study design. This is what I chose to do.

Through my review of the existent literature on clusters and ambidexterity I developed three propositions that attempt to answer my research question, these were compared to the qualitative data collected over the course of this thesis.

Proposition 1: The management team help firms engage in exploitation activities by taking a broker role and using market-pull programs

Proposition 2: The management team help firms engage in exploration activities by taking an activist role and using technology-push programs

Proposition 3: In order to facilitate ambidexterity in the cluster the management team must take on both the role of broker and activist, and employ both market-pull and technology-push programs.

Unit of analysis

In this study the unit of analysis is the management team within the clusters, and the level of analysis is the cluster as a whole. The management team was chosen as the unit of analysis in order to better understand how they think about ambidexterity and what tools they can use to facilitate it in the cluster. When I am trying to determine how the management team in a cluster facilitates ambidexterity it would not make sense to interview the individual firms within the cluster as they might not know the full scope of programs implemented by the

cluster. Also, by choosing the management team as the unit of analysis I am contributing to an under-researched stream of literature.

Research Design

I designed my case study as a deductive, multiple case, holistic study. I chose to to do a multiple case study based on Yin's (2014) argumentation that a multiple case study provides more robust conclusions than a single case study due to the fact that you get richer data from multiple sources. By doing a multiple case study, and collecting data from multiple sources I am improving the reliability and internal validity of my study (Yin, 2014).

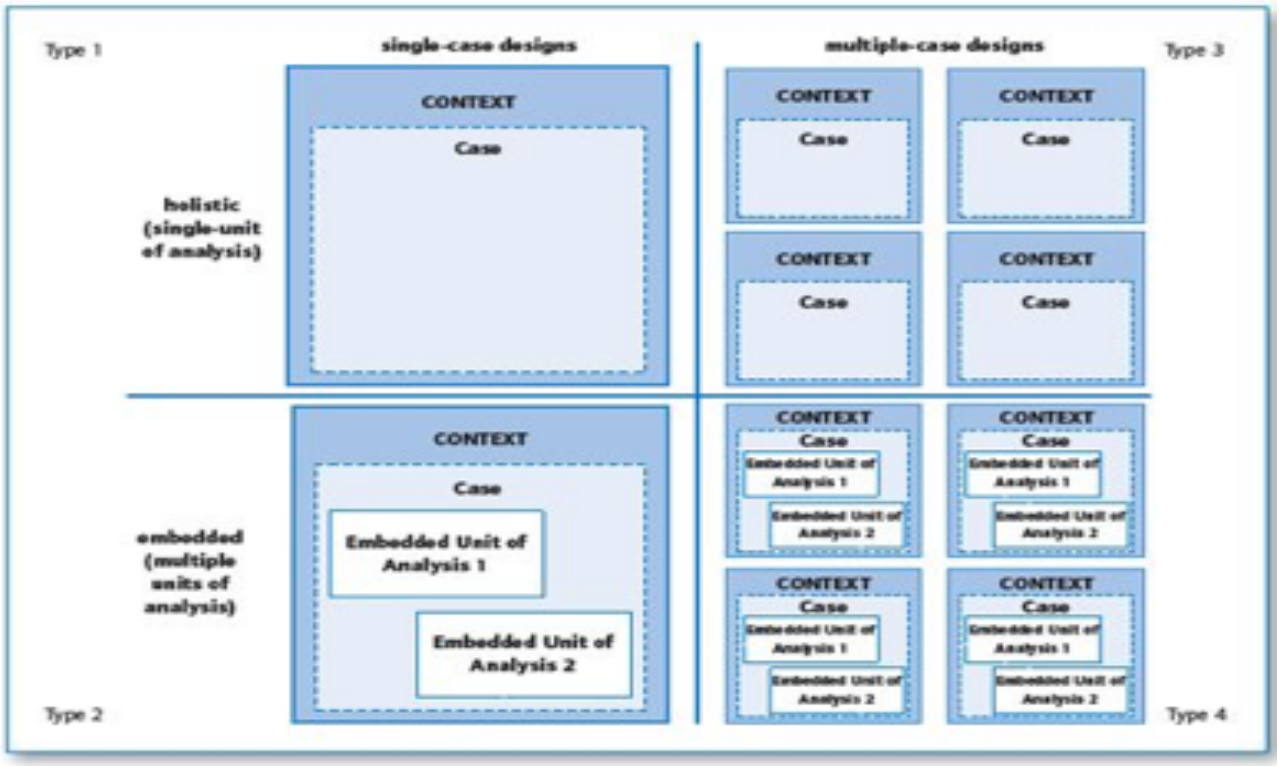

Figure 4: This thesis is based on a multiple-case, holistic design (type 3) (Yin, 2014)

I am basing my analytical framework for this thesis on the existent literature around the themes of cluster ambidexterity (Bocquet and Mothe; 2010, 2015) and knowledge exchange intermediaries (Hine, et al. 2010). Therefore, this is a deductive study where I developed my research question, propositions, analytical framework, and interview questions based on the existent literature around these topics.

Since my research question is focusing on the management team and the tools that they have available to facilitate ambidexterity it made sense to do a holistic study. By doing a holistic study I am focusing on a single unit of analysis, the management team, and collecting my primary data from this source. If I were to do an embedded design, with multiple units of

analysis, it could make it difficult to determine which unit of analysis is causing the observed effect, and which is just correlated to it.

Secondary Data Collection

This thesis project began by doing a thorough literature review on the secondary data available on the subjects of ambidexterity and clusters. I found the relevant literature by first doing a broad search on Google Scholar using different combinations of the search terms; "organizational ambidexterity", "exploration", "exploitation", "ambidexterity", "clusters". I also used the same search terms in the Oria database. This led me to seminal works in the fields of ambidexterity (March, 1991; Benner and Tushman 2003; Raisch & Birkinshaw, 2008) and clusters (St. John & Pouder, 2006; Maillat, 1998). From these starting points I used the reference lists from these works in order to locate other articles and cited works that could be valuable for this thesis. Locating literature that specifically addressed ambidexterity within clusters, or other types of innovative networks was a bit more challenging. I took the same approached as before by using both Google Scholar and Oria search engines searching for the search terms "~cluster + ambidexterity" and "~innovative networks + ambidexterity", the "~" was included in the search terms in order to include similar terms that are related to innovative networks and clusters in the search criteria. This led me to the work of Bocquet and Mothe (2010, 2015) which identified two distinct ambidexterity types within clusters and what type of governance model is most effective for each model. Through the reference lists from these articles I also discovered relevant literature on knowledge exchange intermediaries within innovative networks.

My reading and interpretation of this literature resulted in the preceding chapter, development of my research question, propositions and analytical framework.

Analytical framework

After reading through much of the literature on ambidexterity I have taken an orthogonal view of ambidexterity. This means that I believe, if managed correctly, there is no inherent trade-off between exploration and exploitation activities, and organizations can successfully pursue both types of activities simultaneously. For the context of this thesis I will be adopting the definition of ambidexterity presented by Turner (2011):

Ambidexterity is understood as the ability to both refine existing domain knowledge (exploitation) whilst also creating new knowledge to overcome knowledge deficiencies or absences identified within the execution of the work (exploration). (2011: 28)

I have also taken a knowledge based view of clusters, meaning that I view the main task of the cluster as managing, gathering, and distributing knowledge within the cluster to benefit the member firms (Maskell, 2011).

I gained a lot of knowledge through the literature on the topics of ambidexterity, clusters, knowledge management, and knowledge exchange intermediaries, the illustration in *figure 5* represents the combination of all these streams of literature.

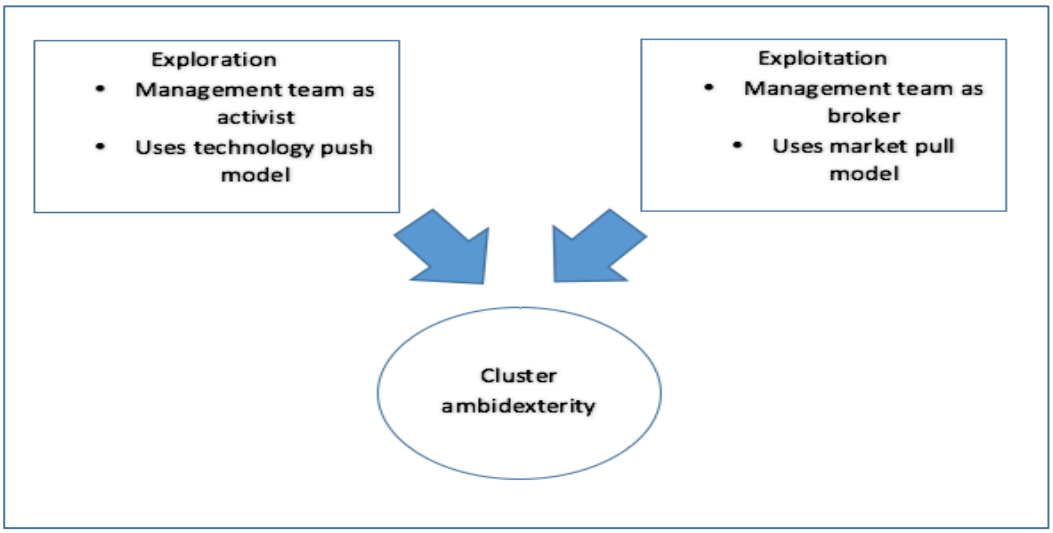

Figure 5: Illustration of theoretical framework

From the early literature on ambidexterity I took the separation of exploration and exploitation activities, these are the key building blocks of ambidexterity and balancing them are a crucial part of succeeding in the long run. From the writings of Bocquet and Mothe (2010, 2015) on ambidexterity models in clusters I took the division of management roles as *activist* and/or *broker*. When taking on the role of *activist* the main function of the management team becomes to keep track of what the members are doing and search for knowledge, external and internal, to the cluster in order to locate valuable knowledge for the cluster members. When the management team takes the role of *broker* their main task becomes to facilitate contact between different parties, internal or external to the cluster, who can help solve each others problems. In this role the cluster management also needs to keep track of the activities of their members in order to make fruitful connections to other members, but they are not actively searching for solutions to their problems. From the literature on knowledge exchange intermediaries I took the distinction between *technology push* and *market pull* programs, and the need to balance these two types of programs.

"*Employing a diversity of programmes simultaneously, both technology push and market pull, will increase the likelihood of successful knowledge exchange as it offers a flexible integrative approach to creating knowledge overlaps*." (Hine et al., 2010, p.726)

In a *market pull* program the management team receives a request from one of their members, and sets up a program in order to respond to this request from the member. In a *technology push* program, the cluster management team decides to set up a program in order to push some valuable knowledge out to their members. So the big difference between these two types of programs is that the *market pull* is started externally from the management team, while *technology push* is started internally, by the management team.

When putting all of these factors into one model I ended up theorizing that in order to facilitate ambidexterity within the cluster the management team must embrace both the role as broker as well as activist, and employ both market pull and technology push programs. By creating my analytical model from the existent literature, I hoped to strengthen the internal validity of my study.

Once the process of coming up with the theoretical framework was completed it was time to start primary data collection efforts.

Primary Data Collection

My primary data collection efforts consisted of semi-structured interviews with one member of the management team within 6 different Norwegian high-tech industry clusters.

Replication logic

I took a replication logic approach to this multiple case study. A replication approach to data gathering means that I select interview candidates that I expect to either give very similar results (*literal replication*), or that I expect to give opposing results for anticipatable reasons (*theoretical replication*) (Yin, 2014). The analytical framework, research question and propositions I came up with were compared with the results of the data collection efforts from each *case* and for the multiple case study as a whole.

In my study I was trying to create literal replications of the data in each single case. I tried to facilitate this through careful selection of my interview subjects.

Interview subjects

In order to secure interviews with people in the management teams of clusters I wanted to talk to I sent out an initial email describing the nature of my thesis, and asked if they were available for an interview within a certain timeframe. Those who were interested in

participating were contacted again in order to set up a time and place for the interview, as well as agree on the practical considerations of how to conduct the interview. Face-to-face and Skype interviews were utilized in order to conduct the interviews.

When deciding on which clusters to contact I kept three criteria in mind; *size, scope, and focus*. I wanted to talk to clusters that were fairly large, encompassing at least 50 organizations. I wanted clusters that included a wide variety of organizations, small, large, purely R&D focused, suppliers, and those bringing the final product to market. The reasoning for this is that much of the literature on ambidexterity within clusters (Bocquet and Mothe; 2010, 2015) is focused on clusters that are, almost exclusively, made up of SMBs. By including clusters with larger organizations in my case study I might be able to add something new to this literature. Lastly I wanted clusters that focused on high-tech industries. By combining these criteria, I ended up with the list of interview subjects displayed in *figure 6*.

List of interview subjects

Interview date	Cluster	Interviewee	Cluster type	Industry	Location	# of firms	Management size
01.03.2016	GCE NODE	Marit Dolmen	Technology/Industry	Energy and Maritime	Kristiansand	72	6 full-time
10.03.2016	NCE Instrumentation	Lars Gåsø	Technology/Industry	Instrumentation	Trondheim	55	1 full-time, 6 part-time
14.03.2016	Windcluster Norway	Vegard Saur	Technology/Industry	Wind energy	Verdal	66	3 part-time
08.04.16	Oslo Cancer Cluster	Ketil Widerberg	Technology/Industry	Cancer research	Oslo	75	5 full-time
16.03.16	GCE Blue Maritime	Per Erik Dalen	Technology/Industry	Maritime and Energy	Ålesund	216	2 full-time
08.04.16	Oslo Medtech	Ane S. Oppedal	Technology/Industry	Medical technology	Oslo	190	4 full-time, 7 consultants

Figure 6: Interview subjects

All of the clusters included in this thesis have, either currently or previously, received partial funding from the Norwegian government through the different cluster programs they offer. The government cluster program is called Norwegian Innovation Clusters, this is a joint-cooperation program between Innovation Norway, SIVA, and the Norwegian research council. The program has three different levels of cluster classification, Arena, Norwegian

Centres of Expertise (NCE), and Global Center of Expertise (GCE). I will now give a quick overview of these programs and which clusters are involved in what programs.

Arena

The aim of the Arena projects is to help establish cooperation and interaction between industry and knowledge creating environments within a region, and for this to result in the development of a regional cluster. Arena clusters are early stage clusters that are just getting started and have a regional scope. The clusters established through the Arena program should lead to increased innovation and cooperation between business environments, research environments, and public stakeholders in the region. Clusters that are established through the Arena program receive financial and practical aid to keep the cluster going for a 3-year period, which in certain cases can be extended to 5 years. In 2014 the Arena program consisted of 22 clusters, with a total of 1093 firms, 115 R&D institutions, and 66 developmental partners. Windcluster Norway was started in 2010 as an Arena project.

Norwegian Centres of Expertise

The NCE cluster program was established in 2006, it aims to create clusters with a national scope and the potential for international expansion for their members. NCE clusters have 4 key areas of focus:

- Increased innovation
- Goal oriented internationalization
- To strengthen the attractiveness of the clusters for new members
- Increased access to customized competences

The NCE program provides financial and practical backing for the developmental efforts of their members for a period of 10 years.

In 2014 the NCE program consisted of 14 clusters with a total of 568 firms, 77 R&D institutions, and 50 developmental partners. NCE Instrumentation, Oslo Cancer Cluster, and Oslo Medtech are all part of the NCE program.

Global Center of Expertise

The final level of the Norwegian Innovation Clusters program is the Global Center of Expertise (GCE). The GCEs have the same key focus areas as the NCEs, but GCE clusters

already have well established cooperative efforts both within and external to the cluster, nationally and internationally. The firms within the cluster are part of the global value chain within their industry, and have a high potential for growth in both national and international markets within their operating sector. GCE NODE and GCE Blue Maritime are two of three certified GCE clusters in Norway.

GCE NODE

GCE NODE is a technology cluster operating within energy and maritime industries worldwide. The cluster is located in Kristiansand, Norway and is comprised of 72 members based in the Agder municipalities. The members of GCE NODE represent suppliers to the entire value chain of the energy and maritime industries. The cluster is funded by Innovation Norway, The Norwegian Research Council, and other local stake holders. It is one of three Norwegian clusters to receive the distinction as a Global Center of Expertise (GCE).
GCE NODE's governance structure is made up of a management team that has 6 full-time employees, and a board comprised of 8 members that represent different stakeholders within the cluster. My interview subject at GCE NODE was Marit Dolmen, who is the RD&I manager in the cluster.

NCE Instrumentation

NCE Instrumentation is a technology cluster within instrumentation that mainly focuses on solutions for the oil and gas industry, but also serves the alternative energy and maritime industries. The cluster is located in Trondheim, Norway and is comprised of 55 members based in the Trondheim area, the cluster has close ties to NTNU, SINTEF and HiST. The cluster is divided into three main parts, NCEI Wireless, NCEI Supply Chain, and NCEI Offshore. NCEI Wireless is focused on the market for communications and sensor technology, NCEI Supply Chain is focused on facilitating supplier relationships and production management, and NCEI Offshore concentrates on creating networks for suppliers to the oil and gas industry.
NCE Instrumentation has been a part of Innovation Norway's Norwegian Centres of Expertise (NCE) program since 2006, this program will discontinue its support of the cluster in 2016, therefore the cluster will shut down in June, 2016.

The governance structure is made up of a management team with 1 full-time employee, 6 part-time employees and aboard comprised of 6 members that represent different stakeholders

within the cluster. My interview subject at NCE Instrumentation was Lars Gåsø who is the CEO of the cluster.

Windcluster Norway

Windcluster Norway is a technology cluster within the wind power industry. The cluster is located in Verdal, Norway, and is comprised of 66 companies that are located in the central part of Norway and serve the market for wind energy. Windcluster Norway started out as an Arena project funded by Innovation Norway in 2010, this project ended in 2014, since then the cluster has been funded by their members and local stakeholders. The governance structure of the cluster is made up of 3 employees, who together equal one full-time position. All 3 of these individuals are employees of Innovasjonsselskapet Proneo AS, and are rented out to Windcluster Norway on an as needed basis. Windcluster Norway also has a board consisting of 6 board members. I interviewed Vegard Saur who is one of the employees from Innovasjonsselskapet Proneo AS, and serves as the CEO of the cluster.

GCE Blue Maritime

GCE Blue Maritime is a technology cluster within the maritime industry. The cluster is located in Ålesund, Norway, and operates out of Ålesund Kunnskapspark. The cluster has 216 members that together represent the entire value chain within the maritime industry. GCE Blue Maritime's governance structure consists of a management team with 2 full-time employees, and a steering committee with 10 members. I interviewed Per Erik Dalen who is the CEO of both GCE Blue Maritime and Ålesund Kunnskapspark.

Oslo Cancer Cluster

Oslo Cancer Cluster is a dedicated oncology research cluster that is dedicated to accelerating the development of new cancer diagnostics and medicines. OCC is located in Oslo, next to Radiumhospitalet, and also operates an incubator on the premises. The cluster has 75 members that represent the entire value chain from oncology research through regulation and commercialization processes. The governance structure consists of a management team with 5 full-time employees, and a board with 10 members. I interviewed Ketil Widerberg who is the general manager of OCC.

Oslo Medtech

Oslo Medtech is a technology cluster within the health technology industry. Oslo Medtech has approximately 190 members, consisting mainly of SMBs, but also including global

companies like Siemens and HP. The cluster members represent the entire value-chain of the health technology industry. The cluster administration is located in Oslo Science Park, where they also operate a co-working space that houses about 15 of the member companies. The governance structure consists of a management team of 4 full-time employees, and 7 consultants that work on a project basis. The board of Oslo Medtech consists of 11 board members. My interview subject was Ane Solesvik Oppdal who is International Project Manager.

The interview process

The interviews were conducted face to face for the clusters that are located in Oslo; Oslo Medtech and Oslo Cancer Cluster, while the remaining four interviews were conducted over Skype due to the large geographical distance between myself and the interview subjects. The interviews ranged in length from 15 to 40 minutes, and were of a semi structured nature. I chose semi-structured interviews because I wanted the opportunity to explore topics and themes that came up during the course of the interview. Also, since none of the interview subjects were familiar with the term *ambidexterity*, the semi-structured nature of the interviews made it easier to provide clarification around the meaning of the term where this was needed. All the interviews were taped in order to aid the analysis process, and allow me to concentrate on the interviews instead of focusing on taking detailed notes. All interviews were transcribed immediately after they were done, and the recordings were deleted once processed in order to protect the informants.

Analysis process

Analyzing qualitative data can often be challenging due to the fact that there are no numbers to run statistical analysis on. According to Lazar, et al. (2010) qualitative data content can take two forms, *media content* and *audience content*. Media content is any material that is printed in publications or on websites, while audience content is data that is collected directly from an audience group, such as an interviewee. In order to get as rich a data set as possible I decided to include both data and audience content in the analysis process. My qualitative data set consisted of approximately 152 minutes of audio recordings from the interviews, the transcripts from these audio recordings, as well as archival data from websites and other publications. In order to get value out of this data set I employed discourse analysis. Holsti (1969) defines discourse analysis as "*a technique for making inferences by objectively and systematically identifying specified characteristics of a message".* The goal of content analysis is to explain a process, or change over time, by using prior knowledge about the

process to develop well constructed categories, and ideally combine or restructure these categories in order to create new knowledge (Lazar, et al., 2010). *Coding* is a very common method of conducting content analysis in qualitative research, during the coding process the researcher interacts with the data set, compares different data, and derives coding categories to represent the data (Corbin and Strauss, 2008). When it comes to coding data there are two different approaches, *a priori*, and *emergent* coding. With *a priori* coding, the categories are decided before the coding process begins, and the categories are based on existing frameworks or theories within the literature. *Emergent* coding is a process by which multiple researchers examine the data set independently to create categories, and then their lists of categories are compared and combined in order to arrive at a consolidated list that all the researchers agree upon (Yin, 2014). This process is most appropriate when there is very limited existing research on a given topic. There was enough existing literature on my chosen topic for me to come up with an analytical framework, so I took the *a priori* coding approach, and used that analytical framework to create my coding categories.

Coding categories

Based on the analytical framework and propositions presented in the methodology chapter I created the coding structure shown below. This approach to creating coding categories is called *hypothesis coding* and is appropriate when analysis is applied to a qualitative data set in order to assess a researcher-generated hypothesis and search for causes and explanations (Saldana, 2009).

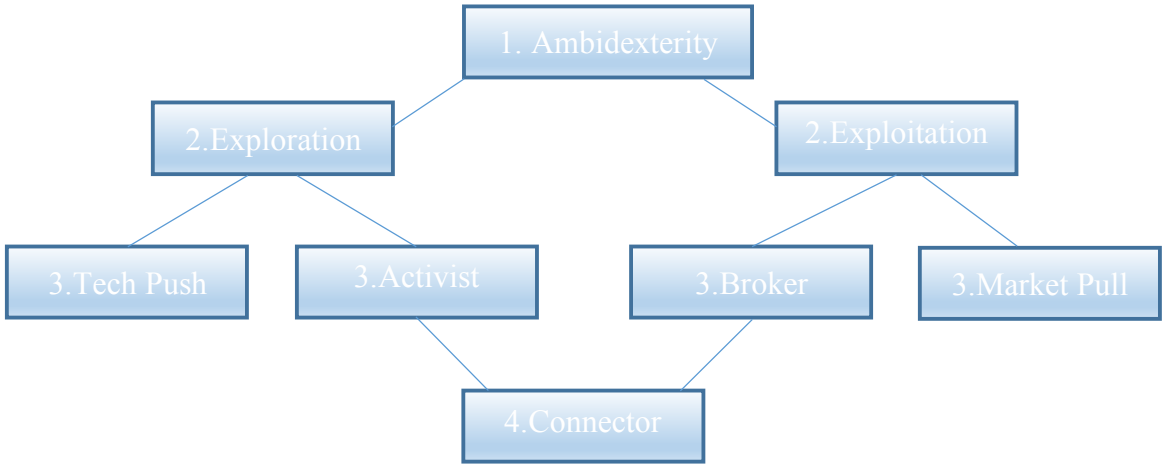

Figure 7: Coding categories used for the analysis of interview data

The highest level category is ambidexterity, which is then broken down into exploration and exploitation. Exploration is further broken down into tech push activities and an activist role, while exploitation is broken down into a broker role and market pull activities. When acting as a connector the management team can take either an activist or broker role.

Ambidexterity: this code was used when the cluster management engaged in or aided both exploration and exploitation activities.

Exploration: this code was used when the cluster management engaged in activities aimed at helping members come up with radically new innovations.

Exploitation: this code was used when cluster management engaged in activities aimed at helping members improve or find new markets for existing products.

Activist/Tech Push: this code was used when cluster management approached members or external parties to engage in an action.

Broker/Market Pull: this code was used when cluster management were approached by members or external parties to engage in an action

Connector: this code was used when cluster management in some way facilitated contact between different parties.

I coded the transcripts between these different categories using a *propositional approach* which means that I broke down the text in order to examine the underlying assumptions. Stemler (2001) gives the following example to illustrate this technique; a transcript sentence that reads "*investors took another hit as the stock market continued its descent"* would be broken down to: the stock market has been performing poorly recently, and investors have been losing money. I took this approach to coding because the interview subjects I talked to were not familiar with the term *ambidexterity* and the separation between *exploration and exploitation* activities. This meant that I had to ask more general questions about the programs administered by the cluster and how they interacted with their members, and then code this into the different categories based on my interpretation of their answers.

Results

In this chapter I will present the results from my analysis of the primary data set. Based on advice from (Anderson, 2010) I have decided to present the results by going through each

coding category and highlighting selected quotes from the interviews that represent each coding category.

Connector

In practice, one of the main functions of cluster management is to facilitate contact between different parties and connect those who can benefit from working together. I saw several examples of this throughout my interviews.

"*if we see that one of our members is succeeding in a certain aspect of their business we can ask them to share their knowledge with the rest of the cluster in order to lift the competency of the entire cluster…" GCE NODE*

"we have RD&I and management forums where we meet several times a year to get a sense of what programs are succeeding and where we should focus our attention…. if we see that our members need a certain solution we can point them in the direction of people or organizations who could provide that" GCE NODE

The practice of seeing that a member has a problem, and pointing them towards someone who can help them solve their problem was also mentioned during all the other interviews.

"if competitors within the cluster have the same problem we have to be careful, but we can set-up a workshop and get them in the same room to discuss it" GCE NODE

the practice of connecting members who face similar problems in order for them to find common a solution was also mentioned in all interviews.

"we can show our members, here is a technology that would be useful for you.... we can visit other organizations or conferences to show them how others have implemented these solutions" GCE NODE

"(when doing collaborative projects) our members find each other, for us (management) to put them together is no use..." NCEI

this was an example of the management team in NCEI not seeing it as their task to proactively connect members. But they did say that if approached by a member they will of course facilitate contact between two parties.

"we arrange breakfast meetings every other Wednesday, companies tend to find each other there…. or if I get a request from someone I can make the introduction, I will do that" NCEI

"much of the value of the cluster is in the network, and the ability to facilitate contact between organizations to create a new partnership" NCEI

"we have cluster activities where we get our SMBs together and send them to seminars and such in order to educate them and help them acquire new skills" GCE Blue Maritime

all the other clusters also pointed out that they paid special attention to connecting SMB's who might be able to help each other develop in a positive manner.

"if we see that someone (outside the cluster) is doing something interesting, we will ask to visit them or invite them to do a seminar for us" GCE Blue Maritime

this idea of pushing outside knowledge into the cluster (technology push) was also reflected in the other interviews.

"our Industry meets Science seminars try to connect R&D institutions and our companies to exchange ideas, and get updates on the latest research results" Windcluster Norway

"I work in member's services, so our members can contact me if they need a new contact at a hospital or need to contact someone they don't know" Oslo Medtech

"we just did a joint design process thinking seminar with the Edtech cluster due to the overlapping areas between the Edtech and Medtech industries" Oslo Medtech

this is an example of connecting two different clusters in hopes of creating useful knowledge spillovers between them.

Broker/Market pull

I saw that the management team starting an action based on a market-pull happened quite often, and in all clusters. Usually this resulted in the management team taking the role of broker in order to connect two parties, but there were also examples of market-pull leading to the management team acting as an activist.

"we survey our members in order to gauge what they need in order to face current and future challenges, based on this we can conduct early stage feasibility studies" GCE NODE
this type of contact with members occurred in all the clusters, and is an example of market pull activated programs.

"members will contact us with a request to scour the market I order to see what solutions are available to them" GCE NODE

this is an example of a market-pull request leading to the management team taking on the role of activist.

"we get requests from our members to put them in contact with someone who has a certain skill set or technology" NCEI

depending on the connections the management team already have, this request could lead either to broker or activist behavior.

"if more than one member contacts us because they are facing a similar issue, we will put them in contact with one another" Windcluster Norway

"our members will come to us with requests for a seminar topic, and we will work with them in order to develop that seminar" Oslo Medtech

all the other interviews also had examples of cluster members making requests for topics to conduct seminars or courses around.

Activist/ Tech push

All the clusters used technology push programs and acted as an activist. NCEI seemed to have less of a focus on this, than the rest of the clusters.

"we will reach out to organizations outside the cluster that have an interesting competence, this recently happened during our composites project" GCE NODE

"we show our members new technology and solutions that we feel could be useful for them" GCE NODE

All the other interviews, other than NCEI, also showed examples of this type of activist behavior.

"the management team here has not felt that it is the role of the team to actively search for new solutions and technologies" NCEI

"we can help our members do early feasibility studies for a proposed project, and scout potential partners, if requested to do so" NCEI

This shows that the management team in NCEI would not act as an activist unless it was a result of a market-pull request from one of their members.

"we do Industry meets Science seminars where our members can come see presentations of the newest research results from several R&D institutions and PhD candidates" Windcluster Norway

"researchers often want to stick to research, so we try to take the results of their research and pass it on to our members who can use it to create a product" Oslo Medtech

Exploration

When it came to engaging in exploration activities I saw that all clusters stated that this was a goal of theirs. It was also a goal for all the clusters to help their members finance and start exploratory projects.

"members are complaining that there is a lack of public funding for these types of projects, so the role of the cluster then becomes more political and lobbying focused" GCE NODE

"we spend a lot of time showing our members what funding programs and grants are available to them, and how to apply for these" Oslo Medtech

The two previous quotes are representative of activities in all the clusters interviewed.

"it is hard to introduce new innovations in industries that are as established as the oil and gas industry, so this is not a major focus for us" NCEI

The above quote reflects that NCEI would happily help their members engage in exploration based on a market-pull, but did not see it as their role to use technology-push in order to facilitate exploration.

"through initiatives like our Industry meets Science seminars we help our members explore new technological opportunities" Windcluster Norway

"we try to facilitate the creation and dissemination of new knowledge that can benefit all our members, we don't get very involved in how our members utilize this knowledge because some of our members are competitors" GCE Blue Maritime

"members who are SMBs are too small to fund research projects by themselves, so we can point out opportunities for them and introduce them to new technology" GCE Blue Maritime

"we are a research based cluster…." Oslo Cancer Cluster

Exploitation

It seemed to me that exploitation within the cluster happened a lot without direct involvement from the management team. It was hard to find specific examples from the interviews that showcased exploitation activities.

"our deep sea mining project is a good example of helping members to take an existing technology and applying it to a new market" GCE NODE

"this is mostly what we do, we help our members find new markets for their existing solutions" NCEI

"I think this type of activity is how most clusters operate…" NCEI

The cases of exploitation that were evident from the interviews, were mostly the cluster management helping members to find new markets for their existing products.

Ambidexterity

Strict examples of ambidexterity were also hard to find concrete examples of from the interviews, it was more of a tacit result of the combination of exploration and exploitation initiatives.

"we don't focus on balancing these two types of activities, we help our members do what they need to do, regardless of how it is classified within this distinction" NCEI

"we are comprised of a knowledge producing core that is surrounded by organizations that use that knowledge to create products" Oslo Cancer Cluster

"we do both these types of activities, but we have a strong focus on getting it into the market quickly …so explore tends to bleed into the exploit category" GCE Blue Maritime

Discussion

During the process of writing this thesis I have reviewed much of the available literature on ambidexterity within clusters, and added to the knowledge I gained from this with my own data gathering efforts and analysis. These efforts have given me a lot of insight into how a cluster's management team might facilitate ambidexterity within the cluster, and helped me develop the following discussion points:

- Are clusters consciously pursuing ambidexterity?
- What influence does the industry a cluster operates in have on ambidexterity?
- The role of the management team as a connector

Are clusters consciously pursuing ambidexterity?

When discussing whether or not the management team of a cluster is consciously trying to make the cluster, or the members within it, ambidextrous it is important to point out that none of my interview subjects were familiar with the term *ambidexterity* before the interviews. At the beginning of each interview I had to explain that ambidexterity is the ability to balance *exploration* and *exploitation* focused activities. However, this does not necessarily mean that the answer to this question is unequivocally *no*. Even though the interviewees were not previously familiar with the term it seemed to make sense to them when it was explained. Another important thing to note in this regard is that many of the goals and visions that are set out for the clusters embody the goal of ambidexterity, without explicitly mentioning the word.

GCE NODE states that they have two main goals for their members:

1. *to strengthen their competency in core markets by employing new technology and novel solutions.*
2. *to help their members enter into new and valuable markets with their existing solutions*.

Nowhere in this mission statement is the term ambidexterity mentioned but it is quite clear that these goals are near textbook definitions of *exploration* and *exploitation,* respectively.

GCE Blue Maritime have developed the following eight SMART goals for their cluster:

1. *Increased rapidity in product innovation*
2. *Increase the speed of process and organizational innovations*
3. *Strengthen global knowledge connections for world-leading technology and knowledge environments*
4. *Strengthen national knowledge connections with research environments, clusters, and maritime companies*
5. *Create global SMB winners*
6. *Create new entrepreneurs and growth companies*
7. *Increase host attractiveness*
8. *Crossover-innovations from the maritime industry to new marine businesses*

I would argue that goals 1, 3, 4, and 6 are related to succeeding with, or developing exploratory programs. Goal 1 aims to increase the rate of new product innovations, which is aided by the strengthened relationship with research environments stated in goals 3 and 4. The knowledge coming out of the research environments can lead to new start-up companies as stated in goal 6. The goals that are more focused on exploitation are goal 2 and 8, goal 2 aims to continually develop and refine current production and logistics processes, while goal 8 aims to take well developed maritime solutions and apply them to new markets. This means that 6 out of the 8 stated SMART goals are in some way related to either exploration or exploitation.

Oslo Cancer Cluster has a stated vision of *improving the lives of cancer patients by accelerating the development of new cancer diagnostics and treatment.* In order to do this, they focus on the following strategic areas:

1. *Collaborative networks and partnering*
2. *Innovation*
3. *Access to capital*
4. *Clinical trials efficiency*
5. *Public policy*
6. *Workforce & competence development*

In this case the focus on innovation is obviously an exploratory initiative by attempting to create new treatment and diagnostic options, while the focus on improving clinical trials efficiency is more exploitation oriented by continually improving on an already established process. Lobbying for public policy changes can result in improved conditions for exploration and, or, exploitation.

Windcluster Norway states that their goals for the cluster are:

1. *For members to work together in order to collectively strengthen each others ability to compete, and deliver products to their defined markets.*
2. *Windcluster Norway should work to improve regulatory and recruitment frameworks in order to improve the cluster's competitive and market positions.*

3. *Windcluster Norway shall facilitate new innovations within the area of wind power, and strengthen collaboration between its members and R&D institutions both nationally and internationally.*

In this case goal 1 can be achieved through either exploratory or exploitation focused initiatives, while goal 3 is clearly exploration focused. Goal 2 can result in improved market conditions for either exploration or exploitation, based on the needs of cluster members.

Oslo Medtech's mission is to *develop and industrialize world class health technology products and services that enables sustainable and high quality treatment, care, and Norwegian Medtech industry growth.* In order to do this, they are focusing on the following areas:

1. *facilitating R&D&I collaboration between research, industry and health care providers, nationally and internationally*
2. *stimulate and facilitate market driven innovation and innovative procurement processes*
3. *facilitate clinical trials, testing and verifications*
4. *accelerate business development and international scaling;*
5. *attract development and investment capital;*
6. *provide co-working space in Medtech Growth House and spread the word of the Norwegian Health technology industry nationally as well as internationally.*

Goal 1 and 2 are clearly exploration focused and meant to increase the amount of novel innovation discoveries through exploring the opportunities available in the newest research from R&D&I institutions. Goal 3 and 4 are exploitation focused by improving existing processes for clinical trials and business scaling. Goal 5 will help facilitate increased exploration efforts.

NCEI states that their main goals are to:

1. *increase value creation and their members' ability to compete in a global market*
2. *members should use the cluster to find new customers and suppliers, or create projects with other members to win new contracts or develop new technology*

In order to help their members compete in a global market it is reasonable to assume that they need to assist members in exploring new innovations and business models. The goal of

connecting members in order for them to win contracts or cooperate on developing new technology can, and should, rely on both exploration and exploitation focused initiatives.

After looking at the mission statements and goals set for all the clusters I interviewed I feel confident in saying that even though ambidexterity is not a term they are aware of, it is embodied in their guiding principles. They all state that they want to help their members improve their key competences within a given market, as well as discover new markets and developing new innovations to improve their current and future market positions. In order to achieve these goals, it is vital to engage in and balance both exploration and exploitation activities.

Does the industry a cluster operates in have an effect on ambidexterity?

One interesting observation I made during the analysis process was that there seemed to be a clear difference in how the clusters operating within the less mature industries of oncology, med-tech and alterative energy (Oslo Medtech, Oslo Cancer Cluster, Windcluster Norway), and those within the more mature oil and gas industry (GCE NODE, GCE Blue Maritime, NCEI) talked about exploration focused programs and integrating new knowledge from R&D institutions. The members of the oil and gas industry clusters were a lot more set in their ways and it was harder to get them to embrace new innovations and exploratory research. Their main argument for joining the cluster was to gain access to a broader network that can help them create supplier networks and lower production costs instead of creating new solutions for the future. This view was reflected in some of the comments from the interviews, like Lars Gåsø from NCEI stating:

"the management team here has not felt that it is the role of the team to actively search for new solutions and technologies"

The interview with GCE Blue Maritime also revealed that even though they tried to focus on both exploration and exploitation, the exploration efforts would often bleed over and become more exploitation focused. This was easy to see in hindsight but happened based on the feedback and requests from their members. It also seemed that the less mature clusters were better at taking advantage of the new research coming out of R&D

institutions, while the core of the oil and gas industry based clusters seemed to be the network of suppliers and producers within the cluster. In *figure 8* I illustrate what I see as the difference between how they seemed to operate.

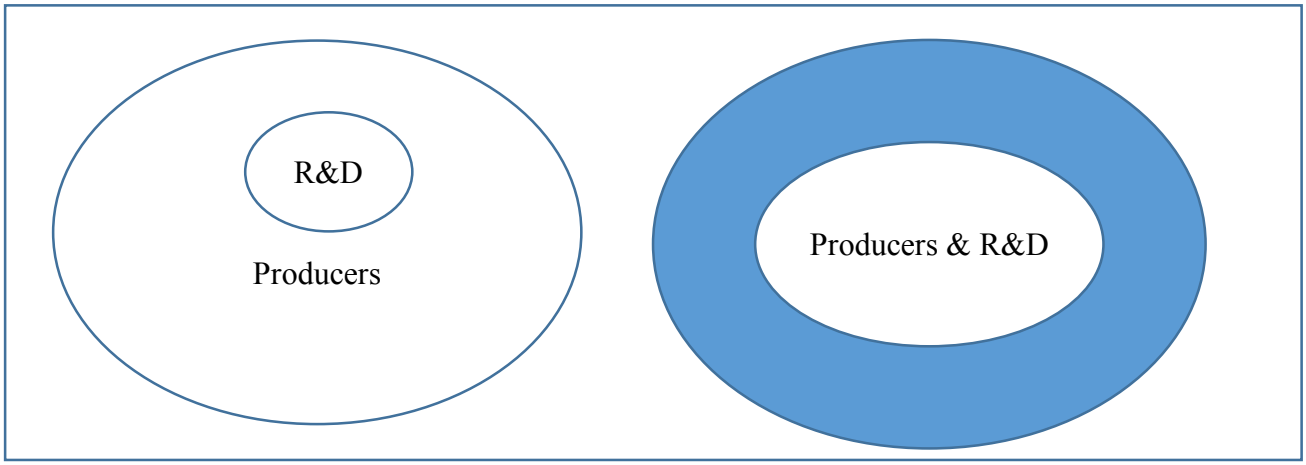

Figure 8: On the left is the core R&D model, on the right, the network model

The less mature industry clusters had a core of knowledge producing R&D institutions who constantly pushed new innovations out to the producers in the cluster, who can use this new and innovative knowledge in order to create new products. The network based model of the oil and gas industry also encompasses both producers and R&D institutions but they are all mixed in a large network. To the degree that producers and R&D institutions interact it seems to mostly be on a market pull basis, where the producers request specific solutions, instead of continually adapting to the new knowledge coming out of the R&D institutions.

Obviously this observation, that less mature industries tend to pay more attention to stimulating and exploring R&D efforts, is not a new one and might be something that I should have anticipated.

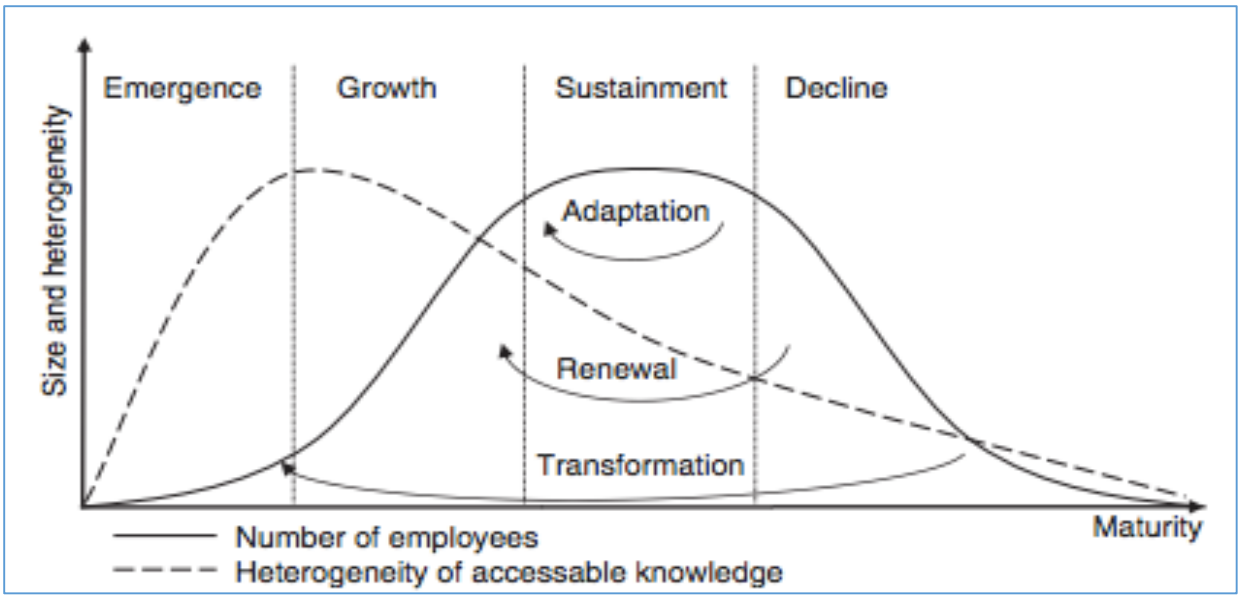

Figure 9: The cluster life cycle, source: Menzel & Fornahl (2009)

As mentioned in the introduction to this thesis, the oil and gas industry is in the middle of a substantial downturn, which has had an effect on the clusters operating in that industry. When looking at the cluster life cycle illustrated in *figure 9* I would say that oil and gas clusters are in the middle of the sustainment phase. According to Menzel & Fornahl (2009) this stage is characterized by stagnation in cluster growth and decreasing heterogeneity within the cluster. I would say that wind energy, oncology and med-tech are in the early to mid growth stage. This stage is characterized by the emergence of a dominant cluster design, increase in employment, substantial heterogeneity and a high number of startups (Menzel & Fornahl, 2009). Therefore, it is natural for the clusters within the less mature industries to be more research focused, and the members more willing to embrace the results of new research. Another interesting effect the difference in industry maturity and external environment seemed to have, was on the view cluster members had of one another with regards to competition. I did not get any substantial examples of differences; it was something that occurred to me while transcribing the interviews, and listening to the way the different interviewees talked about helping members. All the interviewees described how the clusters attempted to help their members succeed with both exploration and exploitation. But the interviewees from the clusters serving the oil and gas industry also pointed out that they tended to contribute general knowledge that could benefit the entire cluster. They were careful with giving specific help to one member, because after all the members were competitors. The attitude within the less mature industry clusters seemed to be more of a "rising tide lifts all boats" type of attitude. This observation probably also stems from the less mature industry

clusters looking at a longer time horizon, while in the mature energy industry some might begin to see the end on the horizon.

The role of the management team as connector

During the course of working on this thesis it has become very clear to me that the most important role the management team within a cluster plays is that of being a connector. I would compare the dynamic between cluster management and its members to that of a worker's union and the workers it represents. The role of the union is to represent the workers in order for them to have a strong united front, and help the workers out in any way they can. While at the same time the union itself does not have any real power over the workers and can not dictate what they should do on a day to day basis. This is the same relationship that exists between the cluster management and their members, the main goal of the cluster is to represent the interests of their members and show them what opportunities are available to them. This sentiment was captured in several of the interviews I conducted.

"we don't focus on balancing these two types of activities, we help our members do what they need to do, regardless of how it is classified within this distinction" NCEI

"we can show our members a "fruit platter" of opportunities that are available to them, but in the end it is up to them what they do with that information" GCE NODE

This means that the management team has a fairly limited tool box with regards to achieving ambidexterity. As I posed in the propositions for this thesis the main tools available to them are to employ either market pull or technology push based programs. As well as connect their members to others, either internal or external to the cluster, that can help solve whatever challenge they are facing at the moment. In addition to this, I also discovered that the clusters played a bigger role than I expected when it came to politics and lobbying. This is another one of those things that seems obvious in hindsight but that I did not consider as a key role of the cluster before starting the data gathering process. All the clusters spend a considerable amount of time helping their members to become aware of what public funding programs are available to them, and what sort of projects these funding programs can be used to finance. The clusters, especially within the mature energy industry, also received many requests from their members to lobby government agencies in order to improve the framework and conditions for receiving public funding. Now that many oil and gas companies are trying to save money in any way they can there is decreased internal funding for innovation projects. One request received by the GCE NODE cluster was for public government agencies to fund exploration projects, and for cluster members to provide the man-hours to complete the

projects. In cases like these, cluster management must lobby the government in an attempt to increase exploratory activities in a cluster, and industry, that is self-admittedly mostly exploitation focused. When operating in a challenging industry with unstable external conditions the political role played by the cluster management becomes much more apparent. There is especially one area that has received increased focus by GCE NODE and GCE Blue Maritime, and most likely would have been an area of focus for NCEI were it not for the fact that they are shutting down in a few months. GCE NODE and GCE Blue Maritime have implemented new programs in order to stop the "bleeding" of skilled workers from the southern part of Norway. As mentioned in the introduction, about 35,000 employees have lost their jobs so far, and another 15,000 are expected to lose their jobs before the trend turns around in 2018. GCE NODE has established something they call Greenhouse, which is a pre-incubator program for employees who are terminated. At Greenhouse the former employees are encouraged to use their competence and knowledge in order to develop new business ideas aimed towards the oil and gas industry. The best ideas that come out of Greenhouse are offered a spot in GCE NODEs incubator program in order to develop and further realize the idea.

GCE Blue Maritime have established several programs to retain workers in the area and help create new jobs. In collaboration with Mafoss and NAV they are establishing a series of competence enhancing programs for active, and suspended employees. They are also participating in the Massachusetts Institute of Technology Regional Entrepreneurship Accelerator Program (MIT REAP). This is a program that focuses on economic growth and job creation through innovation driven entrepreneurship within the region. These efforts are obviously exploration focused, which is exactly what the oil and gas industry needs in order to recover from the current downturn. They are also an example of the cluster management responding to a *market pull* request, improving framework conditions for innovation, by creating exploration focused programs.

These types of programs are in line with the guidelines identified by Menzel & Fornahl (2009) for how a cluster in the sustainment stage of the life cycle can create new growth and revive the cluster. They need to increase the heterogeneity within the cluster by exploring and pushing knowledge from new and underutilized sources into the cluster.

The role of connector can be activated in a market pull version, where the cluster management receives a request from a member to connect them to someone. There is also a technology push version where the management team sees someone with interesting competence, either

internal or external to the cluster, and asks them to share this with the rest of the cluster. I saw that market pull and technology push are not isolated processes that result in a pre determined outcome (exploration or exploitation). There were many examples of a cluster member approaching the management team with a request to do a market analysis or feasibility study in order to map out the possibilities for a new project. In that case a market pull request leads to a technology push initiative, and the management team taking an activist role in order to fulfill that request. So I saw that reality is not as black and white as the analytical framework I created in the early stages of this thesis suggested.

Summary

When I started the process of analyzing my data for this thesis I had a clear picture of how I theorized that cluster management could facilitate ambidexterity in the cluster. To a large extent the analytical model in *figure 5* turned out to be an accurate picture of how clusters can achieve ambidexterity, but as with most analytical models reality never matches perfectly with the model. There were especially two crucial factors discovered during the process of analyzing my primary data set that were not captured in my analytical model, but turned out to have an effect on how cluster ambidexterity is pursued.

The first is that *exploration* focused programs can be based on either *technology push* or *market pull* initiatives depending on the request they receive from their members, and might result in the management team taking either a *broker* or *activist* role. *Exploitation* focused initiatives were always started from market pull, but could lead the management team to act as either *broker* or *activist* depending on the market pull request.

The second factor I failed to capture in my analytical model is the mitigating factor played by the cluster's external environment and how this effects their ability to engage in either exploration or exploitation activities. The revised analytical model can be seen below in *figure 10.*

It was very clear from my interviews that the clusters who served the oil and gas industry, and therefore were operating in a turbulent and uncertain environment faced more challenges than those operating within med-tech, oncology, and wind energy.

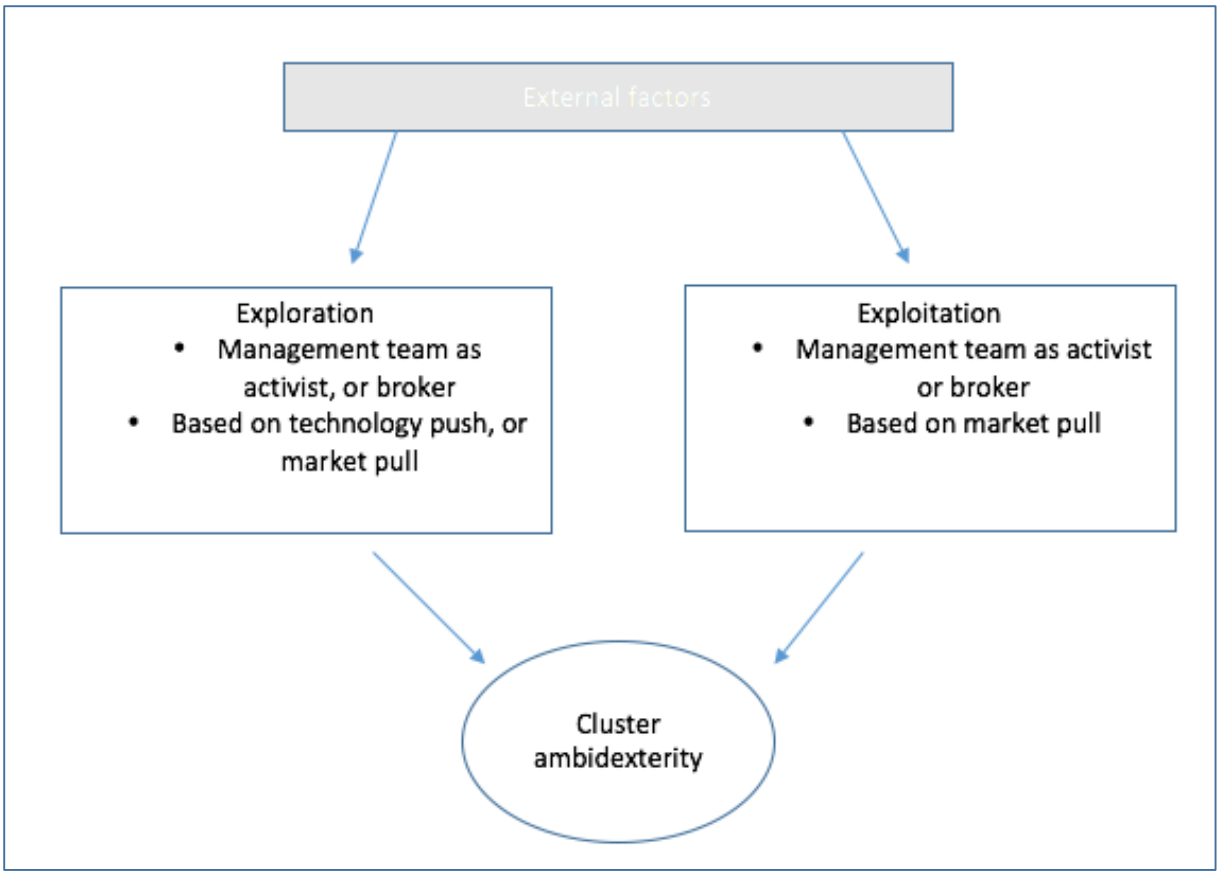

Figure 10: Revised analytical model

The main challenge faced by the clusters serving the oil and gas industry were that of being able to secure funding for new, and much needed, exploration projects. As is common when an industry is facing a downturn, the companies operating within the industry are doing everything they can in order to reduce operating costs. This means that it is very difficult, even with funding support from Innovation Norway and other public programs, to find the necessary funding for these projects.

With regards to the propositions I developed during the course of writing this thesis, I found the following:

Proposition 1: The management team can help firms engage in exploitation activities by taking a broker role and using market-pull programs

This proposition was partially confirmed. I saw that exploitation focused efforts, like projects for improving production processes, were started when the management team received a request from one of their members (market pull). But the response to this request could manifest itself in the form of management taking either a broker or activist role. If the management team had someone within their network of contacts who could help improve the production process, they would take a *broker* role and connect the two parties. If they did not have a contact in their network, they would have to take an *activist* role and attempt to locate someone.

Proposition 2: The management team can help firms engage in exploration activities by taking an activist role and using technology-push programs

This proposition was also partially confirmed. In what way the management team helped firms engage in exploration activities depended on the make-up of the cluster. Except for NCEI, all the clusters stated that they would actively search for new and useful technology outside of the cluster, thus using technology push and taking an activist role. But, as all the clusters that were part of the primary data collection efforts in this thesis included a number of R&D institutions it was also possible for the management team to start exploration efforts based on market pull and by taking a *broker* role. In that case they would receive a request from a member, and connect them to an internal R&D institution that could help them. I also saw that the activist role in some cases consisted more of lobbying and representing the political interests of a given industry, than searching for new technology or members.

Proposition 3: In order to facilitate ambidexterity in the cluster the management team must take on both the role of broker and activist, and employ both market-pull and technology-push programs.

I found this proposition to unequivocally true. The clusters that had the best ability to balance exploration and exploitation used both *market-pull* and *technology-push*, and took on the role of either *broker* or *activist* depending on the circumstances.

As for what impact this thesis has on further research within the area of cluster ambidexterity, I have seen that the external environment the cluster operates within has a large impact on the ability of the cluster firms to balance exploration and exploitation. So it would be interesting to see a study attempting to find out how the impact of the external environment on a clusters ability to achieve ambidexterity can be mitigated or reduced as much as possible. Whether

this would be through increased public funding, achieving the right composition of members in the cluster, focusing more on lobbying etc.

Weaknesses and limitations of this study

The main weakness of my study is, as mentioned in the discussion chapter, that none of the interviewees had any familiarity with the term ambidexterity. This means that their ability to talk about the subject and how they attempt to achieve it relied on my explanation of the term. I tried to mitigate this as much as possible by sending an email well in advance of the interviews with information about the topic, and allow the interviewees time to think about how it was handled within their clusters. However, it could not be expected that the interviewees would research the topic and put a lot of effort into developing a complete picture of the topic, so they mostly relied on my explanation. Another possible weakness is that I conducted the interviews in Norwegian and translated them into English during the transcription process, this was done because the thesis is written in English and therefore the quotes much also be in English. Translation errors or changes in the grammatical structure of the translated quotes could impact how they are interpreted, and misconstrue what the interviewee actually meant to say. This reduces the face validity of my data. In order to ensure that the interviewees agreed with the translations I had written, and improve validity, I sent them the 1st draft of the thesis and asked for their feedback. This led to some criticism of a few of the translations, in accordance with their requests I subsequently edited these translations to better reflect the true intent of the interviewee.

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Appendix

Interview Guide

- Are you familiar with the term ambidexterity?
- Do you try to balance exploration and exploitation within the cluster? How?
- Would you say your members are specialized in either exploration or exploitation?
- Do you try to pair members specialized in exploration with those specialized in exploitation?
- Does it ever happen that your members approach you with requests?

- Of what nature are these requests? How do you respond?
- Do you actively search for new members or technology outside the cluster?
- What do you do to help your members innovate?
- How do you, or do you, keep track of your member's activities?
- Will you approach your members with technology or partners that are relevant for them?