Evaluating the effect of VRI on regional innovation through an absorptive capacity approach

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Anna Linnea Rydell

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FORFATTER:

Anna Linnea Rydell

VEILEDER:

Ragnhild Wiik

EMNEORD/STIKKORD:

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Abstract

The purpose of this to study was to evaluate the effect of the VRI (Virkemidler for regional innovasjon) project on regional innovation. This effect was evaluated through an absorptive capacity approach.

Explained in basics, the concept of absorptive capacity can be understood as an organization's ability to find, absorb and make use external knowledge to enhance its competitiveness by creating even better products, services and solutions. It is therefore closely knit to innovative output and the ability to be in the forefront. This study therefore aimed at finding out how VRI's various enablers affected the participating organizations' absorptive capacity and therefore also, their innovative capability.

The operalization of the concept make it possible to further explain how four different dimensions contribute to the overall absorptive capacity (and therefore also its two components potential absorptive capacity and realized absorptive capacity). The dimensions are described to have a variety of internal and external factors that affect them and in turn, the overall absorptive capacity. It is therefore possible to indirectly evaluate the level of absorptive capacity in an organization by mapping out the presence of these factors.

The chosen method was qualitative oriented using semi structured interviews. The interview questions were designed to find out if and how the VRI enablers affected the above mentioned influencing factors. Interviews were conducted with VRI-participant companies in each of the VRI categorized sectors of energy and maritime. As a reference group, interviews were also conducted with non VRI-participants in each of the sectors.

The thesis concludes that VRI mainly influences the level of absorptive capacity in the participating organizations by enabling them to better identify relevant, external knowledge. This is done by initiating R&D collaborating with knowledge institutions, various attempts to increase the organizations' prior knowledge base and by offering expertise help to identify external knowledge.

This is not enough, however, for the organizations to achieve a long lasting absorptive capacity. Instead it is up to the organization itself to build the routines and practices that affect the ability to also absorb and make use of external knowledge into competitive advantages. This can be done by focusing on the characteristics concerning both the organization itself and its employees.

Preface

This master thesis is my final assignment as a master student in Change Management at the University of Stavanger (UIS). It therefore concludes five years of studies and it is both with joy and sadness that I enter work life the coming fall.

I would like to extend my thanks to the following people for their valuable and much appreciated contributions to the process of writing this thesis:

Ragnhild Wiik, Research Director for Innovation at IRIS (International Research Institute of Stavanger), who has been my supervisor. Ragnhild generously welcomed me to be a part of her research group at IRIS. Throughout the whole process she has shown great engagement in my thesis. She has continuously challenged my mode of thinking, shared her expertise and provided very helpful insight and comments. I am also very grateful for the opportunities given as a result of this collaboration. As a special thanks, I promise Ragnhild that I will continue the heritage of her former supervisor by in the future offering the same generosity and helpfulness to other students.

The Innovation research group at IRIS and the VRI project for the kind welcoming and for their valuable insights throughout the whole semester. I would especially like to thank Christian Quale, Kjersti Vikse Meland and Hilde Uppstad for their patience and helpful assistance.

The thesis would not have been possible without my informants being willing to participate. I therefore like to extend a great thanks to my informants. The interviews were very interesting and it was great to take part of their insights and experiences.

Thank you to Joachim, friends and family for motivational support.

Finally I would like to sincerely thank Eva and Stig for their priceless support and assistance throughout my years at school.

Anna Linnea Rydell

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1.0 Background for study

After spending a semester at the University of California, Berkeley, studying topics such as technological innovation and entrepreneurship, I became very interested in the reason why certain territorial areas, industries and organizations are better than others at inventing and commercially developing new technological solutions. I became fascinated by the nearby located Silicon Valley and the large number of high technological companies that originate from there, for example, Google, Facebook, IBM, Apple, and Microsoft. What was so special about Silicon Valley and why did this region experience such a high rate of development in technology? What was the reason that companies located in Silicon Valley are acknowledged as extraordinary examples of an ability to be far ahead in developing new technological products and services?

The above reflections and study led me to wonder more about what factors it might be that influences an organization's likeliness to be technologically innovative. In discussions with Ragnhild Wiik, Research Director for Innovation at IRIS (International Research Institute of Stavanger), I was introduced to a phenomenon known as absorptive capacity. Explained in basics, the concept can be understood as an organization's ability to find, absorb and make use of external knowledge to enhance its competitiveness by creating even better products and services (Zahra and George, 2002). The idea of the concept is therefore to somewhat capture how susceptible organizations are to external knowledge and how this knowledge is applied and taken advantage of within the organization. It is therefore closely knit to innovative output and the ability to be in the forefront. In addition, can the concept be studied within the reference frame of technology meaning how susceptible organizations are to external technological knowledge and how this knowledge is made use of to create better technological products and services. In other words, it was a concept much suitable for finding out why certain organizations are better than others at inventing and commercially developing new technological solutions.

Furthermore, I was told that there is a national project from the Research Council of Norway called VRI (Virkemidler for regional innovasjon) that aims to increase regional research and development (R&D) innovation. In the region of Rogaland, the project is double-barreled in two different projects, a research project and a cooperation project.

The aim of the cooperation project is to increase innovation by further developing and (partly) financing connections between companies, industries, the public and knowledge institutions

(universities and research institutes). This is done through a variety of established enablers such as:

1. The use of experienced and well oriented **competency brokers** that can find and establish cooperation between relevant companies and research institutions. By the use of competency brokers, the program wishes to encourage research and development in companies that have potential to increase profit by cooperating closer with knowledge institutions.
2. **Dialogue and cooperation** which represents different approaches to increasing organizational development and cooperation within the company and/or across companies. Examples of this enabler are *dialogue conferences* (offering an arena for interaction and discussion), *development circles* (related to solving a concrete problem), *group establishment* (aimed at helping out already established networks) and *experience transfer* (increasing the competencies of regional knowledge institutions by allowing them to visit and gather experience from knowledge institutions outside the region).
3. **Person Mobility** which means that personnel, primarily students or researchers, are being transferred between the knowledge institutions and industries.

(Roth, 2009, p. 37)

The aim of the research project is to evaluate the innovative impact of the regional VRI project. Relevant research topics are the innovation processes initiated, the enablers and their effects (for example the effect of dialogue on innovation) and political and economic factors that influence the rate of innovation in the Rogaland region. While the cooperation project is managed by the County Council in Rogaland is the research project managed by the International Research Institute of Stavanger.

Through discussions, Ragnhild and I came up with the idea that the VRI cooperation project could be seen in the light of the absorptive capacity concept. It became clear to us that it would be of interest to find out if (and possibly how) the VRI cooperation project and its enablers affect the participating organizations' ability to find, absorb and make use of external knowledge that can increase their competiveness. What effect do, for example, the competency brokers have on the organizations' ability to find useful external knowledge and to what extent can cooperation with a knowledge institution, help the organization in making use of the newly acquired knowledge?

1.1 Presentation of problem formulation

In this thesis, I therefore wish to look closer at the following problem formulation:

Does the VRI cooperation project affect the level of absorptive capacity in the participating organizations and if so, in what ways?

Furthermore, I want to explain how I intend to answer the above.

Absorptive capacity is conceptualized as a four-dimensional model that is grouped into two components. Below is a simplified model of the absorptive capacity concept.

1. Acquisition
2. Assimilation

Potential Absorptive Capacity

3. Transformation
4. Exploitation

Realized Absorptive Capacity

The four steps are different but complementary dimensions of absorptive capacity that must progress chronologically. Acquisition (1) is the ability to identify valuable external knowledge. Assimilation (2) is the ability to actually absorb the knowledge into the organization. Transformation (3) is the ability to combine already existing knowledge with the newly acquired knowledge. Exploitation (4) is the actual use of knowledge in terms of developing new or improved competitive solutions. By grouping these steps into two components one can also differ between potential absorptive capacity (Step 1 and 2) and realized absorptive capacity (Step 3 and 4).

Previous research has not only pinpointed out certain *internal factors* that inhibit or promote the presence of absorptive capacity in the organizations, but also to a large degree found out exactly what steps in the model that are affected. We know, for example, that the ability to identify valuable external knowledge (Step 1) increases if the employees are highly educated, and with a diverse background. Another example is that the organization's ability to make use of the newly acquired and combined knowledge into new competitive solutions (Step 4) decreases if the organization is characterized by a high level of bureaucracy.

In addition to internal factors, there are also *external factors* that affect an organization's absorptive capacity. Examples of external factors are the organization's participation in networks and their relation to the other participants in the network. The assistance from VRI, which works as a public support system, would also be considered as an external factor.

In my thesis I therefore wish to find out if and how the VRI cooperation project affects the level of absorptive capacity. This will be done by attempting to find out if and how the enablers affect the steps in the absorptive capacity model. In order to understand the external stimuli that come from VRI, I also need to have a good understanding of what internal factors that are present in the organizations. This is because absorptive capacity is influenced by both internal and external factors.

The above will be done by interviewing companies in two sectors that VRI aims to help, categorized as the energy and maritime sectors. In order to specifically find out the effect of VRI, I decided to interview similar organizations that had not received help from VRI. By choosing this approach I will be able to compare companies in between as well as two different industries.

In conclusion, the aim of my Master research is therefore to find out *if VRI promotes the level of absorptive capacity and if so, in what ways.*

1.2 The purpose of my thesis

The main purpose of my thesis is to assist the VRI research project in finding out the enablers' effect on the organizations' absorptive capacity. Since the concept of absorptive capacity is closely knit to innovative output, my attempt to answer my problem formulation, can give the research team on IRIS important indicators on how the VRI cooperation project contributes to increased innovation.

Furthermore, even though my problem is rather specific, the layout of my thesis attempts to answer several underlying questions.

Part of the purpose for my research is to try to map out which and to what degree the internal and external factors are present in the organization and if their presence is intentional or coincidental. In other words, I want to find out if the organizations studied are proactive in achieving absorptive capacity or if it is more coincidental. Do they build their organization consciously attempting to influence their organization in such a way that it is highly susceptible to external knowledge and the use of it? What do the organizations think are the most important factors for reaching a high level of absorptive capacity and which of the internal and external factors do they value the most? Even though my informants might not be familiar to the naming absorptive capacity, I assume that they are aware of its general notion of meaning. By answering these questions, I can provide some information on which of the

enablers that are valued the most and what other possible enablers the VRI cooperation project perhaps should consider. The ultimate goal is to give inputs to VRI on how the enablers work and what could be done to improve them.

In addition, I wish to find out more about the view on using public support systems such as VRI. What do the organizations think of them, how do they get to know about them, and in what ways might they be helpful? In regards to VRI, it is also interesting to find out more about the organizations' views on cooperating with knowledge institutions and their attitude towards academic research.

In order to reach the purpose of my thesis, I will start off by explaining the theory on absorptive capacity more specifically and why the operalization of the concept is critical for its ability to be measured. Thereafter, I will tell more about the method of research that I have decided for in order to answer my questions. In the consequent sections, I will present my empirical results and make an attempt in analyzing these. At the very last, I will conclude my main discoveries in addition to reflecting over my last semester's work as a Master student.

2. 0 Theory on absorptive capacity

This chapter provides a theoretical background on the concept of absorptive capacity. It will offer an understanding of what internal and external factors affect the level of absorptive capacity in organizations. In addition, I will explain why the operalization of the concept is of such importance for the ability to measure it.

2.1 The absorptive capacity concept

All organizations are open systems susceptible to both internal and external influences (Busch et al., 2007, p. 17). In terms of innovation, researchers claim that the innovation process is largely dependent on external knowledge and that the ability to make use of external knowledge is critical for being innovative (Cohen and Levinthal, 1990, p.128).

The concept of absorptive capacity attempts to capture how susceptible organizations are to external knowledge and how this knowledge is applied and taken advantage of within the organization. It is a concept mostly studied within the reference frame of technology. In other words, it attempts to capture how susceptible organizations are to external knowledge and their ability to make use of this knowledge in terms of new or improved technological solutions.

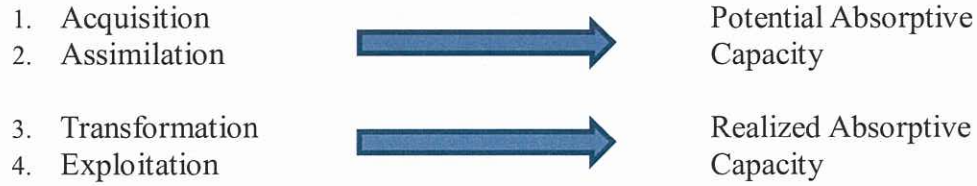
Cohen and Levinthal (1990, p.128) define absorptive capacity as the capacity of a firm to value, assimilate and apply, for commercial ends, knowledge from external sources. The definition can therefore be understood as a three dimension concept that differs between 1) identifying external knowledge as valuable for the organization, 2) the absorption of the knowledge and 3) the actual exploitation of it.

Zahra and George (2002) have further developed this definition by referring to absorptive capacity as an organization's ability to acquire, assimilate, transform and exploit external knowledge to increase competitiveness. They also group these four dimensions into two components, allowing us to differ between potential absorptive capacity and realized absorptive capacity.

The definition of absorptive capacity by Zahra and George (2002) is a reconceptualization of the concept by Cohen and Levinthal (1990). It is also currently the most widely cited definition of absorptive capacity. It is a definition that increases the dimensions from three to four. A dimension called transformation is added which allows for a more detailed

conceptualization of the process where the newly acquired knowledge is combined with already existing knowledge. Even though this was seemingly included in the Cohen and Levinthal (1990) definition of assimilation, strictly speaking, is assimilation only the absorption of knowledge and not a guarantee that the newly absorbed knowledge is combined with already existing knowledge. Dividing Cohen and Levinthals' (1990) definition of assimilation into two, assimilation and transformation, allow us to separate the different processes in addition to underlining that they belong to two different components, potential absorptive capacity and realized absorptive capacity (Camison and Fores, 2010, p. 709).

Zahra and George (2002) therefore claim that absorptive capacity can be understood as a four-dimensional model grouped into two components. The four dimensions- acquisition, assimilation, transformation and exploitation- are different but complementary and must come after one another (Zahra and George, 2002, p. 189). Below is the simplified version of their model (as previously shown on page 3).



Furthermore, I will start by explaining these steps in detail.

Acquisition refers to the first step and is the organization's ability to both recognize and acquire external knowledge that is critical to its operations. The routines concerning acquisition can affect the level of absorptive capacity mainly through three factors. These are intensity, speed and direction. Attempts made by the firm to develop routines that try to facilitate both the intensity and speed in which it tries to recognize valuable knowledge and acquire it, will also help to enhance the organization's absorptive capacity. The direction refers to that already gathered knowledge will naturally steer what new external knowledge one attempts to gather and is able to identify (Zahra and George, 2002, p. 189).

Assimilation is the second step and it refers to routines and procedures that allow the organization to understand, analyze and interpret information from external sources. It refers to the ability by the firm to actually absorb the external knowledge. Knowledge, for example,

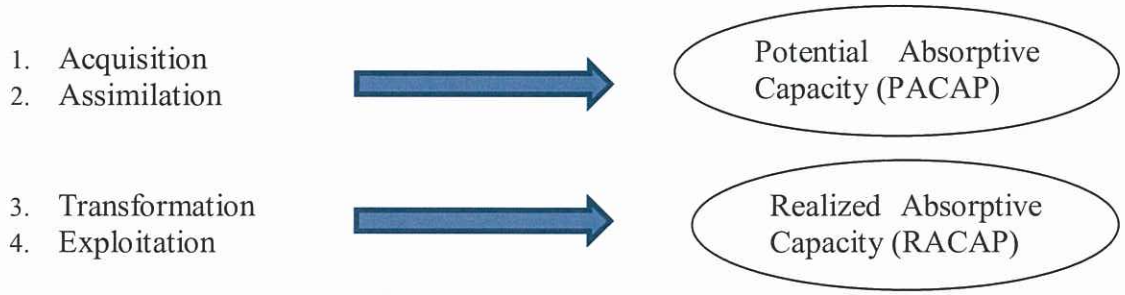
that is beyond comprehension will evidently not be absorbed into the organization (Zahra and George, 2002, p. 190).

Transformation is the step after assimilation. Transformation is the organization's ability to develop routines that make it easier to combine existing knowledge with newly acquired and assimilated knowledge (Zahra and George, 2011, p. 190). The process that enables this is bisociation. Bisociation is the process in which different concepts, for example conceptual categories and contexts, usually viewed separately, are combined together to form a new way of thinking and frame of reference (Kostler, 1964, p. 35). Bisociation is very much a process that promotes creativity, a necessity in order to be innovative. The process influences both the organizations entrepreneurial mindset and actions. The reason for this claim is that bisociation enables the organization to get new insights and abilities to recognize new opportunities in addition to that it alters its definition of both the organization itself and its competitors (Zahra and George, 2002, p.190).

Exploitation is the very last stage of the absorptive capacity process. Exploitation refers to the ability to apply the new knowledge commercially based on the routines that allow the organization to refine and extend existing competencies or create new ones. In others words, it refers to the actual application of the knowledge, systematically incorporating acquired and transformed knowledge into the organization's operations (Zahra and George, 2002, p. 190).

The concept of absorptive capacity should not be understood as a one-time phenomenon but as a dynamic capability that increases the probability of firms to identify, take in, transform and exploit external knowledge to increase competiveness (Lane, Koka & Pathak, 2006, p.845). Ordinary capability refers to the routines, or collections of routines, reflected in activities that produce outputs important for the survival of the organization (for example IKEA's low cost furniture production capability). Dynamic capabilities, however, reflect more the organization's ability to change and are therefore more strategic, influencing the further development of the organization. Zahra and George (2002, p.188) argue that the four steps in the absorptive capacity (ACAP) process help to create and make use of knowledge essential to build other organizational capabilities (for example, marketing- and production capabilities). These capabilities are what enable the organization to have a competitive starting point in achieving high performance compared to its competitors.

Besides describing absorptive capacity as a process with four consequent steps one differs between two components of the concept. By grouping these steps in two different components, one can differ between potential absorptive capacity (acquisition and assimilation) and realized absorptive capacity (transformation and exploitation). In other words, the concept of absorptive capacity can be understood both from a perspective of different steps that all need to be present and chronological in order as well as it being potential or realized (Zahra and George, 2002).



Potential absorptive capacity is therefore the organization's ability to acquire and assimilate external knowledge. This does not mean however that the knowledge becomes realized in terms of new competitive services and products. Instead it is the realized absorptive capacity that refers to the ability to make use of the new knowledge in terms of new technological solutions (Zahra and George, 2002, p.190). Realized absorptive capacity is therefore primarily what influences the performance by the organization and what results in innovative outputs that creates a competitive advantage (Zahra and George, 2002, p. 185).

The components of PACAP (potential absorptive capacity) and RACAP (realized absorptive capacity) are complementary as well as dependent on each other. For example, RACAP is not possible without a satisfactory PACAP and even though the PACAP is high, it does not mean that it will result in a high RACAP. The factor that intends to measure the relationship or ratio between the components is the efficiency factor. In organizations where the efficiency factor is high, RACAP meets PACAP and therefore enables the organization to enhance its performance through new competitive services or products (Zahra and George, 2002, p. 191).

Most importantly, a high level of absorptive capacity, where the PACAP meets RACAP, will result in a competitive advantage for the organization. The competitive advantage consists of strategic flexibility, innovation in the form of new technological solutions and increase in

organizational performance. In the literature concerning absorptive capacity, there is a clear agreement on this view. Cohen and Levinthal (1990, p.128) state that a high level of absorptive capacity in an organization is *"critical to its innovative capabilities/.../and innovative performance"*. Camison and Fores (2010, p.707-708) underline that:

"In a dynamic and turbulent environment, knowledge represents a critical resource to create value and to develop and sustain competitive advantages. However, rapidly changing environments, technologies and rules of competitiveness exacerbate the problems organizations face in attaining self-sufficiency in knowledge creation. An inward looking approach to knowledge creation, in which the firm relies on its own resources, appears to be a conservative strategic option, as in that case firms miss out on the dynamic effects of interaction between internal and external knowledge. External knowledge enables the firm's internal knowledge to be extended by stimulating competitiveness and innovation. Absorptive capacity has become one of the most important constructs in the last years precisely because external knowledge resources are so important."

Furthermore, it is of interest to explain more explicit how a high level of absorptive capacity leads to a competitive advantage, strategic flexibility and increased performance. This is often explained by referring to the components of potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP).

A high level of potential absorptive capacity will result in strategic flexibility. Zahra and George (2002, p. 195) are clear in that there are many ways that a firm can achieve competitive advantage but when it comes to ever changing markets, the ability to be strategically flexible and innovative is critical. Organizations well equipped to continually identify and absorb relevant knowledge will also be more flexible in changing their strategy since they most likely will have the ability to identify and gather knowledge necessary to conduct the changes. Organizations with a high level of potential absorptive capacity are also likely to change and improve their knowledge in accordance with trends in the external environment. This ability gives them a competitive advantage in timing new trends in the market as well as being more cost effective in realizing the knowledge needed (since they have already gained it previously trough a high level of potential absorptive capacity). According to Zahra and George (2002, p. 195-196), these attributes, cost and timing, that

potential absorptive capacity result in, are main factors in explaining performance differences between companies in the same industry.

A high level of realized absorptive capacity, that is when firms have the ability to transform and exploit external knowledge, will also make the firms more likely to invent new technological products and services. This will in turn increase their performance and competitiveness (Zahra and George, 2002, p. 195).

2.2 The importance of absorptive capacity operalization for its ability to be measured

The previous reconceptualization by Zahra and George (2002) is essential when one should attempt to measure absorptive capacity. The authors argue that their operalization of the concept open up for the ability to measure it more efficiently. By dividing it more specifically than Cohen and Levinthal (1990) and by exploring the roles, importance of and relationship between the different parts, it is possible to further explain how each dimension in the model contributes to the overall absorptive capacity (and therefore also their components PACAP and RACAP). This is important when attempting to explain performance differences between companies in the same industry as well as the ability to sustain this difference over time (Zahra and George, 2002, p. 186).

Furthermore, this is because the different dimensions are described to have different internal and external factors that affect them and in turn, the overall absorptive capacity. Like mentioned, this opens up for the possibility to create a research design that is able to more specifically find out not only an organization's level of absorptive capacity but also trace what factors that might inhibit or promote its presence. It is also possible to find out the level of potential absorptive capacity and realized absorptive capacity within the organization. It might, for example, be that the organization has a high level of potential absorptive capacity but is unable to realize it since various internal factors make it impossible to go from the assimilation stage to transformation.

On the next page is the original model of absorptive capacity developed by Zahra and George (2002). It shows the antecedents, moderators and outcomes of the concept.

FIGURE 1
A Model of ACAP

(Zahra and George, 2002, p. 192)

In the following section, I will explain the model by Zahra and George (2002) more thoroughly.

The antecedents of absorptive capacity include external knowledge sources and complementarity. High exposure to knowledge sources that are complementary (the knowledge is related to but yet different from already existing knowledge in the organization) will increase the possibility of achieving a high level of potential absorptive capacity (Zahra and George, 2002, p. 193). External knowledge sources can, for example, be acquisitions and purchasing of other companies, joint ventures, R&D co-operations or relevant alliances (Zahra and George, 2002, p. 191).

Experience is closely related to organizational memory and previous successes or failures will be internalized into this memory. The organization memory influences the organization's attempts to search for external knowledge since organizations tend to search for information in areas where they have had past success. The organizational memory therefore influences what information the management, for example, wants to proceed with in addition to determining in what technological area the organization attempts to acquire and assimilate external knowledge (Zahra and George, 2002, p. 193).

Activation triggers act as moderators on the impact of external knowledge sources and experience on absorptive capacity. Internal triggers, such as performance failure, and external triggers, such as technological shifts in the industry, are events that (even though negative) will encourage the organization to put more effort into seeking external knowledge. The source and the intensity of the activation trigger are of importance in this context. The source of the activation trigger will most probably influence the area where the organization attempts to search for new knowledge. If, for example, Volvo launches a flying car (which would be considered a radical technological shift in the car industry), the competitors would most likely begin seeking for technology related to the new shift. The intensity of the activation trigger will also affect the attempts to acquire and assimilate the external knowledge. If the other car producers will be excluded from the car industry if they cannot come up with a similar flying car (everybody wants it now), they will intensify their efforts in acquiring and assimilating the necessary knowledge (and therefore, at the same time, increase the overall level of potential absorptive capacity) (Zahra and George, 2002, p.194).

Social integration mechanisms, that facilitate the sharing and eventual exploitation of knowledge, will decrease the gap between potential absorptive capacity and realized potential

capacity. Zahra and George (2002) argue that these mechanism increase information sharing and the assimilation and transformation capacities. It is therefore of importance that the organizations attempt to enhance cooperation and the sharing of ideas and knowledge within the organization. This can either be done informally (social networks) or formally (using coordinators). It is noteworthy to mention that since social integration mechanisms decrease the gap between potential and realized absorptive capacity, they also increase the efficiency factor (Zahra and George, 2002, p.194).

The regimes of appropriability that is dominant in the industry, is a factor that can affect the organization's ability to remain competitive. It refers to what extent new technological solutions will be protected from competitors. If the regime of appropriability is low, it means that knowledge can more easily be picked up by the competitors. The organizations that operate in industries with a low regime of apporpriability, are therefore most likely not going to spend so much time and effort on developing a high level of absorptive capacity since it will not provide them with the desired level of competitive advantage. Organizations who operate in industries where it is harder to imitate competitors, in other words where the regime of appropriability is high, will often work more actively into achieving a high level of absorptive capacity. This will give them a great competitive advantage in the market (Zahra and George, 2002, p. 196).

It is, however, important to mention that organizations that operate in low regimes of appropriability can still benefit from having a high level of absorptive capacity, if they also develop good routines on keeping their outcomes of it secret to competitors (Zahra and George, 2002, p. 197).

2.3 Internal factors that influence the level of absorptive capacity

In his article "*Absorptive capacity and the implementation of knowledge-intensive best practices*", author Abdelkader Daghfous (2004) presents an overview of what internal and external factors that affect the level of absorptive capacity within an organization. Below is an overview of what internal factors that affect absorptive capacity (ACAP), whether it is a positive or negative relationship in addition to what dimensions of ACAP affected.

Internal factors that affect an organization's absorptive capacity (ACAP)

Internal Factor	Effect on ACAP	Dimensions of ACAP affected
Prior knowledge base	Positive relation	Acquisition
Individuals' ACAP	Positive relation	All factors
Level of education and academic degree	Positive relation	Acquisition, assimilation, transformation
Diversity of background	Positive relation	Assimilation, transformation
Presence of gatekeepers	Positive relation	Acquisition
Investment in R&D	Positive relation	Acquisition
Organizational Structure	N/A	Assimilation, transformation, exploitation
Level of internal communication	Positive relation	Assimilation, transformation
Level of organizational bureaucracy	Negative relation	Exploitation
Organizational culture-empowerment of employees	Positive relation	Transformation
Size	Positive relation/ Negative relation	Acquisition, exploitation
Organizational Inertia	Negative relation	Exploitation
HRM (recruitment, job rotation, reward systems)	N/A	All factors

(Daghfous, 2004, p.23)

Furthermore, I will explain what the different factors consist of and how they affect the level of absorptive capacity in the organizations. Several of the factors have already been mentioned, either implicitly in the model by George and Zahra (2002) or in the explanation of the concept. This section is therefore intended to provide an overview and to deepen and complement what has already been mentioned.

Prior knowledge base- Prior knowledge base is the individual units of knowledge present in the organization (Daghfous, 2004, p.22). Already existing related knowledge is a prerequisite acquiring a given new knowledge (Røvik, 2007, p.45). Accumulated previous knowledge therefore enhances both the ability to put new knowledge into our memory and the ability to

assimilate and make use of this knowledge when needed. The importance of prior related knowledge is one of the explanations for why absorptive capacity is path-dependent, which is that organizations are more susceptible to already familiar knowledge/knowledge related to existing knowledge. It can also explain why organizations with production experience, might have a higher level of absorptive capacity due to their hands-on, experimentation and learning-by-doing experience (Daghfous, 2004, p.22). Zahra and George (2002) show this principle in their model by referring to "experience".

Individuals' absorptive capacity- An organization's absorptive capacity relies on the absorptive capacities of its individual members (Da Silva and Davis, 2011, p. 360). In order for the organizations to achieve a high level of absorptive capacity, the organizations need to aggregate the different individual absorptive capacities through combinative capabilities. These include system capabilities, coordination capabilities and socialization capabilities (Daghfous, 2004, p. 22). It is important to mention that an organization's absorptive capacity is simply not the sum of individuals' absorptive capacity but by attempting to stimulate the individual absorptive capacity through the mentioned combinative capabilities, the organizational absorptive capacity is likely to also increase as a result (Cohen and Levinthal, 1990, p. 131). What the theorists are attempting to say about the concept by mentioning individual absorptive capacity is that even though the concept is to be studied on an organizational level, it has aspects to it that need to be considered at an individual level.

Cohen and Levinthal (1990, p.131-132) therefore mention that it is not only the exposure to external knowledge that is of importance, but also what happens in the organizations in the subsequent stages after it has been identified. It is therefore essential to look closer at knowledge transfers within the company which is the flow of knowledge across and within subunits of the organization. In the model by Zahra and George (2002) this is mentioned by the mapping out the box "social integration mechanisms".

The organization can attempt to influence this flow of knowledge across and within subunits of the organization by developing combinative capabilities. The combinative capabilities refer to enhancing individual absorptive capacity and therefore, also the organization's absorptive capacity. Daghfous (2004, p.22) explain the three combinative capabilities as *"(1) system capabilities: a firm's formalized procedures and policies; (2) coordination capabilities: relations between members in a group that is formally created or emerges as a result of interaction and job rotation; and (3) socialization capabilities: ability of firm to create a shared ideology.*"

Level of education and academic degree- Other factors that influence the absorptive capacity (dimensions of acquisition, assimilation and transformation) are the employees' level of education and academic degree (Daghfous, 2004, p. 22-23). In her article *"Absorptive Capacity and Innovative Performance: A Human Capital Approach"*, author Anker Lund Vinding (2000, p.10-11), claim that higher education is sometimes more important than work experience since it provides the latest technology and management knowledge. Furthermore, higher education within the relevant field enables the employees to identify, absorb and combine relevant knowledge with already existing knowledge (Daghfous, 2004, p. 23).

Diversity of backgrounds- Cohen and Levinthal (1990, p.133) explain that as long as there is some common knowledge ground and prerequisites for understanding, diversity of background among the employees will have a positive effect on the assimilation and transformation stages. This is because the different backgrounds will enable and encourage new linkages between old and new knowledge not achievable by just one individual.

Presence of gatekeepers- According to Cohen and Levinthal (1990), gatekeepers work as monitors of what external knowledge is important for the organization. They have the ability to identify external knowledge relevant for the organization in addition to explaining why and presenting it internally to the organization. The gatekeepers, who often are experts, therefore have an important positive effect on the acquisition dimension of absorptive capacity. In order for the external knowledge to be fully used, however, the organization relies on the whole organization's ability to assimilate, transform and exploit it (Cohen and Levinthal, 1990, p. 132).

Investment in R&D- In previous studies, one has attempted to measure absorptive capacity solely by measuring R&D efforts and outcomes. This has been somewhat misleading since the level of absorptive capacity is only partially illustrated by R&D efforts and outcomes (Camison and Fores, 2010, p. 709). R&D efforts are, however, of importance since they increase the knowledge base in the company which has a positive effect to the acquisition dimension (Daghfous, 2004, p. 24).

Organizational structure, level of internal communication and organizational bureaucracy- The organizational structure will affect the spread of the acquired knowledge to all parts of the organization involved in innovation, allowing the acquired knowledge to be assimilated, transformed and exploited. A high level of communication within the organization will enable for exchange of ideas, information and knowledge, and therefore also

having a positive effect on the ability to assimilate and transform the acquired external knowledge. Furthermore, the organization is more likely to reach the stage of exploiting the knowledge into new competitive solutions and products if there is no heavy bureaucracy that will inhibit the ability to do so. It should therefore be aimed at creating an organizational structure that is as dynamic and flexible as possible (Daghfous, 2004, p. 24).

Organizational culture (empowerment of employees)– Research has shown that organizations with an organizational culture where the employees are empowered also encourage knowledge-sharing between the employees. In terms of absorptive capacity, this has a positive effect on the transformation dimension (Daghfous, 2004, p. 24)

Firm size- The size of a firm can both have a positive and negative effect on the level of absorptive capacity. Some researchers argue that larger firms have a higher level of absorptive capacity since they often have greater R&D departments. Other researchers, however, argue that smaller firms are likely to have a higher level of absorptive capacity, since their organization is less bureaucratic and more flat allowing them to be innovative in responding to change (Daghfous, 2002, p.24).

Organizational intertia- It has already been stated that one of the competitive advantages a high level of absorptive capacity results in, is a high level of strategic flexibility (Zahra and George, 2002, p. 195-196). This result, however, assumes that the organization is willing to actually change and respond to changing circumstances. If the organization suffers from intertia, which is the tendency for organizations to hold on to their current strategies and resist change, it will evidently affect the level of absorptive capacity. This is because the organization will not efficiently respond to the external environment by exploiting the knowledge into new competitive products and solutions (Daghfous, 2004, p.24).

HRM (Human Resource Management)- This factor attempts to explain how the management of human resources can attempt to increase the level of absorptive capacity in the organization. Daghfous (2004, p. 25) mention that examples of such attempts can be interdisciplinary workgroups and planned job rotation (increasing the diversity of backgrounds) and delegation of responsibility (empowering the employees).

2.4 External factors that influence the level of absorptive capacity

In the model by Zahra and George (2002) we have already become acquainted with a number of external factors that are known to influence an organization's absorptive capacity. These include external sources of complementary knowledge and external activation triggers. In order for a high level of absorptive capacity to become a competitive advantage, the external factor, regimes of appropriability, will have an important role. Furthermore, I will provide a short summary of the mentioned external factors.

Exposure to external sources of complementary knowledge- The antecedents of absorptive capacity is that the organization is exposed to sources of external knowledge complementary to already existing internal knowledge. Examples of external knowledge sources can be joint ventures, R&D co-operations and relevant alliances (Zahra and George, 2002, p. 191).

Activation triggers- External activation triggers act as moderators on the impact of external knowledge sources. Zahra and George (2002, p.194) explain that external activation triggers, such as technological shifts in the industry, will encourage the organization to put more effort into seeking relevant external knowledge (thereby increasing the level of absorptive capacity).

Regimes of appropriability- The regime of approprability that is dominant within an industry refers to what extent new technological solutions will be protected from competitors. It will therefore affect to what extent a high level of absorptive capacity will be a competitive advantage. As a result, the regime of appropriability will most likely affect to what extent an organization attempts to achieve absorptive capacity (Zahra and George, 2002, p. 196).

There has, however, been conducted research that shows us that there are also other external factors that will influence the level of absorptive capacity within the organizations. In the consequent section, I will present these.

Industry dynamism- Industry dynamism can most easily be explained as a similar, but wider factor than regimes of appropriability. Just like the name implies, the factors intends to capture how the industry works and looks like and furthermore, how its dynamism affects the organizations' absorptive capacity (Daghfous, 2004, p. 25).

Position and relation to others in external knowledge networks- An external factor that influences an organization's absorptive capacity is the strength of its relationship with other members of knowledge networks, where knowledge institutions act as primary participants (Daghfous, 2004, p. 25).

2.5 Summary

The concept of absorptive capacity aims to capture how susceptible organizations are to external knowledge and how this knowledge is applied and taken advantage of within the organization to increase competiveness. It is a four-dimensional model that is grouped into two components.

The four dimensions of absorptive capacity are different but complementary. They must also progress chronologically. The first dimension, acquisition, is the ability to identify valuable knowledge. The second dimension, assimilation, is the ability to actually absorb the knowledge into the organization. The third dimension, transformation, is the ability to combine already existing knowledge with the newly acquired knowledge. The fourth dimension, exploitation, is the actual use of knowledge in terms of developing new or improved technological solutions. By grouping the steps into two groups one can also differ between potential absorptive capacity (step 1 and 2) and realized absorptive capacity (step 3 and 4).

The operalization of the concept by Zahra and George (2002), built on the works of Cohen and Levinthal (1990), make it possible to further explain how each dimension in the model contributes to the overall absorptive capacity (and therefore also their components PACAP and RACAP). In addition are the specific dimensions described to have different internal and external factors that affect them and in turn, the overall absorptive capacity.

The **internal** factors include prior knowledge base, individuals' ACAP, level of education and academic degree, diversity of background, presence of gatekeepers, investment in R&D, organizational structure, level of internal communication, level of organizational structure, organizational culture (empowerment of employees), size, organizational inertia and human resource management.

The **external** factors include exposure to external sources of complementary knowledge, activation triggers, regimes of appropriability, industry dynamism and position and relation to others in external knowledge networks.

Lastly, it is of interest to mention that in previous studies and conceptualizations of the concept most focus has been on PACAP. Zahra and George (2002) however argue that more studies are needed on the RACAP component and its importance for a full process ACAP. Like mentioned, a high level of RACAP is very important since it provides firms with ability

to transform and exploit external knowledge, which also make the firms more likely to invent new technological products and services. This will in turn increase their performance and competitiveness (Zahra and George, 2002, p. 185).

Camison and Fores (2010, p. 710), however, argue that focus instead should be on conducting research that can find out the co-variance between the different dimensions and components, more specific than that they are complementary. This lack of defining the complementarity has been a critique to the model by Zahra and George (2002). In addition have Zahra and George (2002) been met with critique for involving too many influences in terms of measuring the level of absorptive capacity. By referring to Van den Bosch (2003), Camison and Fores (2010, p.711) claim that measuring the antecendents and consequences of absorptive capacity should and needs to be very different from attempts to measure the concept itself.

3.0 Method

In this section, I will describe, and reflect around, the method I chose for conducting my research.

3.1 Choice of method

Professor Sigmund Grønmo (2004, p.27) describes method as a planned process to achieve a given goal and that in the case of science, the goal is to build knowledge about a certain phenomenon. It is the role of the method to make sure that the knowledge obtained meets standards concerning scientific quality and relevance within the related research area.

Furthermore, there are two main types of research method, qualitative and quantitative method. A quite common, yet rather simplified, way to differ between the two is that in qualitative methods one "tells a story" while in quantitative method one "counts". At the same time, however, this explanation reveals a lot, both about the information gathered and the way of working that characterizes the methods (Dalland, 2007, p. 83). More precisely, Blaikie (2010, p. 204) explains that in quantitative studies *"data are collected in numbers, or are very soon converted into them, and are subsequently analysed and reported in the same form. In qualitative studies, the original data are produced in one of the two languages, the technical language of the researcher or the everyday language of the respondent. These languages are used to describe behavior, social relationships, social processes, social situations, and, in particular, the meanings people give to their activities, the activities of others, and to objects and social contexts"*. It is important to mention, however, that most research methods have elements of both quantitative and qualitative methods in them. Research methods are therefore often considered to be either quantitative or qualitative *oriented* (Dalland, 2007, p. 83).

What method one chooses, depends on the problem formulation. My problem formulation, *"Does the VRI cooperation project affect the level of absorptive capacity in the participating organizations and if so, in what ways?"* is most efficiently answered by using a qualitative oriented method. In the following section, I will account for this statement.

One of them main objectives for the VRI research project is to find out if the VRI cooperation project enhances the level of innovation in the participating companies. From discussions with the research team, I have understood that this task is vast and requires a well-thought through research design. One of the main difficulties has been to find a research design that isolates

the effect of VRI satisfactory enough. How do you know that the increased level of innovation in the participating VRI companies is the result of VRI and not some other factors? Such a research design has now been successfully designed.

The idea behind my master thesis was that it could contribute to the IRIS research project by investigating if the concept of absorptive capacity could be used in this design. In other words, I wanted to investigate if the absorptive capacity concept could be helpful in measuring the relationship between the VRI cooperation project and the rate of innovation. My findings could then be used by the research team to formulate valid questions in this larger quantitative study that aimed to pinpoint VRI's effect on regional innovation (in other words producing statistics).

Since there was no prior research on the absorptive capacity concept in relation to VRI, it was difficult for me to attempt a quantitative study. In order to conduct a valid and reliable quantitative study, one needs to understand what lies in the concept and the relationship between the concept and what one attempts to measure (in this case the rate of innovation). If one has not acquired this understanding, it is extremely hard to produce a valid data collection in terms of choosing the right variables and level of measurement etc. (Øhrn, 2005, p.11)

Instead, I therefore aimed at attempting to understand the concept and its meaning in relation to my reference frame, the VRI cooperation project. This understanding is more easily answered conveyed by words than numbers and also the main reason why I decided to conduct a qualitative oriented study.

By using semi structured interviews, I was more confident that I would achieve an understanding of the concept itself and in relation to the VRI project. By choosing semi structured interviews, I could ask more open questions and follow up on and deepen the answers I was given (compared to a questionnaire or a structured interview). It would give me an opportunity to concretize what my informants intended to say in addition to allowing me to control to a higher degree that they actually understood my questions. My research design also meets the criteria for when interviews are the most optimal, that is when relatively few units are investigated and the individual's perception, interpretation and understanding of a given phenomenon is of importance (Jacobsen, 2005, p.142-143).

The choice of method is a consideration between the optimal research design and what is actually executable (Dalland, 2007, p. 85). This consideration I meet by deciding to interview companies in two sectors that VRI aims to help, categorized as the energy and maritime

sectors. In order to specifically find out the effect of VRI, I decided to interview similar organizations that had not received any help from VRI. By choosing this approach, I would be able to compare companies in between as well as two different sectors.

3.2 Choice of informants and organizations

Like mentioned, I decided that an executable research design would be to interview companies that had received support from VRI from two of the sectors that VRI aimed to help, categorized as the energy and maritime sector. I would then compare these companies with a reference group, that is companies that had not received help from VRI but who would (according to the categorizations made by VRI), be counted as members of either the energy or maritime sector.

Furthermore, I asked the regional coordinator for VRI, Hilde Uppstad, if there was an overview over what companies that had participated in the VRI cooperation. There was such an overview and I was allowed to take part of it. In the beginning it was, however, quite difficult for me to understand the VRI coordination project and grasp how it worked, what the enablers were and who did what (as the large VRI project is divided into several parts, areas and among several actors). I therefore asked for help in the VRI organization for finding suitable organizations for interviews.

In finding suitable organizations to interview for the energy sector, I asked a competency broker for the energy sector, who also happened to work at IRIS, for help. By explaining to him the purpose of my thesis, he helped me to pin point relevant organizations from the list that I had received from Hilde. For example, he explained which of the organizations were larger with employees. Some of the organizations that VRI assist consist of one or two people, which would be irrelevant for me, since absorptive capacity is a concept to be studied on an organizational level, not an individual level. He also explained to me thoroughly how VRI intends to help the organizations and what a meeting with a competency broker would look like.

In finding suitable organizations to interview for the maritime sector, I received the same help as above, but from a researcher, who worked with the VRI project at Polytech, Haugesund. Both also suggested relevant companies to interview for my reference group. Their help was invaluable since their guiding and explanation, made me understand the VRI project much quicker than I otherwise would have, enabling me to pick the most suitable organizations for my thesis.

The organizations that I chose to interview for my master thesis were all small or medium sized companies. The reason for this was that I was not interested in extremely small companies (with one or two employees) for reasons already mentioned. Larger companies or corporations were not either of interest since I would not find enough large companies in the VRI participants (large companies are not part of the VRI's target group).

The organizations I chose from VRI, had all finished at least one of their collaborations with VRI. That meant that I had a final report to relate to. These final reports were provided to me by Hilde, and were very helpful, since I got an overview over what contact the organization have had with VRI and the result of it. This allowed me to be well prepared for the interviews with the VRI participants and to ask relevant questions about their collaboration with VRI.

Furthermore, the non-VRI organizations that I chose to interview were all characterized by being innovative and groundbreaking within their field. Several of the companies that I interviewed had in the recent years received innovation awards. The reason why I wanted my companies to have these characteristics was that I wanted to find out if they seemed to have a high level of absorptive capacity and if so, if it was coincidental or worked actively with to achieve. It was also of interest to find out if they had used public support systems (other than VRI) and what their view was on such collaboration.

In all of the companies, I interviewed informants who worked with developing the company's technology. Most of my informants were managers or directors of the technology department. Some, however, were also the managing director. I was aware that by interviewing the management within the companies, I could risk getting the "perfect picture" by the informants not wanting to view themselves or their organizations critically. This was, however, a risk that I was willing to take mainly because I felt that interviewing regular employees would not give me the strategic perspective on absorptive capacity that only the management can provide. It is the management who takes the decisions regarding many of the internal and external factors that we know effect absorptive capacity. It is also the management who will have the final word in deciding whether the company should work with external collaborators such as VRI. By letting my informants know that they were anonymous and by designing interview questions that referred to employees ability to influence, I felt that the informants were more willing to give the true picture in addition to allowing me to somewhat understand the absorptive capacity concept from the employees' perspective.

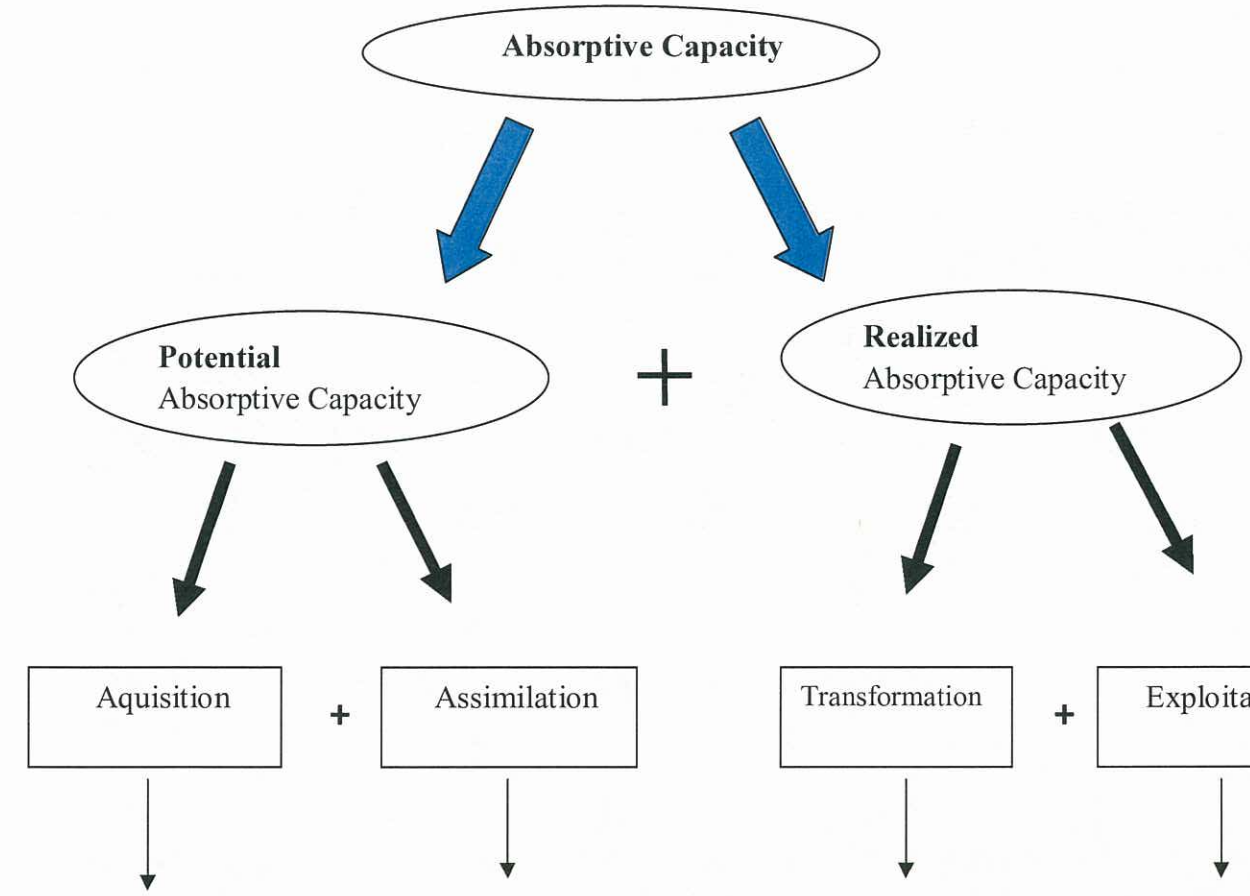
It is also noteworthy that all of my informants were men. This was not an intended choice but ended up being the result. At first I thought it was strange and became rather disappointed in having such a homogenous group of informants. Later I found out, however, that my group of informants reflects the homogeneity that exists in VRI as a whole. In a recent study on VRI, it was stated that VRI-participant companies from the energy and maritime sectors, on average only consist of 20 percent women (Ljungren et al., 2010, p. 126).

In conclusion, I therefore decided to interview two VRI-participant companies in the maritime sector and three VRI-participant companies in the energy sector. I also interviewed one non VRI-participant company in the maritime sector and two non VRI-participant companies in the energy sector. In total, I therefore interviewed eight companies. By choosing this approach, I could compare VRI-participant companies with non-participating companies. I could also compare the absorptive capacity concept across industries.

3.3 Design of interview questions

My interview questions were closely related to the conceptual model of absorptive capacity by Zahra and George (2002). As mentioned, their operalization of the absorptive capacity concept make it possible to further explain how each dimension in the model contributes to the overall absorptive capacity (and therefore also their components PACAP and RACAP). The different dimensions are described to have different internal and external factors that affect them and in turn, the overall absorptive capacity. This opens up for the possibility to create a research method that is able to more specifically trace what factors that might promote or inhibit the level of absorptive capacity.

My idea was that I would design the interview questions in such a way that they controlled the presence of the previously mentioned internal and external factors that affect the level of absorptive capacity. By choosing this approach, I would be able to get an idea of what factors are present and most important in my chosen organizations. On the next page is a model that illustrates my idea and how the factors are indirectly measured.



Indirectly measured by:	**Indirectly measured by:**	**Indirectly measured by:**	**Indirectly measured by:**
Prior knowledge base			
Individuals' ACAP'	Individuals' ACAP	Individuals' ACAP	Individuals' ACAP
Level of education and academic degree	Level of education and academic degree	Level of education and academic degree	
Presence of gatekeepers			
Investment in R&D			
	Diversity of backgrounds	Diversity of backgrounds	
	Organizational Structure	Organizational Structure	Organizational Structure
	Level of internal communication	Level of internal communication	
			Level of organizational bureaucracy
		Organizational culture-empowerment employees	
Size			Size
			Organizational Inertia
HRM	HRM	HRM	HRM

Based on this model, I therefore designed questions that aimed at mapping out the presence and importance of:

Internal Factors: Prior knowledge base, individuals' ACAP, level of education and academic degree, diversity of background, presence of gatekeepers, investment in R&D, organizational structure, level of internal communication, level of organizational structure, organizational culture (empowerment of employees), size, organizational intertia and human resource management.

External Factors: exposure to external sources of complementary knowledge, regimes of appropriability, industry dynamism and position and relation to others in external knowledge networks.

Examples of questions were *"What education and background does your employees have?"*(aimed to establish the factor of education), *"What is your main business area and what do you attempt to further develop?"* (aimed at mapping out the prior knowledge base) and *"Who decides what ideas you will attempt to further develop?"* (aimed at establishing to what degree the employees are empowered) etc.

By asking questions that aimed to find out the presence of the above mentioned factors, I could attempt to also map out in what ways VRI promoted or inhibited the presence of them. For example, I could ask questions such as *"To what extent do you believe that the competency broker helped you identify external, relevant knowledge?"*. In the interviews with the VRI participant companies, I therefore added particular questions on how the collaboration with VRI helped to inhibit or promote factors that they either seemed to lack or that they felt were of importance.

Furthermore, the reason why I chose a qualitative oriented method of research using semi interviewed questions, was that I wanted to get an *understanding* of the absorptive concept in relation to the VRI project. The interviews were very much characterized by that there has been done no prior research on it, meaning that I let the answers given by my informants influence what I chose to further ask about. The only fixed layout in my interviews was that I made sure to ask about the internal and external factors. The answers that I were given, gave me hints about what was most important in terms of my attempt to understand absorptive capacity in relation to the VRI project.

The idea behind formulating the interview questions with the attempt to map out the internal and external factors was that I could analyze my answers in accordance with the model by Zahra and George (2002). Like mentioned, their operalization of the concept, make it possible to quite specifically trace how the factors affect the different dimensions and therefore, the overall absorptive capacity. For example, like shown in the theoretical section, if the technology department has employees with a varied background, this will enhance the absorptive capacity dimensions of assimilation and transformation.

By asking the VRI participants specifically how the collaboration with VRI enhanced the different factors, I could use the same principle to find out how the VRI enablers contribute to increasing the absorptive capacity. For example, if it turned out that the competency brokers helped to identify external knowledge (enhancing the acquisition dimension), it also meant that VRI helped to enhance the organization's potential absorptive capacity.

As mentioned previously, I also wished to find out if the companies are positive in using public support systems such as VRI and their views on cooperating with knowledge institutions. I also wished to find out how the VRI participating companies found out about VRI and why the non participating companies had decided to use either another or none of the public support systems (similar to VRI). I therefore also made sure to ask my informants about this. The aim was to provide a helpful insight to the VRI project on how to reach out to organizations in addition to forming the support program in accordance with the companies' desires.

Lastly, when asking my informants about the presence of the internal and external factors, attempting to map out the influences on the absorptive capacity, I also tried to figure out if the organizations studied were proactive in achieving absorptive capacity or if it was more coincidental. For example, if my informant claimed that the level of communication was good, was this a result of the organization's deliberate efforts or did it just happen to be that way.

3.4 Critical reflections over my chosen method

The concept of absorptive capacity is vast in that it both influences and is influenced by a large number of factors. An evident challenge is to isolate the concept efficiently enough so that we know that the result is mainly due to the concept and not some other factor. This can be difficult since it is so interlinked with other important aspects.

The above has also been one of the major critiques of the model by Zahra and George (2002). By referring to both the antecendents and the consequences of the concept in addition to the concept itself, might just be too many factors and a too complicated picture to attempt to measure (Camison and Fores, 2010, p. 211). Imagine, for example, that I was going to map out the antecendents and consequences for my chosen organizations. In what possible ways could I get a total overview of all relevant external knowledge sources and the experience of the firm, in addition to mapping out the industry's regime of appropriability and what competitive advantage the organizations achieved by their level of absorptive capacity? It clearly would demand a greater study with more resources, competences and experience than I have. This is the main reason for why I have chosen not to consider the antecendents and consequences too much in my research, expect having in mind that they are present. Even though this was a necessity in order for me to be able to conduct my research, it is still an important flaw and I might have missed out one or many vital factors that influence the absorptive capacity process and level.

Furthermore, I am quite pleased with my choice of method since I feel that it most efficiently answers my problem formulation. There are, however, a few things that I would do differently if I were to do it again.

Most of the interviews were conducted by meeting my informants in person. Since, however, many of my informants are prominent, busy and hard- working, it was sometimes difficult to meet up in person. Some of the interviews were therefore done by phone. Even though this was better than the option of not having the opportunity to interview, the quality of the phone interviews was worse than those conducted in person. It was more difficult to follow up on the answers since I could not read the body language to get a feel of what was important (to the same extent that I could if I saw them in person). The phone interviews also turned out to be shorter in length. Next time, I would therefore make a greater attempt at meeting with my informants in person.

An important ethical aspect is that the informants feel their story is presented correctly. It is highly unethical to slant an informants view so that it will better fit a given argumentation or presentation (Jacobsen, 2005, p. 50). In order not to make my informants feel misquoted, I offered that they could later see my transcript and summary of the interviews. The intention was therefore good. At the same time, this opened up for the possibility to alter the result in hindsight if they felt that their organization or themselves were put in a bad light. This did not

turn out to be a problem but next time, I would not give the same offer. Instead it would be enough that I made sure in the interviews that I had understood them correctly.

Lastly, I think I could have been pickier in choosing my organizations. They were chosen using the energy and maritime categorizations by VRI. These were, however, rather wide definitions so I ended up with comparing a porcelain fabric with companies that develop high-technological solutions and devices to the oil industry. Even though this offers an interesting view, it would most probably have been easier to compare organizations from a more narrowed defined category, such as *renewable* energy sector.

4.0 Results

4.1 Organizations that have received VRI Support

4.2 Maritime industry

4.2.1 VRI Maritime I

My informant is the Director of Technology in a privately owned Norwegian shipping company known for its innovative and efficient solutions.

The company has developed its own system of cleaning ballast water from its ships. There is however no known way of measuring the effects of such a system. The company therefore received VRI support in 2010 for a preproject which aim was to find out, together with knowledge institutions, how such a measuring system could be developed. Factors that were to be researched were laws and regulations, necessary technological and scientific foundations as well as expected corrections of the cleaning ballast system that had to be made. The overall expectation was that the preproject would result in a larger project where the actual development of the measuring system would occur. This actually happened and the larger project received further funding from the Research Council of Norway, however not through the VRI project.

My informant says the support from VRI was of great importance and that it was important in several ways.

First, it was VRI who initiated the preproject through one of its competency brokers. My informant says that these play a vital role since they help to establish contacts with the relevant knowledge institution. He says that without them it would be almost impossible to know where to turn to and that they really open up doors for collaboration between companies and academia.

Secondly, he also says that receiving support from VRI helped out in giving the preproject recognition, especially from the organization's management. According to my informant, it can be up to debate what new technologies the company chooses to further develop. Even though the company spent almost 25 million NOK in research and development in 2010, funding a project such as the above is not always relevant. The main reason for this is that finding a method for measuring the effect of cleaning systems for ballast water, is not strictly part of the company's business area. Even though the company in the long run will benefit having such a system, the short term benefits are rather vague. Therefore, even though the

money for funding is available within the company, it would be unlikely for the company to fund such a project as if it is not part of the immediate business or that it will result in increased revenue.

Furthermore, my informant therefore argues that a program such as VRI, besides opening up for collaboration between companies and academia, can help to develop or improve technologies that serve the overall industry and/or public authorities more than the company itself. The measurement system can, for example, be used by the port state authorities to control that regulations on cleaning ballast water are fulfilled. In addition, having received external recognition and funding is a great motivational factors as it indicates that the project is of importance.

4.2.2 VRI Maritime II

My informant is the Managing Director of a company that provides Remotely Operated Vehicle (ROV) services to the global oil and gas industry. The company was established in 2008. My informant also has previous experience as Technical Manager in a larger, similar related service company.

When discussing absorptive capacity my informant is eager to underline the importance of economics. He believes that the major reason why externally gathered knowledge is not exploited is due to costs. He explains that in every organization, there is always a battle about the costs and resources and what ideas one chooses to pursue further. My informant mentions what he calls the "quarterly report syndrome". That reflects the management's unwillingness to further develop an idea simply because the cost of it will have a negative impact on the quarterly financial reporting. Conducting research and development is there seen as a cost with no immediate financial benefit/profit (in the following three months).

Furthermore, he explains that this creates a delicate situation for the management to handle. Even though some ideas are rejected due to costs, it is important that this does not kill the overall willingness in the organization to come up with new ideas. For an organization to have a high level of absorptive capacity, it is important that the employees within the organization are committed and involved in its development. An organization is dependent on always trying to gather and make use of external knowledge that can improve and make services and products more efficient.

My informant mentions several effects that the management can use to keep the employees committed and engaged. For example, he suggests that companies should have an "idea box" where the employees can submit their ideas. He also says that it is important that one makes room in the budget for testing out new ideas, even though they were to fail. All ideas should be evaluated fairly and thoroughly. It is also of importance that there is a culture that allows openness in sharing and discussing new ideas. An organization needs to be characterized with openness towards being innovative.

What ideas one chooses to further develop, is very much steered by the market. The idea needs to improve services and products noteworthy according to demands from the customer. There are often many competing ideas in the organization that employees want to develop, but management will go for the idea that is the least expensive to develop and the most cost saving in the future.

In terms of help from official support systems, my informant says that support from these is often applied for after the organization has chosen to further develop an idea. The financial support is therefore viewed as a useful but not critical and large enough to make the fundamental difference. He is clear on that this only applies to established companies and not start-up businesses. In those cases, the support can be essential. In addition is support from public support systems generally of most importance in periods of recession. It is often during these times that it is the most difficult to find risk capital.

My informant's company received help from VRI in 2008 for a preproject that was to evaluate how its ROV services could be improved. The aim of the preproject was to formalize the cooperation with another partnering company, as well as attempting to identify other, potential cooperation partners. My informant's company was also to identify a certain relevant technology needed for the ROV services.

The conclusion from my informant was that the VRI support was of help but it was not elementary for a successful development of the company. The most important is that the idea or concept that one attempts to develop is market competitive and that the people working with it are familiar with the industry and how it works. My informant is firm in his belief that companies with good ideas will always find both financial funding and collaborative partners, despite help or not from public support systems. He notes, however, that programs such as VRI can help to some extent, like in recession times or for startup companies.

4.3 Energy industry

4.3.1 VRI Energy I

My informant is the CEO of a company created solely with the aim of being a national and international research- and development center for energy efficiency related to housing and office/industrial buildings. The company is an established network consisting of eleven companies who normally are market participants in heating, cooling, engineering services, ventilation and electro. The current network also market services for facades and architecture.

The goal of the company is to develop new products, services and companies. The different owners also wish to co-localize parts of their enterprise in a common building. This building is designed to be in front of energy efficiency and to work as an inspiring example of how energy efficiency could be done.

According to my informant, the very point with the network company is that all suppliers should be able to meet the demands for an energy effective building simultaneously. This would have been impossible for the companies to achieve in singular units. Part of the aim for creating the network company is therefore its ability to solely supply all parts needed to build an energy efficient building. The other aim is to make the network company the main research and development forum for developing even better energy efficient buildings. It is therefore a necessity that the company is characterized by an ability to be proactive and innovative.

The company is very much initiated by my informant and in the interview, he tells me about the company's opportunities and challenges. He also talks about how VRI and its support has affected the company.

In order to fully understand the dynamics in the network company, my informant divides the participants in entrepreneurial and product companies. The entrepreneurial companies make their living by offering and selling services, for example, plumbing. The product companies make their living offering and selling products, for example, facades for buildings. This distinction is very important for explaining differences in opinions and visions related to the interest in developing new technology and cooperating with knowledge institutions.

As the product companies, according to my informant, invest money and time into further developing or creating new products, they are normally very interested in collaborating with knowledge institutions that can help them with this. This is the opposite view of the service companies. The service companies have a harder time to see how such cooperation could be beneficial to them and their services. They were therefore the hardest to convince to cooperate with knowledge institutions and to take part in programs such as VRI.

Furthermore, my informant experienced that it was most difficult to convince the entrepreneurial companies that being innovative and focusing on this, could be a competitive advantage. The service companies were quite short dated in their thinking and usually achieved company growth by buying up other companies. Their growth was therefore vertical and not horizontal in that they do not necessarily come up with new technological and competitive services. They of course meet the market expectances of what should be delivered but make no attempt further to innovative and groundbreaking in what they do.

My informant somewhat felt that he in the beginning had to force the parties to take part in research. He partly explains this by referring to the educational background of the participants. The participants, who are all general managers in their company, come from a rather practical education, like vocational school. Arguing for research in relation to their companies seems to them, rather farfetched.

The above is challenging in several ways. My informant claims that the network company would probably do better if it was not the general managers, but those who normally work with development in the companies (related to the products and services) who participated. My informant claims that it is more likely that these, despite it being a product or entrepreneurial company, would be more interested in cooperating with knowledge institutions. In terms of VRI, my informant thinks that it is of importance that the financial support to preprojects should be paid out to the network company itself, and not to any of the participating companies individually. This would offer the company the best possible support.

VRI contributed greatly in that the program financing projects that would never have happened if the companies were to pay themselves. My informant is clear on that it is important to remember that the companies are economically driven and unlikely to invest time and money into something that they do not see will result in rather immediate profit. The margins in these companies are small and research is looked upon as an expense. All focus

and time is put into daily management. If employees use too much time on other tasks (such as research or attempts to develop) this is negatively noticed by the management.

The challenge, according to my informant, is to make the companies realize the competitive advantage innovation can be and how this could be achieved by cooperating with each other in the network company as well as with knowledge institutions. Research and development should not be seen as an expense, but as an ability to increase profits in the long run. This, however, demands for a consciousness around what strategic advantages research can provide. Research can, for example, help the companies to outline future needs and opportunities that they were not even aware of themselves.

4.3.2 VRI Energy II

My informant is the Technical Manager in a company that offers ventilation- and air treatment products and solutions. It is also one of the companies participating in the network company mentioned in the previous section.

The company received support from VRI in 2008 for a preproject related to testing of the company's water based heat batteries in cooperation with SINTEF. The reason for testing was that at too low temperatures there was a risk that the batteries could freeze. The preproject was part of the continuous development of the company's main product.

The company would have tested the batteries despite VRI (as it was part of the main product's development) but VRI enabled a more valid and extensive testing than what would otherwise have been initiated. The reason for this was that VRI supported cooperation between the company and SINTEF in the testing. According to my informant, this made the testing more valid since the company could refer to a third party (SINTEF) in the test documentation.

In addition, the fact that VRI decided to support the testing of batteries and the cooperation with SINTEF, made the company put more effort into the actual testing procedure. My informant explains that the external recognition in the form of VRI's support made the company feel that the testing and their product was of interest for others and that the testing therefore should be done more thoroughly. He expresses that they somewhat felt more responsible for it since the society (through VRI) had shown interest in what they were doing. VRI's support was therefore an important signal factor.

VRI therefore supported the company mainly in two ways. First, they initiated the cooperation between the company and SINTEF. Secondly, they helped to finance such cooperation. Most importantly, my informant says that VRI eased the whole process of testing by enabling the previous. Furthermore, my informant informs that it was the CEO of the network company who initiated support from VRI and not my informant or the company itself. My informant is therefore mostly familiar with the actual cooperation of the testing and not so much on the procedure of applying for support. He claims that having the CEO of the network company as the administrator and initiator of VRI usage was a great advantage since he was very familiar with the program, how it worked and the process of applying.

In order to gather new knowledge needed to further develop and innovate the company's products and services, my informant says that he tries to attend as many seminars and network events as possible. He says that this is a great way to find out about new trends in the industry. He also says that he will get indicators from the sales department and the competitors (market) on what is going on in terms of new technology. There is however no documented system or plan for how my informant and his technical team should attempt to keep up with identifying valuable external knowledge. This is somewhat a weakness, he admits, and could become a lot better.

The employees in his technical group come from a varied background and most of them have worked at the company for quite a long time. Some of them are engineers while others have advanced from starting in the production. Even though he believes that they are relatively creative and good at seeing possibilities with new solutions, it would be desirable to get a newly graduated, younger engineer to join the group. It is a while since the other members of the group went to school and sometimes they tend to think too much alike and are static in their thoughts. The new engineer would hopefully come with new input to the group in terms of different and fresh thoughts and knowledge.

My informant says that his company is so small that it neither has the ability nor competencies to be in the forefront of new technology. Instead the company focuses on keeping up with the market by conducting smaller improvements on products already in the product portfolio. The gathering and application of external knowledge is therefore closely knit to product development. As a result of this, the company rarely initiates any larger projects that could acquire the assistance from knowledge institutions. Instead the company collaborates with industry partners. My informant says that it is not so hard to find collaborating partners in the industry since it is not very large and people who work in it tend

to know about each other. My informant was, for example, aware that there was no relevant company in the industry that could be used in testing the batteries. This is another good reason for why they chose VRI.

In conclusion, however, my informant is very satisfied with the collaboration with SINTEF through VRI. It is definitely an approach that could be used again.

4.3.3 VRI Energy III

My informant is the Production Manager at a local porcelain company. The company received support from VRI in attempting to map out possibilities to recycle energy released from their ovens used in the production. The outcome of the project was that there were no such executable recycling opportunities because conducting the solutions would be too costly.

My informant has worked as the Production Manager since 1997. He says that the VRI project was their first contact with a public support system since he started. He got to know about VRI in an informal conversation with an ex-colleague. They were discussing the current opportunities and challenges in the company, when the ex-colleague suggested the company should contact VRI for assistance. It was therefore the company itself that initiated contact with VRI.

The reason why they decided to contact VRI, according to my informant, was that it was a great opportunity to receive expertise help in addition to financial support for the project. It was also great to get an external opinion and someone who questioned what the company considered to be right. Without the assistance of VRI, the company would most likely not have done the project or not done it so thoroughly. These projects are often too costly and there is no room for them in the budget.

The company has not been so active in applying for assistance from public support systems since they feel that it is almost impossible to receive relevant knowledge and input from actors in Norway. The porcelain industry is special in that it is quite a small and old industry. Not many knowledge institutions work with problems related to the industry and there is no comparative industry. Instead the company cooperates and buys services from a research institute in England, specialized in porcelain related matters. They also cooperate with suppliers, a cooperation mostly initiated by the company itself. In addition, does the company cooperate with retired ex-colleagues who can offer them a valid inputs and perspectives. All

contacts with collaborators are therefore mostly initiated by the company itself and through networks and acquaintances.

Another reason why there has been so little cooperation is that the public support systems often have as a criterion that assistance only will be given if it is used to create new technological solutions. My informant says that this is not easily fulfilled by his organization. They have used the same technology in production since the 1950's and it is not easily changed completely. Instead he wishes that the public support systems would assist in developing already existing technology, by for example improving (not changing) the technology used in production, or assisting in finding better ways to use the company's resources.

The company tries to keep up with the latest trends in the market by travelling to various industry gatherings. My informant says that they try to keep up but that they do not have any established routines for how to proceed. In the production, the company has, however, initiated to conduct Total Product Maintenance (TPM), a service that they bought from an external partner. TPM is a maintenance process that is to improve productivity by making processes more reliable and less wasteful. (Cua, McKone & Schroeder, 2001, p.40). Furthermore, my informant explains that there is still a great amount of work left but the aim of introducing TPM is to somewhat meet the demands of renewal and as a way to keep up.

The company has only a few specific demands for how they want the production employee to be like and that is that they like to work, are comfortable with hard work, in good health and enterprising. There is to some extent communication between the management and the production employees concerning technical problem and challenges but I do not get the impression that it is very widespread.

4.4 Organizations that have not received VRI support

4.5 Maritime industry

4.5.1 Non- VRI Maritime I

My informant is the CEO and founder of a prominent company that provides and produces ROVs and subsea intervention technology. The company operation is double-barreled into production and engineering. The company consists of 13 employees whereas half of them are engineers, four in the production and two in the administration. In our interview, I chose to

focus mostly on the engineering department and their absorptive capacity. The reason for this is that they are the group most pressured in the company to stay innovative and constantly deliver original solutions to the customers.

In choosing his employees, my informant says that one of the most important factors is that the candidate has an immense interest in what they are doing. Formal education and extensive experience is of course mostly relevant, but if the interest is not there, it is hard to create an innovative environment in the company. As a result of this criterion, my informant says that his employees are characterized by being proactive and driven by interest. It is them mostly, for example who initiate coursing.

The employees are also from a varied experience- and educational background. This offers a wide scope of perspectives when attempting to come up with new or improved solutions. What ideas that should be further developed, is often discussed informally and immediately after they are presented within the groups. Even though it is my informant who has the last say in the final decision, the decision is often made in conformity with the engineering group. My informant points out that hierarchy is not very much present and that the employees in the company have no problem talking to each other, discussing ideas and solutions. The process is therefore quite fast and does not involve any paperwork. This is natural, according to my informant, since the company is rather small.

Furthermore, my informant says that new ideas often originate from the company's already existing roles. That means that the external knowledge gathered is often naturally steered by what knowledge one needs to improve or come up with new solutions and products. The company therefore mostly backs up on what it already knows and what could be done to improve the product- and service portfolio. On the basis of this, the company uses all channels to find and gather the necessary knowledge. This knowledge could come from collaborating partners (other companies) or known sources from the company's/employees' networks. They also use the internet to track down relevant knowledge sources, for example companies that hold the demanded knowledge.

The company received support from external support systems (Innovation Norge) at the start-up of the company. This was helpful but as the company became more robust and self-driven, the company has actively chosen not to engage in such cooperation again. It is simply not of interest. The reason for this is that my informant claims the company inhibits the necessary

knowledge to develop and conduct projects in the company themselves. In addition, if the project requires new knowledge they are able to find it and initiate themselves a relevant collaboration. In addition, they are not so willing to share the rights and profits of what a project could result it (a new solution/product/improvement). He is also somewhat hesitant to share information.

When I ask my informant if he could consider to work and collaborate with a knowledge institution, such as VRI attempts to promote, he is very hesitant. He says that his experience with knowledge institutions is that they are hard and troublesome to communicate with, monolingual and their matter is hard to grasp. They are often too theoretical and it is hard to understand how their knowledge could be used in practical circumstances. He therefore prefers to collaborate with industrial partners where the knowledge and experience is more hand-on oriented. Furthermore, by initiating the project themselves with industrial partners, my informant claims that the paperwork is less and the ability to earn a profit is higher.

With the above stated, my informant makes some very important distinctions in the interview. He says, for example, that even though he would not actively engage in collaborating with knowledge institutions, he sees their importance. He claims that they are more important when attempting to develop visionary, groundbreaking new technology than smaller improvements on already existing technology. Since it is not the primary objective of his company to come up with completely new technological concepts, working with knowledge institutions is not of interest for his company. The desired improvements that could be done of the ROVs and related solutions are, according to my informant, better, cheaper and quicker solved by collaborating with industrial partners.

In addition, my informant is keen to underline that he has nothing against public support systems and that they can be useful, especially at the startup of companies. Public support systems can, in similarity with knowledge institutions, be helpful when it comes to groundbreaking new technology. The reason why is that it can provide financial funding that otherwise can be hard to find under such circumstances. Since, however, my informants company is at its current position (not in the startup phase and not aiming to develop groundbreaking technology), they are not so interested cooperating with public support systems. This does not mean that if the circumstances changed, that he would not consider seeking support from the public systems.

4.6 Energy industry

4.6.1 Non-VRI Energy I

My informant has a long, extensive career from Research and Technology Management in various industries. Currently, he is the Chief Technological Officer in a firm that attempts to further develop and commercialize a concept that will change and improve methods of exploration.

The concept has resulted in a device that is still to be perfected and thereafter, released on the market. The expectations are that this is to be done within a few years. My informant underlines that the product they choose to commercialize needs to be robust with satisfactory technological solutions suitable for its desired use.

Before the market release, there are technological challenges related to the device that need to be solved. For example, there have been problems with developing a petro bit that will not risk becoming worn-out. It is important to note that the organization attempts to develop a concept (a new method of exploration) that is wide in its scope and associated with not only improved technological solution but also with groundbreaking new solutions. It is a revolutionary concept that is technologically demanding to realize.

The development of the device has been organized into several development projects. My informant explains that when a problem with the device is identified, a project is started with the intention to come up with either new or improved technology to solve the problem. As the company is relatively small, there are not enough resources or competency to solve the problem internally in the organization. The organization is therefore dependant on finding a collaborating partner. These partners can either be other companies or knowledge institutions such as research institutes.

According to my informant there are mainly two criteria applicable when choosing the collaborating partner. First, the collaborating partner needs to have a genuine interest in attempting to solve the technological problem and a strong desire to work with it. Secondly, it is of importance that the collaborating partner stands with a contact person. My informant's experience is that collaboration can be difficult, especially with larger companies, if one lacks a primary contact person that can have a positive influence on both the willingness to work with the problem and the ability to contact the right people in his or hers organization.

The philosophy of the organization is therefore to collaborate with external partners to solve the technical problems related to the exploration device. These collaborations are project oriented and solving the technological problem is the main target for each project. Most often, the collaboration is sponsored and paid by my informant's organization. Besides internal funding, the organization has received funding from external sources such as the Research Council of Norway and some of the larger oil companies in the region. This funding is often of a considerate size and much larger than the VRI program would give.

As the organization relies on its cooperation with others and the identifying and gathering of external technological knowledge to perfect its prototype, the construct of absorptive capacity is highly relevant. The organization needs to have the dynamic capability of absorptive capacity to reach the goal of market entrance and a new competitive method for exploration. My informant is very clear on that the prototype will not be perfected based solely on internal competencies and resources, but that it is highly dependent on external input in terms of collaboration partners and their knowledge.

Furthermore, my informant offers great reflections both from the organization he currently works in as well as from his vast experience working with Research and Development in several companies. Even though he was not familiar with the construct absorptive capacity itself, he was very aware of its general concept and notion of meaning.

He describes the current organization as full of well educated, highly competent employees with a genuine interest in succeeding to develop the concept. He mentions that the employees seem to have a high sense of ownership to the idea they try to develop which in turn has both positive and negative effects. It is positive in the sense that there is willingness and eagerness to go for what one believes is the best technological solution and collaborating partner to work with. The existence of strong will, however, is also a source of conflict for what path one should decide to follow. There can be skepticism toward collaborating with certain partners and to proceed with certain technological ideas. In that sense, there is a noteworthy presence of gatekeepers in the organizations that try to affect what external knowledge should be taken into the organization.

According to my informant, he experiences the above situation as more evident in his current company than when he worked in a larger company. He partly explains this difference by relating to size. He also explains it by referring to the difference between product development and coming up with groundbreaking new technology. He says that when he

worked in the larger company there was a product portfolio that the management, as part of the strategic plans for the company, decided over in terms of what should be further developed or not. These decisions were very much customer orientated in that the company developed what they expected the customers would demand. Attempts to gather external knowledge was therefore somewhat management and product steered and not so much affected by individual gatekeepers. Due to the size of the company with more than 100 people working with research and development, there was also never the evident need or desire to work with external partners or to be dependent on identifying and gaining external knowledge.

Working with developing a concept that demands new technology and external collaborators is therefore more likely to be the source of conflict and gate keeping than in larger companies where the development is steered mainly by top management in accordance with the desired product portfolio.

Furthermore, my informant mentions that there is always a challenge related to the "not invented here syndrome". This syndrome refers to companies that reject research or knowledge in favour of internally-developed solutions. In others words, that the organizations think that in general the organization itself is always better at coming up with new technological solutions internally instead of taking use of external knowledge. The knowledge and research is simply rejected because it is not internal.

It is to a great part up to management in the organization to steer the above by giving some direction on what paths of development one should follow. This is mentioned especially to be important in companies such as my informants, as it consists of many strong willed employees who find their path the best way to go. It is also of importance that the company management works actively with and encourages interaction with external knowledge resources.

4.6.2 Non-VRI Energy II

My informant is a high-profiled inventor, who has been involved in several successful start-ups in the energy sector. My interview with him mainly focuses on his vast experience with developing ideas into self-fluxing companies, whereas the main focus was on the start-up of one of his most famous companies. This company is viewed to be groundbreaking and its technology is regarded to be among the most promising up-and-coming technologies in the world today.

As my informant has been involved in several start-ups companies, he has a good understanding of the challenges and opportunities that meets an entrepreneur. He also has a good understanding of how one can use supporting external sources such as VRI, Innovation Norge, oil companies etc. and how one should build a strong, sufficient organization.

Furthermore, he describes his success by a number of different factors. First of all he claims that he is able to read out in time the signals that the larger oil companies send out. These can for example be that it is signaled that they will focus on decreasing the cost of exploration, attempts to make the oil production more mechanical and less managed by humans, exploit in the North etc. These signals are, however, mostly visionary and rarely resolved into something concrete that is to be done, for example in a new device that will enable exploration in the North. The oil companies are normally not the producers of such devices. The companies that produce these devices are either not susceptible enough to these signals or they do not prioritize and/or have the competencies to develop a device from scratch. This is where my informant comes in.

My informant works as a connecting link between the visionary oil companies and the industrial workshops that make the necessary devices. He does this by making the visions more concrete through designed, put on paper solutions. These designed draughts of, for example, a new device, is handed over to the workshops to produce.

In concretizing a vision into a realized solution, it is essential that he finds suitable collaborators. He often does the groundwork with the design draughts and seeking patents himself, but when this solution has been approved and recognized by relevant parties, more collaboration and help is needed. For example, he needs to find financial funding as well as competencies that can help him further develop his idea. It is also in this part of the process that he will further develop a self-fluxing company that can work with the solution.

My informant has an extensive experience in start-ups and that gives him an advantage in that he knows where to turn to for financial support. He has through his different projects received support from Innovation Norge, Forskningsrådet and oil companies. His view is that public support systems such as Innovation Norge, VRI etc. can be critical for the actual start-up of the company or a further developing of an idea. The support can then be the triggering factor. That is, however, in grand its essential use. After the entrepreneurs have come over the first bump, larger more sufficient funding is needed. This is usually given by the larger oil companies and/or investors.

My informant is also keen on underlining that it is important to have an understanding of the entire value chain attached to the solution that one attempts to develop. This means that one understands who the stakeholders are and how they typically work and respond to new ideas. An example that he gives is the oil companies. If you come to the oil companies with an idea that is not so much developed more than on the napkin stage, telling them that you need funding to develop it, you are very likely to get a negative response. If you, however, come there letting them know that you have an idea that you will develop for free until it seems to be more understandable, you are more likely to receive funding at a later, more developed stage. That is also the reason why public support systems are of importance in the start. They can finance the "free" work at the start.

There is, however, also a level of criticism directed towards these public support systems. One major problem is that there is a large administrative burden to apply. If you have never attempted to develop an idea, it is difficult to know what public support system to turn to as well as applying for support from it. Many do not know how to write a good application that is likely to be accepted. As a result of this, my informant has decided to start a company that solely can help funding those who need help and support to develop an idea. That includes seeking patents, applying for financial support etc. In my interview, I try to understand why my informant's company will provide better help than public support systems. The main conclusion is that his company will be less complicated and bureaucratic.

Another notion that my informant says is that for a satisfying and quick enough moving developing process, it is important that the people one cooperate with externally have the authority to make decisions. It can be very frustrating to talk to a person at a network event who says that this is interesting but I need to talk to my superior/take this further. This often leads to a slow process. It is therefore important to come in contact with those in the external collaborator organization who are close to the decision and have authority enough to take one. My informant mentions that banks tend to organize meetings between entrepreneurs and investors. These have often resulted in a positive and quick resolution.

The main problem with further developing an idea is to get hold of the highest competencies. These can either be in the form of external collaborators or employees in the new company. Getting a hold of these is often the result of networking and/or extensive search efforts. It is not as simple as putting an advertiser in the newspaper. Once again, my informant is keen to point out that one needs to have a good knowledge to the value chain and be aware of what the industry looks like.

5.0 Discussion

In the consequent sections, I will discuss my findings. In order to achieve a comprehensive overview, I have decided to discuss my results by grouping them into main findings. By main findings I mean what internal and external factors have proven to be the most important and furthermore, how the VRI collaboration has either enhanced or inhibited their presence. It will also involve a discussion on the organizations' view on academic research and collaboration with knowledge institutions.

5.1 Prior knowledge base- The importance of industry knowledge

In identifying and acquiring external knowledge, the first dimension of the absorptive capacity concept, most informants seem to underline the importance of knowing the industry that the company operates in. They claim that if you know your industry well, you will also know who does what, what is new in the field and read the signals of what the future demands are likely to be. My informants claim it to be one of the most important factors for success.

The assertion that knowing your industry well is a prerequisite for knowing what external knowledge is relevant is directly linked to the factor of prior knowledge base.

One informant, for example, describes his success as an inventor by referring to just extraordinary industry knowledge. He says that "*I am able to read out in time the signals that the larger oil companies send out. Examples of these can be that they state the coming focus will be to decrease the cost of exploration or attempt to make the oil production more mechanical and less managed by humans. These signals are often visionary and rarely resolved into something concrete. The companies that produce the necessary devices are either not susceptible to these signals or they do not prioritize and/or have the competencies to solve them. This is where I come in. My companies are able to come up with the idea and the draught of the device that the production companies can produce and that will concretize the visions of the oil companies*".

Under the precondition that the industry knowledge results in not only acquiring but also assimilating (step 2 in the ACAP model) the external knowledge, it will also contribute to achieving a high potential absorptive capacity. A high level of potential absorptive capacity will increase the organizations' ability to time new trends in the market as well as being cost effective in realizing the knowledge needed to meet the trends (since they only need to transform and exploit the knowledge). These attributes, timing and cost, that potential

absorptive capacity result in, are main factors in explaining performance differences between companies in the same industry (Zahra and George, 2002, p. 195-196). It is also the theoretical support for why my informants are right when claiming that industry knowledge can enhance the ability to read and time the market and therefore be an important factor for success.

The theory on absorptive capacity has shown that a prerequisite for acquiring new knowledge is that you already posses relevant knowledge (Cohen and Levinthal. 1990, p. 128). Since industry knowledge can be considered to be part of the prior knowledge base, the assumption made by my informants therefore seems to conform the theoretical understanding.

When considered as part of the prior knowledge base, industry knowledge therefore seems to be an important factor for my chosen organizations' ability to acquire knowledge. The companies view the support for VRI as helpful under the precondition that the VRI organization and its enablers radiate good industry knowledge. This is especially important for the enabler competency brokers. The organizations will not consider support from the competency brokers if they do not have equal or, more preferably, better industry understanding than the company itself. If the competency brokers, however, have this extraordinary industry knowledge, they help promote the organization's level of absorptive capacity in that they are able to acquire external, relevant knowledge. The competency brokers can then be understood to increase the organization's prior knowledge base.

5.2 Research and development (R&D) collaboration

Another important factor that can increase the prior knowledge base, is research and development (R&D) efforts. Since acquiring new knowledge is dependent on having already existing knowledge, attempts to increase the existing knowledge (prior knowledge base) by R&D will thus also increase the ability to acquire new knowledge. In other words, the knowledge produced by research and development will increase the knowledge base. The larger prior knowledge base the organization has, the more relevant external knowledge it will be able to acquire (Cohen and Levinthal, 1990, p. 129). The success of a firm therefore largely depends on its ability to develop its knowledge assets (Knudsen, 2006, p. 3).

Since my chosen organizations are relatively small, they do not all have traditional research and development departments. Instead they seem to conduct their research and development by dividing it up into smaller projects that are related to a problem they have with a solution or a product. A project is established with the aim of solving the challenges. Just like

traditional R&D activity, the project results in increased knowledge and therefore also an increased prior knowledge base. In addition will the aim of solving the challenges steer what knowledge the organization attempts to acquire. It is usually in this context that the organization will attempt to acquire new knowledge and collaborate with external partners in doing so, such as industrial partners, knowledge institutions and public support systems such as VRI.

An informant, working in a company that attempts to develop a new device for exploration, explains that *"when a problem with the device is identified, a project is started with the intention to come up with either new or improved technology to solve the problem. As the company is relatively small, there are not enough resources or competency to solve the problem internally in the organization. The organization is therefore dependent on finding a collaborating partner. These partners can either be other companies or knowledge institutions"*.

Many of these R&D projects are not strictly labeled as R&D activity but considered as part of the daily work and business practice. Many employees therefore participate in R&D activity through their daily work tasks. According to a recent study conducted by Blomgren and Sasson (2011, p. 69), this approach to R&D activity can explain why Norwegian oil and gas industry have one of the highest rates of labor productivity among the OECD countries even though scoring poorly on indicators of innovation and R&D.

Furthermore, this approach to R&D activity can also be partly explained by referring to the size of the organizations. Like several of my informants mention, they do not have enough competencies internally in the organization to develop the desired technology. In addition are they rather specialized within their market, offering specific, high-technological solutions rather than generic ones. Just like several studies done on technological collaboration show, these smaller, specialized and technologically less diversified firms often have a higher intensity of collaboration (Rocha, 1997, p. 21). Technological collaboration with external partners serves as an important alternative strategy for these firms to overcome scale disadvantages that may come as a result of, for example, economics (Rocha, 1997, p. 22).

In addition can R&D collaboration with external partners be the decisive factor for research breakthroughs. This is because the collective skills, both scientific and intellectual, in collaborations often exceed that of a single firm (Knudsen, 2006, p. 4). An informant, who used to work in a larger firm with R&D management, explained that *"when I worked in the*

larger company there was a product portfolio that the management, as part of the strategic plans for the company, decided over in terms of what should be further developed. Due to the size of the company with more than 100 people working with R&D, there was also never the evident need or desire to work with external partners or to be dependent on identifying and gathering external knowledge".

The choosing of the external collaborating partner is often determined by the industry knowledge. The organization chooses collaborating partner by deciding which industry related candidate will be the best and most appropriate. An informant says that "*the company usually backs up on what it already knows and what could be done to improve. On the basis of this, the company uses all channels to find and gather the necessary knowledge*". Such situations illustrate the importance of industry familiarity: "*this knowledge could come from collaborating partners (other companies, usually suppliers) or known sources from the company's and/or employees' network".* Another informant explains that *"all collaborations are mostly initiated by the company itself and through networks and acquaintances".*

In addition are there specific criteria that several of my informants mention to be of importance when determining what partner to collaborate with. An informant summarizes it well, *"first, the collaborating partner needs to have a genuine interest in attempting to solve the technical problem and a strong desire to work with it. Secondly, it is of importance that the collaborating partner stands with a contact person. Collaboration can be difficult, especially, with larger companies, if one lacks a primary contact person that can have a positive willingness to work with the problem and the ability to contact the right people in his or hers organization".* Another quite obvious criterion is that the external partner has the desired competency.

The desire to have an energetic and crafty collaborative partner seems to stem from bad experience with unproductive collaboration. An informant explains that *"for a satisfying and quick enough moving developing process, it is important that the people one cooperates with externally have the authority to make decisions. It can be very frustrating to talk to a person at a network event who says that this is interesting but I need to talk to my superior/take this further. This often leads to a slow process".*

The development projects therefore represent the organizations' R&D efforts in addition to steering what knowledge the organization attempts to identify and acquire. Furthermore, it is mostly in this situation that the organization will initiate or accept collaboration with external

partners. The organizations' willingness to collaborate with others can be explained by referring to their size. They are often dependent on R&D collaboration with others to acquire the desired, relevant external knowledge.

The external partners are determined by the organizations choosing which industry related candidate will be the best and most appropriate to collaborate with. It is desired that the collaborating partner has a genuine interest in the R&D project, the desired competency and that it is crafty and have the authority to make decisions.

The organizing of the R&D activity is important for the VRI cooperation project to understand as it is in this context that the organizations are most likely to apply for assistance. In addition should the criteria for a desirable collaboration partner be understood as demands to be meet by the VRI cooperation project.

5.3 External R&D collaboration partner- industrial partners vs. knowledge institutions

The organizations can choose to cooperate with industry partners, such as suppliers or customers. The advantage of cooperating with other companies in the industry is according to one informant that *"the knowledge and experience is more hand-on oriented. By initiating a project themselves with industrial partners, the paperwork is less and the ability to earn a profit is higher. Desired improvements are better, cheaper and quicker solved by collaborating with industrial partners"*. Another states that *"it is not so hard to find collaborating partners in the industry since people who work in it tend to know about each other"*. All of my informants seemed positive to the idea of collaborating with industrial partners.

The organizations can also choose to cooperate with knowledge institutions (which is what VRI attempts to promote). The attitude to cooperating with knowledge institutions was, however, quite divided. Some informants were quite negative stating that *"my experience with knowledge institutions is that they are very hard and troublesome to communicate with, monolingual and their matter is hard to grasp. They are often too theoretical and it is hard to understand how their knowledge could be used in practical circumstances"*.

A very interesting notion was that the informants who were positive to working with knowledge institutions were very familiar with the research community. Many of them had worked at a knowledge institution themselves and had good connections and knowledge about

the different institutions. These informants were often the company's originator in cooperating with knowledge institutions and they were also the most positive towards using public support system such as VRI in doing so.

I sensed that this disagreement in the opinion of working with knowledge institutions was a result of different conceptions on how one should operate the company. The informants who were very critical towards using knowledge institutions for research and development (R&D) seemed to be much more industrially oriented. By industrially oriented I mean that they were more narrow in the view of what actors to involve and in collaborating with external partners that were not customers or suppliers. They seemed to have an idea that the best research and development activity is conducted by primarily cooperating with partners who are closest to the product or solution, such as suppliers or customers. They were also either unaware of suitable public support systems or they thought that the application process was too complicated.

The main problem therefore seems to be that organizations need to see the immediate benefit of collaborating with an external partner. An informant explains that "*companies are economically driven and unlikely to invest time and money into something that they do not see will result in rather immediate profit*".

Furthermore, it seems as if though some of my informants are more likely to see this advantage collaborating with industry partners rather than knowledge institutions. A reason for this could be that, compared to industrial partners, it is harder to value the information provided by knowledge institutions. It is easier for the company to see what it will actually get when cooperating with an industrial partner rather than a knowledge institution (Vinding, 2000, p. 12).

In some of the cases it was not the problem of seeing the benefit of collaborating with a given partner, but seeing the benefit of collaborating with others at all. This was grounded in a perception that extensive R&D activity was unnecessary. An informant, who is the CEO of a network company aimed to be a national and international R&D center for energy efficiency related to buildings, explained that "*it is difficult to convince the entrepreneurial companies that being innovative and focusing on this, could be a competitive advantage. They are too short dated in their thinking and company growth is usually achieved by buying up other companies. Their growth is vertical, not horizontal in that they do not necessarily come up with new technological and competitive services*".

The entrepreneurial companies, defined as offering services (such as plumbing) rather than producing products (such as facades for building), might be somewhat correct in their claim that for them and their daily operations, R&D activity falls flat. In previous studied, one has attempted to measure absorptive capacity solely by measuring R&D efforts and outcomes. This has been somewhat misleading, however, since the level of absorptive capacity is only partially illustrated by R&D efforts and outcomes (Camison and Fores, 2010, p. 709). Buying up other companies, which is the attempt to growth by the entrepreneurial companies, is a possible alternative or complement to R&D activity. The buy up of other companies, will actually increase the exposure to external knowledge sources (in the form of the bought companies' knowledge). This buy up will therefore increase the company's prior knowledge base, making it easier to acquire external knowledge. It is therefore arguable that R&D activity is not a necessity as the acquisition of knowledge can be improved differently.

The entrepreneurial companies' resistance to R&D activity can, however, not as easily be defended when it comes to their participating in the network company. The very aim of the network company is to come up with groundbreaking and innovative solutions for energy efficiency in buildings. It is hard to argue that such solutions will be invented without the use of R&D activity and collaboration (since buy ups are not an option or will be considered as imitating already existing solutions). Therefore, even though R&D activity and collaboration at times might be correctly argued to be unnecessary, such as above, it should still be seen as a prerequisite if the company aims to be in the technological forefront (Dutta, Narasimhan & Rajiv, 2006, p. 510).

It should, however, be discussed to what extent the informants who claim that it is better to collaborate with industrial partners, rather than knowledge institutions, are correct. Several studies have shown that contributions from the vertical chain of production (suppliers, buyers, the firm itself) are more important and provide more valuable input than public research. However, for the sources outside the production chain (competitors, consultants, joint ventures), public research is claimed to have an important contributing value (Fontana, 2006, p. 310).

To not underestimate its existence, the VRI cooperation project needs to have a solid view that collaboration with knowledge institutions can be a great benefit for the companies' R&D activity and that the knowledge institutions (compared to industrial partners) can provide equal, or more, valuable input and knowledge.

5.4 The role of VRI in research and development (R&D) collaboration

The VRI cooperation project seems to most easily come in contact and attract companies where key employees are well familiar with academic research and the research community. This familiarity enables seeing the benefits of cooperating with knowledge institutions and how such cooperation could be beneficial to the operation of the company. Since the company often has contacts in the research community, it is the company itself that becomes aware of VRI and that initiates contact.

Furthermore, it is quite the opposite picture in the companies where collaboration with knowledge institutions is not considered as the most beneficial. The companies in this category have none or few interactions with the research community and have a hard time seeing the reason for cooperating with knowledge institutions rather than industrial partners. In these cases, the contact is often initiated by the VRI cooperation project. In this category are also companies who consider R&D activity as unnecessary (for them) and who prefer knowledge acquisition through other approaches, such as the buy up of other companies.

In all of the cases it is the industry knowledge that steers what the company finds to be a suitable collaborating partner. Another way to conduct this distinction is that companies who are positive to collaborating with knowledge institution (for example through a project like VRI) would consider the knowledge institutions as having valuable and coveted industry insight. This in comparison with companies who would much rather collaborate with industrial partners. In these cases, the industrial partners are viewed to have better industry knowledge in terms of what is beneficial and optimal for the company itself.

This disagreement on the optimal collaborating partner was the main difference that I found when comparing both VRI participants with none VRI participants and the maritime companies with the energy companies. There seemed to be no large differences in the factors that affect the level of absorptive capacity except that of to what degree knowledge institutions should be considered as R&D collaborating partners. Since the VRI cooperation project encourages collaboration with knowledge institutions, the view on VRI was often a consequence of the view on knowledge institutions. If they informants were critical to collaborating with knowledge institutions, it was most likely also critical to VRI.

It is important to note that the ulterior cause to this distinction is that companies, with no exception, will collaborate with external partners that are viewed as the most optimal. It is therefore the perception and categorization of an optimal collaborating partner that results in

the above cleft. For some of the companies, knowledge institutions are viewed as an optimal collaborating partner whereas other companies have a hard time seeing their contributing value.

In order for the VRI cooperation project to reach out to the more critical companies, it therefore needs to attempt changing their perception of knowledge institutions as a collaborating partner. The VRI cooperation project needs to adapt a more business oriented approach, explaining to the companies the black on white value and benefit that the collaboration with knowledge institutions can result in. It is also important the project radiates an attitude that academic research and collaboration between companies and knowledge institutions can be valuable and result in competitive advantage.

The changing of perception could be done by referring to the collaborations that VRI has had with companies and the result of them. The companies that had used VRI in assisting them with their R&D projects were mostly satisfied and pleased. An informant, whose company received VRI support for testing a product, says that *"VRI enabled a more valid and extensive testing that would otherwise have been initiated. The reason for this was that VRI supported cooperation between the company and SINTEF in the testing. This made it much more valid since we could refer to a third party (SINTEF) in the documentation"*. Another valued the help from VRI in that *"it was great to get an external opinion and someone who questioned what the company considered to be right"*.

In addition should the VRI cooperation project stress and make sure that the application process is not too complicated or demanding. This can be a reason for why organizations will choose not to use VRI in their R&D activity. There seems to be a sentiment that applying for public support systems is hazardously. An informant explains that *"one major problem with public support systems is that there is a large administrative burden to apply. If you have never attempted to develop an idea, it is difficult to know what public support system to turn to as well as applying for support from it. Many do not know how to write a good application that is likely to be accepted"*. Another says that "*having our CEO as the administrator and initiator of the VRI usage was of great advantage since he was very familiar with the program, how it worked and the process of applying"*.

I find it rather hard to relate to these statements, however, since it is claimed from the VRI organization that the application process is not too complicated. I also got the impression that some of my informants had preconceived opinions on the application process (many of them

had not taken part in it or assumed that it would be similar to the application process for other public support systems). At the same time, this was only an impression that I got and it was not evident for all informants. The main point to derive is therefore that the VRI project should continue to attempt to ease the application process and if there is still a perception that it is complicated, the problem should be addressed. A high level of bureaucracy in the application process seems to be a major reason for why the organizations would rather collaborate with industrial partners than knowledge institutions.

If the VRI cooperation project manages to address the weaknesses of certain organizations' negative perception on both the knowledge institutions' contributing value in the R&D activity and the (actual) bureaucracy of the application process, it seems that the project can enhance the organizations' prior knowledge base and ability to acquire external technological knowledge. This is because the R&D collaboration with knowledge institutions, supported by VRI, will help to increase the prior knowledge base and therefore the ability to recognize relevant external technological knowledge.

5.5 Presence of gatekeepers and VRI as an external determinant

Gatekeepers are important influencing factors for the level of absorptive capacity. They work as monitors for what external knowledge is important for the organization. Gatekeepers have the ability to identify external knowledge relevant for the organization in addition to explaining why and presenting it internally to the organization. The gatekeepers, who are often experts, therefore have an important positive effect on the acquisition dimension of absorptive capacity (Cohen and Levinthal, 1990, p. 132).

The organizations are therefore positively affected by having such gatekeepers. It seems as if though the VRI cooperation project and the enabler competency brokers can assist in this. The competency brokers seem to work as external gatekeepers or experts who help the organization in identifying external, relevant knowledge. The competency brokers help to identify what knowledge institution the organization will benefit collaborating with, both in terms of acquiring desired competencies and developing new knowledge (enhancing the prior knowledge base) through R&D collaboration. An informant says that *"the competency brokers play a vital role since they help to establish contacts with the relevant knowledge institutions. Without them it would be almost impossible to know where to turn to and they really open up doors for collaboration between companies and academia"*.

I also get the impression that this seems what the organizations perhaps need the most assistance in. An informant explains that "*our prototype will not be perfected based solely on internal competencies and resources, but we are highly dependent on external collaboration partners and their knowledge*". The competency brokers can assist with industry knowledge that the organization itself might lack, setting up the organizations with relevant collaboration partners and thus, relevant external knowledge.

Besides the competency brokers' assistance in finding relevant collaborating partners and knowledge, the organizations are also very pleased with the financial support received from VRI. The increase of the prior knowledge base and ability to acquire external knowledge is dependent on R&D activity and collaboration with others. The actual funding of these R&D collaborations is therefore an important factor in how the VRI cooperation projects affect the organizations' level of absorptive capacity.

A very important notion that I got during my interviews, however, was that if the project is considered as part of the business area and as relevant enough, the company would have financed it themselves. An informant explains that "*support from public support systems are often applied for after the organization has chosen to further develop an idea. The financial support is therefore viewed as useful but not critical and large enough to make the fundamental difference*".

Another informant states that "*the VRI support was of help but it was not elementary for a successful development. The most important is that the idea or concept that one attempts to develop is market competitive and that the people working with it are familiar with the industry and how it works. Companies with good ideas will always find financial funding and collaborative partners, despite help or not from public support systems*".

Even though rather harsh, it seems that the VRI cooperating project at times supports and finances projects that the companies themselves do not prioritize or consider as important. An informant explains that "*even though the company spent almost 25 million NOK in R&D activity in 2010, funding a project such as that through VRI is not always relevant. The main reason was that the project's purpose is not part of the company's business area or that it will not result in immediate revenue. It is a project whose result will benefit the company in the long run, but not the short run. So even though money for funding is available within the company, it is highly unlikely that it will be funded*".

It seems as if though the VRI cooperation project can finance and assist in projects that are not considered as important because they do not result in immediate profit. Instead the company chooses to go through with the R&D project just because it will get the help from VRI. An informant explains that *"programs such as VRI can help to develop or improve technologies that serve the industry and/or public authorities more than the company itself"*. The company then views their participating in the VRI cooperation project as, harshly put, social service.

The opinion on what R&D projects should be considered beneficial and profitable often varies in the organization. An informant explains that *"the strong existence of will is a source of conflict for what path one should decide to follow. There can be skepticism towards collaborating with certain partners and to proceed with certain technological ideas. In that sense, there is a noteworthy presence of gatekeepers in the organization that try to effect what external knowledge should be taken into the organization"*. What some in the organization consider as an excellent profitable R&D project can therefore be considered as useless by others.

In these cases, it seems that the support from the VRI can work as an external determinant in pushing over projects to happen in that its shown interest changes the organizations' opinion on the projects' importance. The fact that a public support system such as VRI is willing to assist and finance the project will motivate the company to conduct it. An informant says that *"having received external recognition and funding is a great motivational factor as it indicates that the project is of importance"*.

The VRI cooperation project can also encourage projects that would not have happened because it is too expensive to conduct. Even though most informants agree on that projects which are considered as important will be financed and conducted by the company itself, this statement assumes that funding is available within the company or that investors are willing to invest. If this is not the case, such as during start-ups or recessions, the role of VRI is of great importance. An informant explains that *"in these cases, support can be essential. It is often during these times that it is the most difficult to find risk capital"*.

Another says that *"VRI contributed greatly in that it financed projects that would never have happened if the companies were to pay themselves. The margins in the companies are small and research is looked up as an expense.* This view is rather consistent throughout most of the interviews. An informant explains that *"without the assistance of VRI, the company would*

most likely not have done the project at all or not so thoroughly. These projects are often too costly and there is no room for them in the budget".

That the VRI cooperation project supports R&D projects that otherwise would not have been conducted at all or not so thoroughly, can be understood by referring to VRI as an external determinant. This means that VRI at times work as an external determinant factor in that it highly influences the conduct and scope of a given project. VRI mainly influences the projects in two ways, financially and motivationally through its shown interest.

The financial funding is important and should be encouraged in the cases where funding falls short. The financial funding leads to R&D collaboration projects that increase the prior knowledge base and therefore, the ability to acquire relevant, external knowledge. It therefore has a positive effect on the company's level of absorptive capacity. Frascatore (2006, p. 11) explain that *"subsidies and grants aimed at mitigating firms' basic research costs can increase the levels of absorptive capacity".* It seems that VRI provides funding both in the cases where funding falls short or when the project is not considered profitable enough for the company to pay itself.

5.6 The importance of having the right employees

When discussing with my informants the concept of absorptive capacity, all of them mention the importance of having the right employees. The perception of what the right employee is seems to be double-barreled. First, it is claimed that the employees need to have the correct competency and background for conducting their work tasks. Secondly are characteristics such as commitment, engagement and initiative, heavily weighted. An informant says that *"formal education and extensive experience is of course mostly relevant, but if the interest is not there, it is hard to create an innovative environment in the company/.../my employees are characterized by being proactive and driven by interest".* Another informant says that for an organization to have a high level of absorptive capacity, *"it is important that the employees within the organization are committed and engaged in its development".*

Several informants underline the importance of having the employees feel entitled to the company's innovation. One informant explains that *"the employees seem to have a high sense of ownership to the idea that they try to develop/.../it is positive in the sense that there is willingness and eagerness to go for what one believes is the best technological solution and collaborating partner to work with".*

An informant, who has experienced great problems within the organizations in terms of lack of interest and commitment, especially in attempts to collaborate with knowledge institutions, says that they *"of course meet the marked expectances of what should be delivered but make no attempt further to be innovate and groundbreaking in what they do/.../arguing for research seems rather farfetched"*. Furthermore, he partly explains this attitude by referring to the educational background of the participants which is rather practical, like vocational school.

It therefore seems that having the right educational background and/or relevant extensive experience is considered important to achieve a high level of absorptive capacity that can result in competitive solutions. This should, however, should be combined with a genuine interest in the concepts and ideas that the company attempts to develop. It is claimed that this interest will result in a kind of ownership to the idea, which is regarded as important for a successful development. Some informants also argue that employees with a high level of education are more proponed to be positive to the idea of a more academically oriented research and development.

The informants' statements are in line with the theory on absorptive capacity. The internal factor of education and academic degree is argued to have a positive effect on the dimensions of acquisition, assimilation and transformation (Daghfous, 2004, p. 23). Employees who have a higher degree of education are claimed to both have a higher individual prior knowledge base and therefore also a higher level of absorptive capacity. Like previously mentioned, the organization's absorptive capacity is dependent on the absorptive capacities of its individual members (Cohen and Levinthal, 1990, p. 131).

In terms of absorptive capacity, research has also shown that familiarity to the production process might be of equal, or larger, importance for a high level of absorptive capacity. Levinthal and March (1993, p. 96) claim that knowledge acquired from repetitive production experience to a great extent explain competitive production innovativeness and improvement. This is because successful organizations learn from experience in that they respond to it by improving technologies and practices. Employees with production experience therefore hold a large prior knowledge base that increases their ability to identify relevant, external knowledge for improvements (Daghfous, 2004, p. 22).

Jensen, Johnsen, Lorenz and Lundvall (2007, s. 690) claim that organizations who focus too much on developing their science and technology base, will miss out on important gains that

could be achieved by designing routines and practices that encourage informal learning through using, doing and interaction. The technology departments in the organization might therefore increase the absorptive capacity by interacting and listening to the production department. In some of the interviewed organizations I got the impression that this was a well established routine. In others, I got the impression that there was little communication between the technological management and the employees concerning technical problems and challenges.

Another reason for why interaction between the technical departments and production should be encouraged is that a diversity of backgrounds will also have a positive influence on the absorptive capacity dimensions of assimilation and transformation. Cohen and Levinthal (1990, p.133) explain that as long as there is some common knowledge ground and prerequisites for understanding, diversity of background among the employees will have a positive effect on the assimilation and transformations stages. The different backgrounds will enable and encourage new linkages between old and new knowledge not just achievable by one individual. The management should therefore attempt to stimulate such interaction, which is interaction between employees who have different backgrounds and work tasks.

The management of human resources can attempt to increase the level of absorptive capacity by influencing the previous. Diversity of background can party be achieved, for example, by job rotation. In addition will job rotation challenge the employees (since they are faced with a new setting) to pay attention to new ideas, recognize the need for invention and see other opportunities and challenges (Van de Ven, 1986, p. 604). Job rotation can therefore work as a trigger for increasing the level of absorptive capacity in the organization.

Diversity of backgrounds should also be a goal within the organizations' departments. A few of my informants are familiar with this thought. One informant says that *"it would be desirable to get a newly graduated, younger engineer to the group. It is a while since the other members of the group went to school and sometimes they tend to think too much alike and are static in their thoughts. The new engineer would hopefully come with new input to the group in terms of different and fresh thoughts and knowledge"*. The recruiting of a newly graduated engineer can, like my informant implies, boost the group into thinking differently. The reason is that they can contribute with the new insights based on the latest technology and management knowledge (Vinding, 2000, p. 10-11).

The importance of employees for the level of absorptive capacity seems to be especially true for smaller- and medium companies. Since the R&D activity is organized through smaller projects, often in collaboration with external partners, the level of absorptive capacity is very much affected by external influence (compared to larger companies where the R&D activity often is in-house and with less or no collaboration with external partners). The in-house factor that is most influential on the level of absorptive capacity in the small- and medium sized companies (SMEs) is therefore their employees. Alessandro Muscio (2007, p. 2) explain that *"the skills, training and experience of SMEs' human capital represent the essence itself of their knowledge base and contribute greatly to the overall capability to absorb external knowledge"*.

The internal factors of individuals' ACAP, level of education and academic degree and diversity of background is mainly influenced by VRI through the use of competency brokers. Competency brokers, with a vast experience, higher education, acting as an external input (increasing the diversity of background), can therefore have a positive effect on the absorptive capacity of the organization. This is also the case for the other enablers that in some way affect these factors (such as the enabler person mobility).

This effect, however, is somewhat temporary and will not result in a long lasting dynamic capability of absorptive capacity. Instead it is very much up to the organization to attempt to build its organization and choose its employees in such a way that it will have a long lasting effect on the level of absorptive capacity.

5.7 Organizational characteristics

In the interviews, it turned out that the employees were considered as critical for achieving a high level of absorptive capacity. The employees' contribution can be both promoted and inhibited by organizational characteristics. These include organizational structure, level of internal communication, level of organizational bureaucracy and organizational culture (empowerment of employees).

The organizational structure will affect the spread of the acquired knowledge to all parts of the organization involved in innovation, allowing the acquired knowledge to be assimilated, transformed and exploited (Dagfhous, 2004, p 24). The intention with the organizational structure should be to create a high level of communication and a low level organizational bureaucracy. A low level of bureaucracy will increase the organization's likeliness to reach the stage of exploiting the knowledge into new competitive solutions and products. In

addition will an organizational structure that is low in bureaucracy have the necessary flexibility that enables responsiveness to change (Daghfous, 2004, p. 24).

A high level of communication within the organization will enable for exchange of ideas, information and knowledge, and therefore also have a positive effect on the ability to assimilate and transform the acquired external knowledge (Daghfhous, 2004, p.24). The organizational culture should empower the employees' possibility to initiate, develop and present ideas to management. The organizational factors therefore play an important role in determining the role of the employees in achieving a high level of absorptive capacity.

Due to the size of the companies, who were all small or medium sized businesses, most informants claimed there to be almost no hierarchy or bureaucracy in the organizational structure. Due to this, it was also claimed that there was a high level of communication and that the employees were empowered to initiate and participate in the development of ideas. An informant explains that *"hierarchy is not very much present and the employees in the company therefore have no problem talking to each other, discussing ideas and solutions. The process is therefore quite fast and does not involve any paperwork. This is natural since the company is rather small.*

Other informants, however, felt that the dialogue and communication could become much better. The informant, who is also the CEO of the energy efficiency network company, wishes that he could have more contact with those who worked with the development in the companies and not only the managing directors. He states that *"the network company would probably do better if it was not the general managers, but those who normally work with development within the companies, related to products and services, who participated. It is more likely that these would be more interested in cooperation with knowledge institutions".*

The previous informant is definitely onto a good point. One of the indicators that researchers use to see if the organizational characteristics are beneficial for the supporting the employees' contribution to the level of absorptive capacity, is to look closer at their participation in higher level decision-making. Participation of employees, other than management, in decisions concerning the company has proven to have a positive effect on the ability of units to innovate and initiate new ideas or activities. Involving the employees will boost the exchange between different perspectives in addition to increasing the number of people searching for relevant, external knowledge (Bosch, Jansen & Volberda, 2003, p. 5).

Furthermore, even in the companies where the organizational characteristics were seemingly good, the informants expressed a worry that it can be difficult to maintain a good spirit when ideas are often rejected due to cost. An informant expresses his concern: *"in every organization there is a battle about the costs and the resources and what ideas one chooses to pursue further. Even though some of the ideas are rejected due to cost, it is important that the employees within the organization are committed and involved in its development. An organization needs to be characterized with openness towards ideas and that of being innovative".*

In order to address this issue the informant mentions several effects that the management can use to keep the employees committed and engaged. He explains that "*companies should have an idea box where the employees can submit their ideas. It is also important that one makes room in the budget for testing out new ideas, even though they were to fail. All ideas should be evaluated fairly and thoroughly".* Several informants had the same mode of thinking underlining the importance of hearing the employees and evaluating their ideas. This evaluation was often quite informal and done in daily conversations and discussions.

The organizational characteristics are difficult for VRI to affect. None of the informants had experienced that the contact with VRI had assisted enhancing organizational structure, level of communication, organizational culture or level of bureaucracy. These factors therefore seem to depend on the organization itself. One possible way that VRI could attempt affecting these factors would be to design enablers that raise consciousness over how organizational characteristics can enhance or inhibit the level of absorptive capacity. By providing financial funding, VRI can also help the organization go through with certain ideas and therefore, assist the management in keeping the employees committed and engaged (since the ideas are not rejected due to cost).

6.0 Conclusion

In my thesis I wished to look closer at the below problem formulation:

Does the VRI cooperation project affect the level of absorptive capacity in the participating organizations and if so, in what ways?

Through my interviews I found out that:

The **prior knowledge base**, in terms of industry knowledge, was considered as important for the ability to identify external knowledge of relevance for the company. My informants argued that knowing your industry well, was one of the most important factors for success. Industry knowledge will help you know who does what, what is new in the field and read the signals of what the future demands are likely to be. It is therefore of great importance that the VRI project and its enablers radiate an extraordinary industry knowledge. *If the competency brokers have an industry knowledge that is better or complementary to that of the organization, the VRI cooperation project can positively affect the acquisition dimension of absorptive capacity.*

VRI also positively affects the acquisition dimension of absorptive capacity by supporting and initiating ***investment in R&D*** *through R&D collaboration between knowledge institutions and companies. This is because such R&D collaboration will increase the prior knowledge base and therefore the ability to recognize relevant external knowledge.* This result, however, is also true for R&D collaboration between industrial partners and companies. It was therefore interesting to find out what criteria the companies have when choosing an external collaboration partner and how the view on academic research influences their choice.

It turned out to be the industry knowledge that steers what the company finds to be a suitable collaborating partner. The company will choose their collaborating partners based on the perception of which industry related candidates will be the best and most appropriate. All of the interviewed companies were positive to the idea of collaborating with industrial partners (such as suppliers). The view on collaborating with knowledge institutions in R&D activity was, however, more spread.

The informants who were positive to collaboration with knowledge institutions were familiar with academic research and the research community. They often initiated the contact with VRI themselves. The companies who were hesitant to collaborating with knowledge institutions instead had a hard time seeing the benefits of such collaboration.

In order for VRI to reach out to more companies, the project should therefore attempt to change certain organizations' perception of knowledge institutions' contributing value in the R&D activity. I suggest that this could be done by radiating a solid view that collaboration with knowledge institutions can be a great benefit for companies' R&D activity. A more business oriented approach should be adopted explaining to the companies the black on white value that such cooperation can result in. Besides easing the bureaucracy, the VRI cooperation project and the knowledge institutions should also make sure to meet the criteria for a desirable collaborating partner- a genuine interest in the companies' R&D project, the desired competency, craftiness and the authority to make decisions.

Through its competency brokers, VRI also affected the level of absorptive capacity by having a positive influence on the acquisition dimension. This is because competency workers turned out to work as external ***gatekeepers*** *by identifying relevant external knowledge sources and/or the knowledge institutions that the organization will benefit collaborating with.*

The factors of **individuals' ACAP, level of education and academic degree** and **diversity of background** were discussed by referring to the importance of having the right employees. Since these factors are closely related to characteristics with the employee force, they are difficult factors for the VRI project, as an external actor, to affect. *Through the pure presence of competency brokers, the VRI project however managed to somewhat influence the level of education and academic degree and the diversity of background.*

The competency brokers help was described to give the companies new insight and perspectives. It is therefore claimable that *the competency brokers increase the diversity of background which has a positive effect on the absorptive capacity dimensions of assimilation and transformation.* To some degree it is also claimable that *the competency brokers also can have a positive effect due to their higher education or vast experience. Level of education and academic degree affect the dimensions of acquisition, assimilation and transformation.*

This effect is, however, somewhat temporary and will not result in a long lasting dynamic capability of absorptive capacity. Instead it is very much up to the organization to attempt to build its organization and choose its employees in such a way that it will have a long lasting effect on the level of absorptive capacity.

The employees' contribution can be both promoted and inhibited by organizational characteristics. These include **organizational structure, level of internal communication,**

level of organizational bureaucracy and **organizational culture (empowerment of employees).**

Mainly due to the small or medium **size** of the companies, the informants claimed that the organizational structures were beneficial to enhancing the employees' contribution to the level of absorptive capacity. There was barely any bureaucracy and the organizational structure encouraged communication between the employees. In addition were the companies aware of their role in encouraging the employees to participate and keep them motivated in initiating new ideas.

The organizational characteristics are however difficult for VRI to affect and none of the informants had experienced that their contact with VRI had been helpful in this sense. These factors therefore seem to depend on the organization itself. One possible way that VRI could attempt affecting these factors, would be to design enablers that raise consciousness over how organizational characteristics can promote or inhibit the level of absorptive capacity.

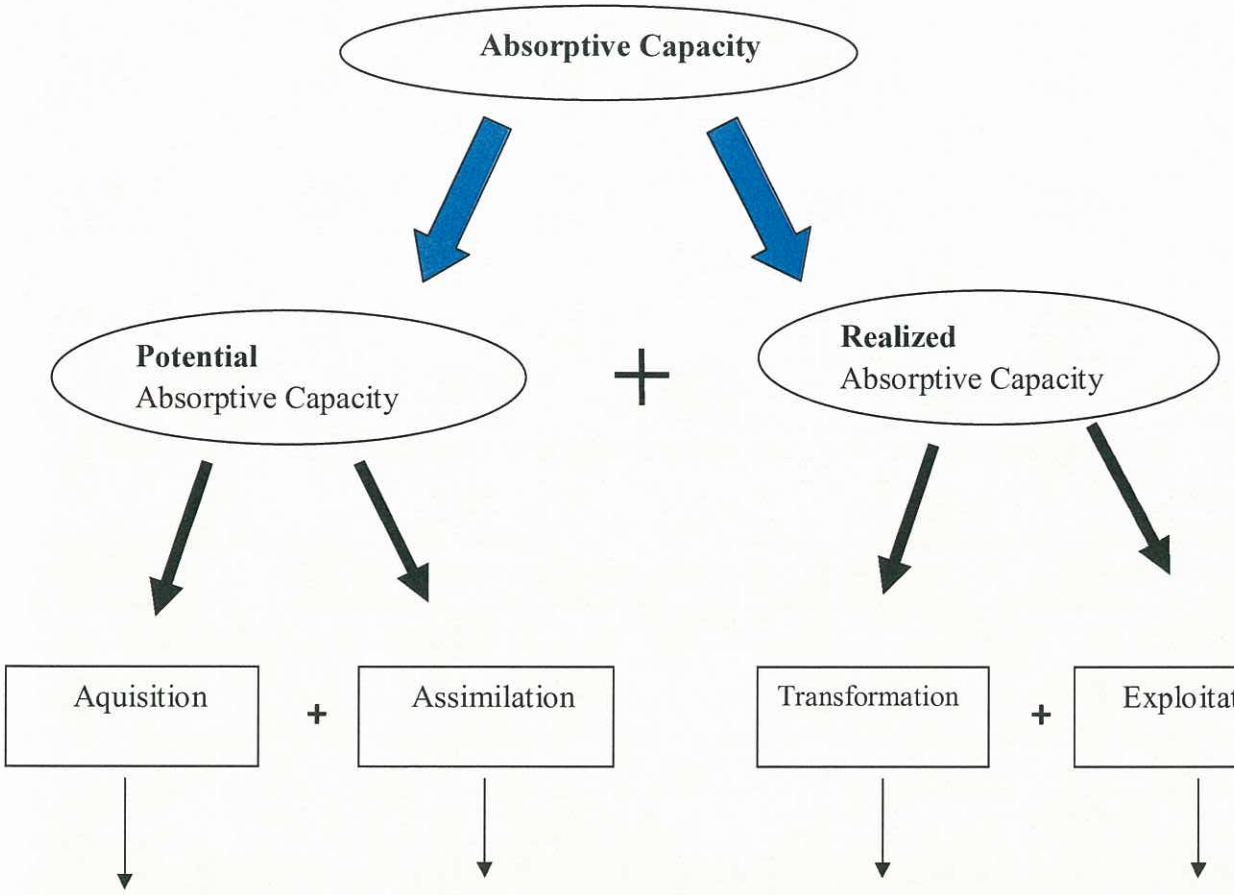
To summarize my findings, I have marked the factors that VRI seems to affect in the model previously shown on page 27. The factors that have proven to be the **most** affected by VRI, have been marked in **green**. The factors that have proven to be **slightly** affected by VRI, have been marked in **yellow.** Those factors who are unmarked have proven to be very little or not affected at all by VRI.

Factors that have proven to the **most** affected by VRI have been marked in green

Factors that have proven to **slightly** affected by VRI have been marked in yellow

Factors that remain unmarked have proven to be very little or not at all affected by VRI

The model is shown on the next page.



Indirectly measured by:	**Indirectly measured by:**	**Indirectly measured by:**	**Indirectly measured by:**
Prior knowledge base			
Individuals' ACAP'	Individuals' ACAP	Individuals' ACAP	Individuals' ACAP
Level of education and academic degree	Level of education and academic degree	Level of education and academic degree	
Presence of gatekeepers			
Investment in R&D			
	Diversity of backgrounds	Diversity of backgrounds	
	Organizational Structure	Organizational Structure	Organizational Structure
	Level of internal communication	Level of internal communication	
			Level of organizational bureaucracy
		Organizational culture-empowerment employees	
Size			Size
			Organizational Inertia
HRM	HRM	HRM	HRM

As the marking illustrates, it therefore seems that VRI has some effects on the level of absorptive capacity. VRI mainly affects the first three dimensions i.e. acquisition, assimilation and transformation. VRI does not seem to affect the exploitation dimension. VRI therefore affects the companies' potential absorptive capacity (step 1 and 2) but barely at all the realized absorptive capacity (step 3 and 4).

As previously stated, VRI's effect on *level of education and academic degree* and *diversity of background* is only temporary and not enough for the organization to create a long lasting absorptive capacity. This is because VRI affects these factors through the pure presence of competency brokers in the organization. This positive effect, however, disappears with the exit of the competency brokers. One should therefore not put too much emphasis on VRI's contribution to the assimilation and transformation steps.

The main effect that VRI has is therefore on the acquisition dimension. VRI affects the dimension of acquisition by its enablers promoting the factors of *prior knowledge base*, *presence of gatekeepers* and *investment in R&D.*

Lastly, it is important to note that in order for a company to have a high level of absorptive capacity, all of the dimensions must progress chronologically. VRI influences the absorptive capacity mainly through the acquisition dimension. It is therefore up to the organizations themselves to build the routines and practices that affect the three consequent steps of assimilation, transformation and exploitation. It is only in the presence of all the steps that the assistance from VRI truly can result in a systematic, competitive advantage for the participating organizations.

7.0 List of references

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