Knowledge Transfer in Innovation Development Teams
A Case Study of Atlas Copco

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Abstract

This study addresses the research gap on knowledge transfer on a team level, by examining the potential and realized Absorptive Capacity (ACAP) on the receiver's side and potential and realized Disseminative Capacity (DCAP) on the sender's side. The research question and purpose relate to how ACAP and DCAP can aid innovation development teams in reaching their goals and what role social integration mechanisms play in this process. We develop a theoretical framework in which we synthesize existing literature and through which we analyzed the empirical data.

We follow a qualitative method and employ a single case strategy that fits our empirical data and allows to gain an understanding of social dynamics underlying knowledge transfer. The data was collected through interviews in the R&D department of Atlas Copco, a large Swedish multinational corporation that operates in the mining and tunneling industry. From our analysis we conclude that social integration mechanisms can be used in order to lower the gap between potential and realized capacities. This can in turn lead to a higher innovative output of teams.

**Keywords:** Knowledge Management, Knowledge Transfer, Absorptive Capacity, Disseminative Capacity, Social Integration Mechanisms, Boundary Spanners, Research and Development, R&D, Innovation, Innovative Output, Innovation Development Teams, Innovative Success
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1. Introduction

In this chapter we describe our research focus by uncovering the research gap on absorptive and disseminative capacity (ACAP and DCAP), its effect on a team’s innovative output, and the role of social integration mechanisms. The argumentation in the end states the research questions and the study's aim.

“Today knowledge has power. It controls access to opportunity and advancement”

Peter Drucker

1.1 Background

Failing to share knowledge costs Fortune 500 companies 31.5 billion USD every year (Babcock, 2004) although it has been almost 100 years since Frederick Taylor introduced his theory of scientific management, in which he was one of the first to stress the importance of knowledge and knowledge transfer. This part of his legacy still reverbs through business research and practices today since it is even argued that we are living in a ‘knowledge economy’ (Cooke, 2001). This means that organizations are becoming increasingly reliant on knowledge carriers and their intellectual capital (Stewart and Ruckdeschel, 1998) in order to create a competitive advantage (Vandermerwe and Rada, 1988; Oliva and Kallenberg, 2003).

There are many examples available that support the above reasoning of an increased focus on knowledge: Toyota’s system to generate, transfer and recombine knowledge is regarded as a main contributor to their profitability (Dyer and Nobeoka, 2000). Similarly, BP implemented a structure through which experts could be located globally, exchange knowledge with each other and improve the efficiency with which customers were served (Davenport et al., 1998). There is, however, also ample evidence that shows that not every knowledge management project succeeds, which implies that knowledge management is not a simple process to introduce in a company (Wilson, 2002). This can be exemplified by the fact that these topics are in focus by consultancy firms such as Bain & Company and McKinsey & Company (Bain, 2015; McKinsey, 2015), who provide assistance to organizations in integrating knowledge systems so that they can acquire and transfer their intellectual assets on multiple levels in the organization (bain.com, 2015). Also evidently in
academia, the processes regarding how to handle and integrate knowledge has been given increased attention over the years, mainly following the research stream of the knowledge-based theory that focuses on the combination and utilization of this resource (Nonaka, 1991, Grant, 2002). From this reasoning we bring forth that this subject is highly relevant and can be further understood by taking a closer look at the literature available.

1.2 Knowledge and Research and Development
The knowledge-based theory describes a firm’s greatest asset as the ability to combine and incorporate knowledge, which leads to the creation of a competitive advantage (Phelan and Lewin, 2000: Grant, 2002), and many other researchers have since identified the positive contribution of knowledge and knowledge transfer to organizational performance (Nonaka, 1991; Alavi and Leidner, 1999). What is essential is to understand the process behind the combining and incorporating of this asset in order for a firm to draw upon this advantage and become profitable. This process of knowledge transfer is particularly important in innovative settings since Research and Development (hereafter referred to as R&D) is a new combination of existing knowledge (Schumpeter, 1934). From this it logically follows that knowledge must continuously be shared and recombined in order to create new innovations (Nonaka, 1991; Davenport et al., 1998). Many companies therefore becomes highly dependent on the ability of an R&D department to interconnect since this unit must be able to both receive and process external information but also disseminate it internally as well as externally (Brown and Duguid, 1991). This includes risks, but also great potential; when both the knowledge intake and spreading is done effectively within this central department of knowledge generation, it can enhance a firm's innovative capacity. In industries where R&D plays a central role, this becomes a critical process (Bontis et al. 2009). R&D success in this thesis is referred to as innovative output and is in contemporary literature covered in various ways, for example by self-reported measurements from employees working with the innovation (Lane and Lubatkin, 1998, Liao et al., 2006) or by the degree of novelty of the innovation (Miron-Spektor et al., 2011).

1.3 The Mechanisms of Knowledge Transfer
In order for companies to increase their innovative output they must absorb and apply external knowledge, a process that can be described by the concept of Absorptive Capacity (hereafter
This concept was introduced by Cohen and Levinthal (1990) and entails that a firm’s prior knowledge aids in the ability to take in new knowledge. A firm’s knowledge base also expands when it engages in R&D activities and this new knowledge in turn provides opportunities to generate even more R&D. This will create a self-reinforcing circle between the firm’s ACAP and innovative capacity (Cohen and Levinthal, 1990). ACAP in itself is a concept that focuses on a receiver of information and the way this receiver processes and applies it, but leaves out the sender’s side of the equation. Since knowledge transfer is, by definition, a process in which apart from a receiver a sender is also involved, it is relevant to look at the side where the message is communicated. In order to gain a richer understanding of this, the concept of Disseminative Capacity (hereafter referred to as DCAP) can be applied in order to describe the sender’s ability to transfer information or knowledge. DCAP describes the capacities that a sender should have in order to ensure effective and efficient transfer of knowledge or information to the recipient (Minbaeva and Michailova, 2004). Optimally, DCAP on the sender’s side should be combined with ACAP on the receiver’s side in order to establish an effective transfer (Mu et al., 2010; Tang et al., 2010). Thus we define knowledge transfer as the combination of ACAP and DCAP.

It should be noted that neither ACAP nor DCAP operate in a vacuum, but rather in settings in which multiple actors are involved; a company may be in touch with clients, competitors or suppliers in order to gain knowledge or to disseminate information. This implies that there are certain factors that may hinder or enhance the consistent transfer of knowledge, of which we will address three that have been connected to the concepts of ACAP and DCAP.

Firstly, since knowledge transfer is fundamentally a social process, Grant (1996) and Nahapiet and Ghoshal (1998) stress the need for an organizational environment that induces trust and fosters cooperation. Grant (1996) writes that collaboration will ‘increase the efficiency with which specialized knowledge is utilized’ (p.383), which is one of the central notions within ACAP. Secondly, Cohen and Levinthal (1990) discuss the concept of ‘gatekeepers’, also called ‘boundary spanners’ which are individuals or units that “monitor the environment and translate the technical information into a form understandable to the research group” (p. 132) that can help realize the potential knowledge base in the innovation processes (Zahra and George, 2002; Easterby-Smith et
al., 2008). Third, knowledge transfer facilitators can ease interaction and transfer of knowledge among employees (Dyer and Nobeoka, 2000), especially when procedures are aimed at generating ideas in a group in an intra- and inter-firm networks, which is in line with our focus. These three concepts - a cooperative environment, boundary spanners and knowledge transfer facilitators - are commonly referred to as social integration mechanisms that an organization can employ in order to capitalize on its knowledge base. We regard these three to be of importance for creating a better understanding of how knowledge transfer proceeds and see what role these social integration mechanisms have in enhancing both ACAP and DCAP.

1.4 The call for more Research

So far, DCAP is a concept that has been developed separately from ACAP and has not received the similar amount of attention. Since we argued that in knowledge transfer the actions of both a sender and recipient of knowledge should be taken into consideration, ACAP and DCAP should be investigated conjointly. There are a few studies that have done this before, such as Mu et al. (2010) and Tang et al. (2010) where both stress the need for further research development regarding the interplay of ACAP and DCAP.

Furthermore, most research on ACAP and DCAP has concentrated on the firm level since ACAP was initially developed as a phenomenon on an organizational level (Cohen and Levinthal, 1990) and DCAP was developed analogously (Minbaeva and Michailova, 2004). This means that on a lower-level unit of analysis, less research has been carried out on these concepts. More specifically, the role of ACAP and DCAP on a group and individual level in R&D settings has only sparsely been examined, despite the fact that many authors state that the organizational ACAP is dependent on the ACAP of its members and subunits (Cohen and Levinthal, 1990; Zahra and George, 2002). By raising understanding for the micro-foundations of ACAP and DCAP we can therefore shed light on how knowledge transfer on an organizational level is impacted by the lower-level entities. Micro-foundations describe the individual action and interaction (Foss, 2011), which will eventually cause firm-level outcomes (Abell et al., 2008). This distinction can also be linked to Argote and Miron-Spektor (2011) who theorized about the ‘active and latent’ context of a firm. They described how learning and generation of knowledge takes place in the so-called ‘active context’, which is where people work and perform tasks. On the other hand, the latent context is
described as the goals, strategy and memory of the organization. Although the latent context is likely to be preceded and affected by the active context, studies about ACAP and DCAP have traditionally not examined these microfoundations and neglected the dynamics of the active context that contribute to the latent context.

In line with this, Gupta and Govindarajan (2000) and Phene and Almeida (2008) also call for more studies to create an understanding of the mechanisms relating to ACAP and their role in innovation. There also seems to be a need to go in-depth with the social processes preceding organizational learning (Tsai, 2001) as well as the critical determinants for knowledge transfer (Lin, 2007). Minbaeva et al. (2003) moreover encourage research on the facilitators of knowledge transfer, with a possible inclusion of sender and receiver’s characteristics. Tang (2011) furthermore points at a research direction regarding knowledge transfer processes in organizational networks and the success factors for effective knowledge transfer. Besides this, Zahra and George (2002) have argued for social integration mechanisms and that they play a role in knowledge transfer. As an example, boundary spanners can, because of the embeddedness in multiple environments, potentially connect disseminating and absorbing units through which they enable companies to leverage on their knowledge base in innovative settings (Easterby-Smith et al., 2008). However, studies on the role of the social integration mechanisms have largely neglected this in combination with knowledge transfer (Ambos and Ambos, 2009)

1.5 The Research and Company Focus
The described research gap leads into the main focus of our research: to investigate how innovation development teams can benefit from leveraging on knowledge transfer from inside and outside their organization in R&D projects. We do this by uncovering the social and organizational mechanisms on individual and team level that enhance knowledge transfer by drawing upon previous research on ACAP and DCAP. We will also identify a special role for social integration mechanisms that will be treated as the main instruments in enabling or knowledge transfer. We have approached this question by gathering data from an R&D department where innovation development teams work quite separately but have the potential to combine their knowledge to improve their innovative output. The empirical material will be analyzed through a theoretical framework based on a synthesis of our theory chapter.
The company of focus is Atlas Copco; a global industrial player that is amongst Sweden’s top ten and the Nordic’s top twenty firms in terms of annual turnover (Forbes, 2015). This company is an important cornerstone for the Swedish export and contributor to the economic welfare (Lindbeck, 1974; Swedish Institute, 2015). In this company, innovation is vital to stay ahead of competition and therefore the R&D department must be able to develop technical solutions and products that are attractive for the world market. The Atlas Copco Underground Rock Excavation division is one of the company’s 23 divisions, with one of its R&D facilities located in Örebro, Sweden. This department develops future technology for the mining and tunneling industry, such as machines for drilling and loading. Here, employees, teams, and the department as a whole gain new knowledge that has the potential to be spread and combined in new ways to generate even more knowledge and eventually new innovations. However, the innovation development teams at this company are organized in such a way that they are working quite independently from each other and the company thereby faces challenges to fully utilize their resources. By studying entities where challenges regard combining and integrating existing knowledge we follow the important themes in the knowledge-based view. Considering this, our empirical data creates an appropriate base for gaining insights into how ACAP and DCAP affects an innovation development team’s ability to innovate and what factors can hinder and enable this process.

Because of the good opportunities to access data in this department, we agreed to apply a qualitative approach, using a single case study. We operationalized the concepts of the sender’s capacity (DCAP), the receiver's capacity (ACAP), social integration mechanisms and innovative output based on existing literature. After this, we interviewed nine innovation development teams in order to build an in-depth understanding about how these concepts works in practice and how they relate to each other. Studying this environment fits with the following research questions and creates possibilities for theoretical generalizability.
1.6 Research Questions

- How does a team’s Absorptive and Disseminative Capacity (ACAP and DCAP) affect their innovative output?
- What is the role of Social Integration Mechanisms in enhancing a team’s ACAP and DCAP?

1.7 Purpose

With this study we intend to shed light on the concepts of ACAP and DCAP and examine how they impact the output of teams working with innovations. Researchers have traditionally neglected the focus on the lower-level unit of analysis of teams and therefore we aim to contribute to theoretical development by investigating how actions on this level can impact firm-level knowledge transfer. By also investigating how a company can utilize social integration mechanisms in order to enhance a team’s ACAP and DCAP, we will address the various social dynamics that are related taking in new knowledge, transferring knowledge, and applying this in order to fulfill goals of innovative output. We will formulate theoretically generalizable propositions that could be further tested in future research.
2. Theory

In this chapter we describe the generic theoretical premises on which we build our subsequent empirical observations and analysis. We give an overview of the theories available regarding the topics outlined that lead to a general theoretical framework showing how the subject can be broken down into different concepts.

“To know what you know and what you do not know, that is true knowledge”

Confucius

2.1 Companies and the Resource-based View

When economic theories that used equilibria as their starting point for explaining companies became less prominent, it contributed to the rise of more dynamic theories (Grant, 1991) such as Schumpeter’s idea of creative destruction and Penrose, who describes the human factor in organizations as fundamental for growth of companies. These types of theories tend to focus on the strategic alignment of existing resources within companies and are called ‘the Resource-based theory’. The resource-based theory of the firm outlines how knowledge and resources that are hard for others to imitate must be regarded as a firm’s greatest asset that creates the firm’s competitive advantage (Barney, 1991; Zander and Kogut, 1995; Grant, 1996). Within this view, a firm must be able to leverage these types of assets and attributes to fit its specific environment in order to stay ahead of their competition (Conner, 1991). This means, for example, that a company excelling in a certain advanced type of production that fits market demands perfectly has an edge over competitors who do not possess this form of production (Grant, 1991). When this asset is unique to the company, it forms a barrier of entry for new market entrants as well as a barrier for existing market players to imitate, thus it is less likely that competitors get on the same level (Grant, 1991; Conner and Prahalad, 1996). Since these means of production, technologies, and methods are ultimately rooted in knowledge, the knowledge-based view of the firm was coined in order to describe that it is the knowledge within a company that ultimately drives a company forward.

2.2 The Knowledge-based View

Key research about the knowledge-based view by Kogut and Zander (1992) and Winter (1998) initiated a stream of research dealing with strategies for explaining how a firm can manage its
knowledge assets. A large body of research described that when a firm does this efficiently and effectively, its performance will be superior to the competitors (Kogut and Zander, 1993). Many authors such as Teece et al. (1997) built upon this and put forth that, in contrast to the resource-based view, a firm’s competitive advantage is not the knowledge itself, but rather how a firm’s dynamic capabilities allow coordination and assimilation of this asset. Furthermore, it was suggested that firms should use their combinative capabilities to create advantages in the functions of, for example, R&D, product and services development, technology transfer, intellectual property and organizational learning (Teece et al., 1997).

2.2.1 Explicit and Tacit Knowledge

Following the knowledge-based view, it is vital to build an understanding of how firms can combine and integrate the greatest asset that they should be able to control and coordinate, namely their knowledge. Regarding this, a distinction can be made between explicit and tacit knowledge (Polanyi, 1962; 1966) and out of these two, explicit knowledge is easier to understand independently of its context. Tacit knowledge, on the other hand, is more situation-dependent, hard to express, and is often captured in people’s minds, which is why it is strongly linked to the firm’s competitive advantage. For this reason scholars have become interested in investigating how to share especially the tacit knowledge (Kogut and Zander, 1992; Nonaka, 1991, 1994). Nonaka suggests that firms should transform tacit knowledge into explicit so they can leverage on this and turn the company’s vision into innovations and technologies, placing themselves ahead of their competitors. A prerequisite for this is to understand how knowledge is transferred to, from, and between entities both inside and outside firms. Knowledge transfer enables entities to cooperate and gain learnings that in turn can generate new knowledge and innovations, which is especially critical in R&D settings (Kogut and Zander, 1992; Tsai and Ghoshal, 1998). Argote and Ingram (2000) define knowledge transfer as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (p. 151). Knowledge transfer can often be the reason for organizational units to discover new opportunities by interacting with other entities (Tsai, 2001).

Knowledge transfer can therefore be defined as a critical process and in order for it to take place a firm should have coordination mechanisms in place. This is why we need to look deeper into the
underlying mechanisms and their relationship with innovation, for which we will primarily use the theories of ACAP and DCAP.

2.3 Absorptive Capacity (ACAP)
The sole exposure to knowledge is not sufficient to explain how a company successfully absorbs new knowledge (Penning and Harianto, 1992). In 1990, Cohen and Levinthal introduced the concept of ‘Absorptive Capacity’ (ACAP), paving the way for understanding firms’ capability to learn and innovate. They defined this capacity as the “ability to recognize the value of new external information, assimilate it, and apply it to commercial ends” (p. 128). The absorption of new knowledge was explained to be path-dependent and to develop cumulative, meaning that new knowledge builds upon existing expertise (Cohen and Levinthal, 1990). Because a larger knowledge base enables a company to identify and take in new knowledge quicker, it is important that companies understand the value of investing in their ACAP (Jansen et al., 2005). ACAP has been shown to be applicable in settings of innovations, intra-organizational learnings (Lane and Lubatkin, 1998), mergers and acquisitions, as well as new product development (Lane et al., 2006). The more advanced the knowledge resources within a company are, the more innovative a company becomes (Tsai, 2001; Meeus et al., 2001; Minbaeva et al., 2003). Consequently, the more R&D a firm engages in, the more knowledge it acquires (Cohen and Levinthal, 1990). This then creates a self-reinforcing circle between the firm’s ACAP and innovative capacity.

2.3.1 Exploring the two components of ACAP
Cohen and Levinthal (1990) explain that an organization should not only acquire and assimilate new knowledge, but also exploit it. In a reconceptualization of Cohen and Levinthal’s (1990) work, Zahra and George (2002), adapt a similar distinction when they coin the terms Acquisition, Assimilation, Transformation and Exploitation. Zahra and George (2002) put forward that ACAP must be understood as a dynamic capacity that consists of two distinctive parts: knowledge acquisition and knowledge exploitation. That means, knowledge must first be picked up, interpreted and understood and secondly, be combined with existing practices which will lead to new routines within a firm. The first part of ACAP describes the capacities of acquiring and assimilating external knowledge and is called potential ACAP. The second part of ACAP is called realized ACAP, which enables the firm to leverage the knowledge it absorbed. A firm’s ability to
value and acquire new knowledge (potential ACAP) will influence the amount of knowledge that is applied within the organization (realized ACAP), although not every firm is able to fully realize its potential (Zahra and George, 2002).

2.4 Disseminative Capacity (DCAP)

From our previous argumentation we have demonstrated how a firm can identify and apply new knowledge. What is absent here though, is how this knowledge is supplied. For effective knowledge transfer both the sender and receiver have to cooperate: it logically follows that the process cannot solely rely on the receiver’s ACAP (Cohen and Levinthal, 1990). Thus, it is needed to understand how knowledge holders supply other entities with their knowledge in order to enable a successful absorption (Tang et al., 2010). In 2004, Minbaeva and Michailova theorized the concept of Disseminative Capacity (DCAP) to address this issue with a study on expatriates’ reasons for transferring knowledge in multinational corporations. They defined DCAP as “the ability of the source to communicate his/her knowledge in a way the receiver can understand” (Minbaeva and Michailova 2004, p.666). Mu et al. (2010) and Tang et al. (2010) later defined DCAP as the knowledge sender’s ability to efficiently and effectively package knowledge in a way that receivers can accurately absorb and make use of it by put the learning into practice. Minbaeva and Michailova (2004) identified willingness and ability of a sender as two key factors in explaining DCAP, which in turn leads to knowledge transfer. Lower levels of willingness and ability would thus lead to lower chances of knowledge transfer.

2.4.1 Exploring the two components of DCAP

Similar to Zahra and George’s (2002) argumentation - potential ACAP does not automatically lead to implementation of new knowledge - we argue that DCAP in its current definition does not automatically explain transfer of knowledge. The notion put forward by Minbaeva and Michailova (2004) is that willingness and ability of a sender are driving transfer of knowledge. Other researchers have also adapted this term and talk solely about these characteristics (Hansen, 1999; Parent et al., 2007; Mu et al., 2010; Tang et al., 2010). This indirectly implies that willingness and ability equates ‘successful reception and implementation of knowledge’, without accounting for the actual actions that the senders have to take. The argument relies exclusively on the sender’s motives that could, but not necessarily have to, lead to knowledge transfer. We argue therefore that
the dimension of the sender taking action following his willingness and ability is missing in literature.

This point can further be strengthened by the fact that evidence for the alleged phenomenon is still absent. Minbaeva and Michailova (2004) stated that there is not any guarantee that a person with willingness and ability will actually spread knowledge; no significant effect of willingness on knowledge transfer was found. Similarly, their hypothesis that ability contributes to knowledge transfer was only partially supported. Gupta and Govindarajan (2000) also tested the influence of motivational disposition on knowledge outflows, but did not find support for this either.

From the above reasoning it can be assumed that although willingness and ability and are important, we argue that these abilities merely constitute the potential DCAP. By this we mean that it builds a framework or an environment that antecedes and allows for sending information. If the sender lacks these skills, the knowledge is at risk of being interpreted wrongly, coming out false or being disrupted (Zellman-Bruhn, 2003). The actual process of successfully sending information is dependent on more components than just characteristics. Lane et al. (2001) state that knowledge cannot be applied irrespective of the situation. A sender therefore has to be not only willing and able to spread the knowledge, but also must actively take action to spread, instruct and teach the recipient of the knowledge so that this person is able to understand and adapt the new knowledge in a specific situation (Lane et al., 2001; Kogut and Zander, 1992; Argote and Ingram, 2000). This approach is well-rooted in theories on knowledge acquisition, teaching and psychology, where it is argued that strong guidance (Kirschner et al., 2006), recipient-specific instruction (Cronbach and Snow, 1977) ‘showing how it’s done’ (Sweller, 2003) and developing a shared language (Kogut and Zander, 1992) are important pillars in teaching and enabling a recipient of information to process and apply new information (Chesnais, 1986).

Hansen (1999) stresses the importance that the sender needs to codify his knowledge before sending it, meaning that before engaging in knowledge transfer, a sender has to document or explicitly describe the information that is to be sent. This facilitates for the recipient to understand the knowledge independently of its original context and to apply this in a new situation. Gagné (1985) breaks down the instructional process in 9 steps, putting a strong emphasis on the sender’s
role in the transfer process. These steps, among others, include that a sender has to gain attention before commencing the actual transfer, provide learning guidance, and enhance retention of new knowledge (Kirschner et al., 2006).

We have described that not only sender’s characteristics play a role in successful knowledge transfer, but also the action. We argue therefore that this concept must be broken down into two parts in order to gain a complete understanding of the concept of DCAP. Using a similar approach as Zahra and George (2002), we propose using the concept of ‘potential DCAP’, to refer to the ‘motives’ for knowledge transfer, and ‘realized DCAP’, to refer to the ‘actions’ leading to knowledge transfer. Similar to ACAP, the efficiency factor explains the extent to which the potential is being leveraged.

2.5 The Efficiency Factor
Zahra and George (2002) introduce the term ‘efficiency factor’ in order to measure the extent to which a company can transform its potential ACAP into realized ACAP. This term explains why certain firms are good in acting upon new knowledge that they have identified, namely by realizing their potential ACAP. Expressed more clearly, firms with a high efficiency factor will have a high amount of their potential knowledge realized and firms with a low efficiency factor are less able to leverage their potential ACAP. This implies that firms may not always perform in line with their potential and should strive for a high efficiency factor to realize a high extent (Zahra and George, 2002). Considering the level of analysis of this study, we adapt this term and apply it on a team level by viewing a team’s efficiency factor as the extent to which they turn their potential ACAP into realized ACAP. Similarly, since we treat DCAP in a comparable way as ACAP in the sense that it consists of a potential and a realized part, we contend that the efficiency factor can also be applied in order to investigate to what extent teams can realize their potential DCAP. Measuring this efficiency factor is by Zahra and George (2002) suggested to be done by simply dividing the amount of a team’s realized capacities by potential capacities. Since the purpose of this thesis is not to test hypotheses, but rather to extend existing theory, we have not further operationalized this factor but instead provide suggestions on how to do this later on.
2.6 Knowledge Transfer defined
We defined knowledge transfer as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another". This implies that one team has to send their knowledge and that another teams needs to receive this knowledge and act upon it. Thus, knowledge transfer includes both a sender and receiver. As noted before, the recipient’s side can be described using potential and realized ACAP, through which a recipient identifies and exploits new knowledge. Moreover, a sender has to make sure this new knowledge is formulated in a way that the receiver understands it and knows how to apply it. The sender has to be willing and able to transfer knowledge and also spend time instructing and helping the other to apply it. We propose that these constructs of realized ACAP and realized DCAP comprise knowledge transfer.

2.7 Social Integration Mechanisms
Authors on literature relating to ACAP and DCAP have pointed to a variety of organizational factors that potentially impact an organization’s capacity to absorb and disseminate. As mentioned, realized ACAP and realized DCAP make up the two main components of knowledge transfer and, if carried out correctly and effectively, this may lead to higher innovation and a competitive advantage. It is therefore vital for companies to increase the amount of potential ACAP and potential DCAP that eventually can be realized. High knowledge inflow (high potential ACAP) is not necessarily better than low knowledge inflow when the knowledge that flows in is irrelevant or rarely applied. Similarly, higher levels of potential DCAP are trivial if the knowledge that is to be spread is not applicable. As described earlier, the efficiency factor explains to what extent firms leverage their potential capacity. For this reason it is relevant to understand what mechanisms firms can apply in order to increase this factor (Zahra and George, 2002).

2.7.1 Boundary Spanners
Firstly, we argue that boundary-spanning individuals play a role in assimilating new external knowledge into an entity, a role that Cohen and Levinthal (1990) briefly mention in their seminal article. These are individuals fulfilling a liaison role between their entity, which can be their department, or the team that they work in, and its environment (Tushman, 1977). Following the argumentation on knowledge transfer, innovation arises out of new combinations of existing capabilities (Kogut and Zander, 1996; Schumpeter, 1934). It is therefore needed to combine relevant knowledge in novel ways that requires the "ability to identify, assimilate, and exploit
knowledge from the environment" (Cohen and Levinthal, 1989, p.569). This environment does not only constitute other departments or teams, but also the external environment of corporations, such as customers and the market (Tushman, 1977).

Boundary spanners capacities allow to identify, absorb and assimilate relevant knowledge and experience from outside the entity (Brown and Duguid, 1991). Knowledge can then also be disseminated into their own entity and thereby secure an inflow of information from the environment (Tushman and Scanlan, 1981). Without involvement of the boundary spanners, there will still be an inflow of knowledge, but less of the knowledge may be applicable or applied, following the concept of the efficiency factor (Zahra and George, 2002). A boundary spanner can ensure that the right information gets in and that the irrelevant information stays out of the entity (Jansen et al., 2005). This boundary spanner can also properly ‘translate’ information that flows into an entity, which is needed since it can be argued that different teams may speak different ‘languages’ (Volberda et al, 2010), and knowledge has to be translated in order to fit in new situations that may be different from the original one (Carlile, 2002; Mudambi and Swift, 2011). This also follows from the concept described by Polanyi (1962; 1966), stating that understanding symbolism and interpretation of information is critical in order to fully realize the meaning of things and apply information apart from its original context.

To summarize, boundary spanners assist in increasing the effectiveness of communicating externally and will also contribute to internal knowledge dissemination (Tushman and Katz, 1980; Von Hippel, 1994).

### 2.7.2 Cooperative Environment

An often-mentioned theme in literature is corporations’ need for a cooperative environment (e.g. Kogut and Zander, 1993; Nahapiet and Ghoshal, 1998; Lane et al., 2006). Cooperation also leads to an increase of trust (Fukuyama, 1995; Nahapiet and Ghoshal, 1998), which in turn can contribute positively to combination and exchange of knowledge (Brown and Duguid, 1991; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Roberts et al., 2012) and learning (Brown and Duguid, 1991). Grant (1996) writes that collaboration will ‘increase the efficiency with which specialized knowledge is utilized’ (p.383). Since cooperation inherently involves two or more parties and since
we defined knowledge transfer as an interplay between sender and receiver, we expect that a cooperative environment may impact the way knowledge is transferred within organizations.

### 2.7.3 Knowledge Transfer Facilitators

A third concept that is likely to impact the usage of knowledge within a company is the actual opportunities that facilitate interaction and transferring of knowledge between employees. In a study of Dyer and Nobeoka (2000), they review the successful case of Toyota’s knowledge transfer network. The authors identified a number of important contributors to success, such as general meetings that were held with regards to production, market trends etc. These meetings covered general topics that were relevant for a high number of people. There were also committees that specialized in one particular topic such as cost or safety. Every committee organizes events that increase awareness and knowledge transfer in their specific area of expertise, such as training sessions and tours around facilities.

Involvement of many people is supported by Paulus and Yang (2000), who found that procedures aimed for generating ideas in a group were more efficient than when this was done individually. This people-to-people approached is defined as the personalization strategy by Hansen (1999) and is heavily dependent on intra- and inter-firm networks.

Another widely discussed topic is the use of Information Technology (IT) in knowledge transfer, which Hansen (1999) calls the codification method. This implies that knowledge should be codified as far as possible, i.e. made independent of its situation, and made accessible in visible form (such as schedules, guide or schemes) for others to use. IT can offer a platform for people with willingness and ability to disseminate their knowledge to engage in instructing and coaching. This will also enable recipients to gain a deeper understanding on how to put new ideas into practice (Wasko and Faraj, 2005; Choi et al., 2010). It is thus of importance that the organization creates and makes use of platforms for its members to combine their expertise.

### 2.8 Innovative Output

The process of innovating is highly dependent on the interconnectedness of units within organizations who are both able to receive and process external information but also disseminate
this within their team (Brown and Duguid, 1991). Thus, vital competencies of managers and firms are to identify and coordinate knowledge in order to improve innovation (Kogut and Zander, 1992; 1996; Grant, 1996; Hansen, 1999; Dunning, 2000). This becomes clear in the case of Toyota, described by Dyer and Nobeoka (2000), where inter-firm ties in combination with knowledge transfer from the external environment to the firm helped Toyota innovating. It can thus be argued that in innovative settings, knowledge transfer is especially important. Schumpeter (1934) brings forth that innovation and development of new methods are nothing more than new combinations of already existing resources. Knowledge, as one of the most valuable resources of a firm (Grant, 1996), has thus to be transferred and recombined continuously in order to innovate (Davenport et al., 1998; Nonaka, 1991). In terms of recombining knowledge in complex innovation activities, innovating firms will profit when there is a knowledge inflow from external parties being applied to ongoing projects (Meeus et al., 2001). This is why the concept of ACAP and DCAP has often researched in conjunction with R&D effort of a company (Cohen and Levinthal, 1990; Zahra and George, 2002; Dhanaraj and Pharke, 2006; Lane et al., 2006).

Innovative output in itself is a concept that has been treated in various ways in literature. Cohen and Levinthal (1990) take R&D spending as a proxy to measure to what extent ACAP contributes to the innovative capacity of a firm. Innovative output success can also be measured on a self-reported scale (Lane and Lubatkin, 1998, Liao et al., 2006) or by the extent to which an innovation was commercialized (Lievens et al., 1997). Fosfuri and Tribo (2008) measure innovation performance as a percentage of annual sales that came from new or substantially improved products.

2.8.1 Type of Innovation

Innovative output can be measured by the type of innovation in terms of novelty (Miron-Spektor et al., 2011). Different innovations have a different character and we distinguish between three main types of innovation. Firstly, new technology development can be seen as the most radical form of innovation where a fully new technology gets developed that the company has no previous experience with and that is not yet widespread in the industry. An example of this could be a car manufacturer that switches to battery technology instead of conventional engines.
In new product development, existing and known technologies get combined in a new way, resulting in a new type of product. Considerable adaptations in existing and known technologies have to be done in order to obtain this type of innovation, for example when a manufacturer of mobile phones and computers combines knowhow from both products in order to release tablets.

Lastly, in product improvement an existing product that is already on the market gets modified or upgraded so that it fits the customer better, complies with new regulation or has a better performance. A mobile phone manufacturer that releases a new version of an existing model with increased capabilities in an innovation in this category.

All the aforementioned constructs provide a multidimensional tool to analyze the output factor of a team.

2.9 Introducing the Theoretical Framework
As described previously, both ACAP and DCAP have originally been introduced as concepts on an organizational level (Cohen and Levinthal, 1990), and most subsequent research has therefore concentrated on the firm level (Szulanski, 1996; Alavi and Leidner, 1999; Nahapiet and Ghoshal, 1998), while fewer examples have focused on the underlying mechanisms that trigger or hinder individuals and teams to transfer their knowledge to each other. More specifically, the role of ACAP and DCAP on a group- and individual level in R&D settings not been given a lot of attention in research. Gupta and Govindarajan (2000) and Phene and Almeida (2008) state that more research is needed in order to understand the mechanisms that constitute ACAP and its effect on innovation. Researchers also call for understanding the social processes preceding organizational learning (Tsai, 2001) as well as the critical determinants for knowledge transfer. (Lin, 2007). Both Volberda et al. (2010) and Minbaeva et al. (2003) also encourage research on facilitators of knowledge transfer, with a possible inclusion of sender and receiver’s characteristics.

This need for a focus on individuals falls in line with Simon (1991), who writes that "all organizational learning takes place inside human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge that the organization didn't previously have" (p.176). Although Cohen and Levinthal (1990) were aware of
this, and even stated in their seminal article that “an organization's ACAP will depend on the absorptive capacities of its individual members.” (p.131), they disregarded the phenomena, resulting in a lack of subsequent academic research that takes these dynamisms into account. In a meta-study by Lane et al. (2006), this was one of the main gaps that the authors found in 289 studies on ACAP between 1991 and 2002. Thus, the key gap we will try to fill is how learning on an individual- and group-level happens and how knowledge can be spread.

Argote and Miron-Spektor (2011) classify these different organizational levels as ‘active’ and ‘latent’ context. According to them, the active context is where tasks and daily operations are being performed and where people are working and learning. This context is influenced by the latent context, which for example concerns the strategy, organizational culture and customer orders. Conversely, the latent context is influenced by the active context when organizational learnings from individuals get transferred to other parts of the organization and get internalized in an organization’s knowledge base. This can happen through knowledge transfer mechanisms like personnel transfer and may thereby impact the efficiency factor. Thus, ACAP and DCAP can be considered as multi-level constructs: learning impacts and is impacted by multiple layers of the organization (Lane et al. 2006; Liao et al. 2006).

This is why this study focuses on individuals and teams, both in terms of learning but also on how these learnings can be spread to and applied in other teams so that the whole organization will be able to profit. Since these topics are currently under-researched and therefore have a high level of abstractness, we intend to use a qualitative case study in order to shed light on the aforementioned themes. On the following page is a visual representation of the relationships that we expect between the various concepts, which we have addressed in this chapter.
Figure 1: Theoretical Framework
3. Data and Methods

In this chapter we describe our methodological choices for conducting an abductive research approach through a qualitative research method via a case study. The methodological choices and empirical data have been selected upon finding an appropriate fit between the theory and data as well as studying the phenomenon of knowledge transfer.

“The greatest enemy of knowledge is not ignorance; it is the illusion of knowledge”

Stephen Hawking

3.1 Research Approach - Abductive Approach

As pointed out in the previous chapter, many researchers call for the understanding of the social processes preceding organizational learning as well as the antecedents of knowledge transfer (Tsai, 2001, Lin, 2007), which we will address in this thesis. In this regard, we argue that the traditional approaches of building or testing of theory following induction or deduction had the risk of not being flexible enough for approaching this subject. We based this notion on that knowledge transfer is quite a complex subject that places high demands on understanding the constructs, especially when the interplay of social interaction is expected to permeate the study (Cohen and Levinthal, 1990). In order not to risk oversimplifying the execution of research (Denscombe, 2009; Dubois and Gadde, 2002), it was important that we as researchers provided ourselves with the opportunity to take many factors into consideration that could possibly influence knowledge transfer (Gupta and Govindarajan, 2000), such as the rapidly changing environment in innovative settings (Grant, 1996). We did this by allowing our preliminary theoretical framework to be altered in various ways, which is in line with Yin (2013), who calls for room to adjust a theoretical model based on research findings. Thus, we first introduced a preliminary theoretical framework, then compared this with reality and lastly adjusted this framework according to the findings and analyses. In this sense, the choice of research approach that was applied followed an abductive approach (Saunders et al. 2009).
3.2 Research Method - Qualitative Method
As previously described, we have strived towards reaching an understanding of social and organizational processes and mechanisms in-depth, which a qualitative research method allows for (Doz, 2011; Saunders et al. 2009). More explicitly: the focus of our research questions is to investigate the processes connected to knowledge transfer and to explore why they occur, how they function and who the main actors in these are. By doing this we aim to build our understanding for the personal, team and organizational mechanisms in knowledge transfer, as well as how ACAP and DCAP work on a team and individual level. An example of this is that knowledge transfer is not only dependent on and influenced by the actual knowledge a person has (know-how and know-why) but also on a person’s network (know-who) (Easterby-Smith et al., 2008). Denscombe (2009) also states that the insights authors gain by using the opposing quantitative approach can be at risk for simplifying reality, which does not give the same richness of insights. This contradicts our purpose since we searched for applying a method that could bring understanding for the phenomenon of knowledge transfer and following this reasoning, we therefore applied a qualitative research method. A quantitative method is likely to be more appropriate in follow-up studies when we have built a clear comprehension of the concepts.

3.2.1 Research Strategy - Single Case Study
The choice of research strategy was a result of decisions regarding three main aspects: firstly, the formulation of the research questions; secondly, the amount of control we desired to execute over behavior of the study object, and lastly the focus on contemporary versus historical events (Yin, 2013). We argue that since our research questions aims to answer a “How?”-question, since we had limited control over the research object to be studied and because this study focus on events in current time; the preconditions were in line with applying a case study as research strategy. The literature on ACAP and DCAP gave us guidance in choosing this approach, since we intended to use similar methods that previous authors applied to study closely related topics. For example, Dyer and Nobeoka (2000) and Mason and Leek (2008) studied the interplay between underlying factors of knowledge transfer and also used a case study method. In this sense, we expected that using the same strategy could give a clear path dependence backwards and signal consistency with other studies, although we focus on a lower unit level, rather than a firm-level. Besides this, DCAP
is still a fairly new concept that calls for more in-depth understanding that suits for a case-study strategy.

From an empirical perspective, there were also benefits to apply this research strategy since our selected company gave wide access to one of their main R&D departments. This created possibilities for going in-depth in this department and focus on the understanding of how ACAP and DCAP were related and in what way they affected output of teams. This then formed the basis for our single-case study where we saw possibilities to apply a well-known theory on a new unit of analysis (Yin, 2013). In doing so, we followed the strategy of an embedded case, rather than investigating the whole company (a holistic case). The multiple-case study was in these premises disregarded, because it would endanger the quality and put us at risk of missing out on rich information (ibid) due to the broad focus.

3.3 The Company of Examination - Atlas Copco
Atlas Copco is a large Swedish industrial firm with a long history that reaches as far back as the 1800s. The company operates worldwide in the four industries of compressor technology, industrial engineering, mining and rock excavation technology, and construction techniques. Today the company’s turnover reaches almost 95 billion Swedish crowns and employs over forty thousand people globally (Allabolag.se, 2015). Especially in the segment of Mining and Rock Excavation the industry is characterized by fierce competition between a few large worldwide players, which tend to compete on product quality and innovativeness rather than price. This makes the R&D function in this segment an important cog and an engine for future growth in this industry segment.

This R&D department invents for the global market and is located in Örebro, Sweden. Here, technologies and products for mining and tunneling equipment is carried out with the help of 200 employees, mostly engineers. As of one year back this department was restructured into three different product categories that has different responsibility concerning Infrastructure: overall service of mines, Material Handling: machines that transport blasted rock in mines, and Drilling: machines that drill rocks in mines. In the latter two product categories, the most technologically advanced machines are invented and developed, which is why we have focused on these. The restructuring of the department was partly carried out with a background of that knowledge was
anticipated to have better opportunities to be shared in the new organizational structure. Yet the company still struggles with taking full advantage and the management has noted that this area has great potential to further develop. This opens up opportunities for us to go in-depth examining how transfer of knowledge proceeds in the department as well as study the role of social integration mechanisms in this setting.

### 3.3.1 The Structure of the R&D Department

![Organizational chart of the URE Department](image)

Figure 2: Organizational chart of the URE Department

Based on company documentation, we characterize the R&D as a mix of a matrix and functional structure, as seen above. The main departments are concentrated around the product categories, and within these there are multiple managers who are responsible for a certain group of products or technologies. Every group manager keeps overview of his or her products or technology area and makes sure they remain up to standard. This is done by regularly communicating with other departments such as the market department and by managing a number of engineers, each with a different specialization such as hydraulics or engineering. This new structure also puts the project
managers in a central position and they work under supervision of the project office, which assigns the various innovation projects to project managers. Thus, a project manager should ensure success and continuity of the innovation project itself, whereas the group manager ensures that the right resources are in the right project group and that project teams create synergies.

### 3.3.2 The Project Teams

As described above, the matrix organization structures employees in project teams, commonly consisting of four to ten people. In these teams, employees are mixed up from various functions. Teams are tasked with one project that can run from a year up to around five years. Project workloads naturally vary in intensity during the innovation process and projects can also be stopped or paused if they ‘get stuck’ or if other innovations are given higher priority. The projects are diverse in character: some are assigned to develop totally new technologies for the future and some concern extending or updating current products.

### 3.3.3 The Respondents

In order to gain a multifaceted understanding on how knowledge transfer looks in this department we focused on innovation projects with a varying nature of success. This variation both regarded knowledge transfer but also the innovative result, and we analyzed both ongoing and finished projects. Similarly, in terms of the respondents, we included people from different levels of the hierarchy, from various functions, with different amount of company experience and of different ages and sexes. We also thought it was beneficial to interview people from closely related functions to R&D in key supporting roles, such as IT, sales and service, which further could clarify a general picture of a team’s way of working.

We let nine teams constitute the main empirical data for this study. For each of the nine projects, we decided to interview two to three people, which totaled 28 interviews. Additionally, we had interviews with 7 people in supporting functions relating to these teams. The table in appendix shows an overview of the total amount of interviews.
3.4 Data Collection Technique

In the interest of conducting this study as thorough as possible, we spent two and a half months on-site at the R&D department, studying the organization both prior to and during the data collection. Through this we received intensive exposure to the firm, its members, and the culture. Before we even started interviewing people, we attended an introductory course and spent one whole day just to see the different facilities and production sites that brought us better overall understanding of the organization. We also had the chance to get to know the office during a number of days in which we were able to talk to various people informally in order to learn even more about the division. We argue this was important for the quality; by being able to gain insights about the company, department, teams and individuals, we were also able to use this knowledge in designing the interview guide as well as in conducting the interviews.

3.4.1 Primary Data

The vast majority of data was collected through interviews formed the empirical base for this study. The choice was deliberate on the background of the wide access we had to this department and to its employees, which created good opportunities for gathering rich, in-depth information that proved to be strategically important for this study. Relying mostly on primary data also allows us to compare theory with reality and develop theory based on this, which logically connects to the aim of the abductive approach (Denscombe, 2009), like this thesis does.

3.4.1.1 Interviews – Semi-structured Interviews

Because of the possibilities for collecting data as described before, we were concerned that methods such as observations or surveys had the risk of not providing us with the aforementioned richness we were striving to obtain (Healey, 1991: Merriam, 1998). For instance, we thought questions regarding the processes of sending or receiving knowledge called for on-site explanation and clarification. We also wanted the respondents to be clear and honest and to have possibilities to explain their ideas and ask questions whenever needed. Consequently, we applied a semi-structured interview form. This choice also follows from the fact that we, the researchers, had some theoretical background information about the subject and the company which we felt was necessary in order to gain a better understanding of the topic and formulate questions based on this background information (Saunders et al., 2009). This stands in contrast to an unstructured interview form,
which is suitable when having little to no prior knowledge about a topic, but in our case would put us at risk of deviating too much from our previously proposed theoretical framework (Merriam, 2009). Neither did we want to push respondents in a specific direction since this leaves little room to ask follow-up questions or make clarifications which is the case in a structured interview (ibid). We therefore developed an interview guide that enabled respondents to speak freely, and where questions could build on new ideas that came up during the interview (Saunders et al., 2009).

3.4.1.2 Interviews - Course of Action
In total, 35 interviews were carried out during a time frame of over 2 months. Each interview lasted for approximately 60 - 90 minutes and was conducted face-to-face in meeting rooms in the respondent’s home department, the R&D headquarters. However, we needed to interview one person via telephone due to this person's busy traveling schedule. We thought it was important that the vast majority of interviews were carried out in an environment that the respondents recognized (Saunders et al., 2009; Stokes and Bergin, 2006). Both authors participated in all interviews, and the conversation was recorded by two different recorders. The strategy of conducting the interviews reflects our ambition to make respondents feel comfortable and make them as interactive as possible to capture a rich picture of verbal and nonverbal expressions such as body language and gestures. We interviewed the respondents one by one and thus did not opt for group-based ways of collecting data. We argued that in groups, the risk for group thinking is too high and a risk that some respondents will not be able to make themselves heard (Saunders et al., 2009).

The first 5-10 minutes of every interview was reserved for ‘general talk’ regarding the technological innovation developed by the team, the role of the interviewee and the other team members. This moment also helped us to gain a general perception about the person, the background, job satisfaction and the like. It also facilitated to establish trust by telling the respondents who we were, what our intentions were with the study, and answer questions that respondents had up front. The participants were told to be fully honest, elaborate as much as possible and ask questions when anything would be unclear. They were also assured that their name and their answers would be treated confidentially both to academia and the company, which we thought could bring more realistic answers. The respondents were given the interview guide beforehand, at least one day in advance. We regarded the respondent’s risk for overthinking or
biased interpretations (Saunders et al. 2009) as subordinated to the advantage of early reflection and thinking processes.

The vast majority of respondents’ mother tongue was Swedish, which is why we encouraged them to speak Swedish. One person stated that he could better express himself in English and therefore we chose to conduct the interview in English instead. This falls in line with our aim for comprehensive answers; allowing respondents to express themselves in their preferred language enables them, for example, to use metaphors and tell stories with more ease. This, in turn, let us capture nuances in the answers better than when they would forcibly speak a language that is not their first (Polkinghorne, 2005). Both authors understand the Swedish language but one of the authors is a non-native Swedish speaker. Therefore the questions were sometimes asked in English, which were then usually translated into Swedish by the other author in order to avoid misunderstanding from the interviewee.

3.4.1.3 Interviews - Interview Guide and Operationalization of Concepts

Before starting interviewing we theorized themes we wanted to explore through a proposed theoretical framework, which can be viewed in the end of the theory chapter. Therefore it was important to design questions that could capture how these themes and how they were interrelated. The constructs of ACAP and DCAP were each broken down to potential and realized capacity. In the former concept we tried to identify the team’s potential for respectively sending and receiving information and in the latter one we tried see if and how the team had realized its capacity. Furthermore we asked about themes connected to social integration mechanisms by examining the degree of involvement of key individuals, the knowledge transfer systems that were in place, and the perception of the organizational culture. In the last step we asked about the outcome of the project that the team had been or was working on. This included both the respondent’s and organization’s satisfaction as well as the outcome of the knowledge transfer process. The interview guide includes about 30 questions and examples of these are attached in appendix 2

3.4.2 Secondary Data

Since the usage of secondary data requires more critical questioning than primary data and may also not be completely accurate in representing the phenomenon of interest (Jacobsen, 2002), we
used secondary data primarily in terms of complementing and deepening our understanding in addition to the interviews we did. For example, we used a few general secondary sources but mostly brochures about the innovations in order to include data such as financial performance of projects in our analysis. We also accessed information about company culture and used organizational charts in order to locate people on certain positions in the company. Subsequently, delving into secondary data sources enabled us to prepare for the interviews, to formulate interview questions based on each respondent’s own role and function and to put the answers in context. We want to bring forth that we had to be especially careful while dealing with some of the data from innovations that were not yet on the market since this was highly confidential information that is therefore not referred to as such.

### 3.5 Research Quality - Validity and Reliability

It is of fundamental that researchers and others have confidence in the ethical implementation of this study and our ambition is that in the future others can land in consistent findings (Merriam, 2009; Saunders et al. 2009). In this section we display how we worked with validity and reliability regarding the research design and data collection and cover external validity, construct validity and reliability, since these are especially critical in single case studies (Yin, 2013)

#### 3.5.1 The Research Design

**3.5.1.1 External Validity**

The external validity concerns awareness regarding the study’s generalizability beyond the specific study (Yin, 2013). Here, we want to stress that the study examines a specific topic by observing a certain set of people, in a specific department and country. Therefore, the logical argument that follows is that the only generalizing would include these particular sets of results to a broader theory (ibid). This means that this study does not aim to generalize results of how knowledge transfer proceeds in innovation development teams to any other situations. Also, since we are dealing with an unsaturated field of research we suggest that this study should get replicated both one and two times before broader generalizing will take place. We propose that the reader keeps in mind to read the results against the background of this specific case.
3.5.2 Data Collection

3.5.2.1 Construct Validity
We want to bring forth that we are aware that case studies especially have been a target for critique in terms of that these studies have not always included a sufficient number of operational measures and therefore let subjective judgements interfered when collecting data (Yin, 2013). This we regarded to be a serious threat that we, during the research phase, have actively worked with. We have done this by using multiple sources of evidence so we could, in a convergent way, support our research and create a chain of evidence (Saunders et al. 2009; Yin 2013) and additionally let key informants review the work (Yin, 2013). The following procedures describe in detail how we have done this:

- We interviewed various respondents from successful and less successful project teams in order to open up for a multifaceted view of innovative success and failure.
- We interviewed respondents from different layers and functions as well as people in support functions in order to open up for contradicting views
- The respondents were interviewed at different occasions over two and a half months in order not to be biased by the situation and time
- We spent a considerable amount of time at the company to study the climate and organization in addition to just conducting interviews
- We have tried to bring forth our own as well as the respondent’s critical reasoning in the text in order to put light on many various dimensions
- During the whole research process, we had had a supervisor both at the university and the company, who have both participated in the process and have critically reviewed the work
- We have used secondary data in order to try to fill in our gaps of technical knowledge skills in order to get a better understanding of the organization and innovations.
3.5.2.2 Reliability

In order to establish consistency with other studies on the subject, we applied a similar approach to Dyer and Nobeoka (2000) and Mason and Leek (2008) to study knowledge transfer. Concerning our study, we have carefully documented every step of the process to facilitate for others to both review and replicate this study (Yin, 2013). Giving some examples of this, we developed a cloud-based case study database, which included case study protocols where we structured and kept overview of documentation, recordings and protocols concerning our empirical data. However, we want to put forth that we see difficulties with achieving complete reliability, just as Merriam (2013) argues that difficulties in social sciences concern the fact that human behavior is never a static product.

3.6 Treating and Analyzing the Data

The 35 interviews were all summarized and partly transcribed with the help of notes and recordings in order to build the empirical chapter including quotes. We decided to only fully transcribe 5 interviews, given the time constraints and the fact that only one of the authors has Swedish as the mother tongue. The interviews that we selected for full transcription were carefully chosen upon the premises that they could represent the other interviews, and covered a variety of respondents of different projects, functions, and levels of hierarchy. Despite only transcribing a few interviews, we both listened to all interviews at least two times so that we were able to capture all the essential parts during the summarizing.

Analyzing the data was an iterative process with constant transitioning between theory and empirical findings following the abductive logic where of the central theme is called 'systematic combining’ (Dubois and Gadde, 2002). We structured our data by using an approach introduced by Gioia et al. (2013), which has been applied by various authors in similar studies to ours (Anan et al., 2007; Nag et al., 2007; Phillips and Maguire, 2008) This approach entailed that, with help of our preliminary theoretical framework, we processed the data and identified key words and quotes from the interviews that represented similar categories. Thereafter we grouped categories together that portrayed comparable characteristics into concepts. These concepts were essentially subdivisions of the overarching theoretical dimensions that followed from our initial framework. We then identified relations between concepts and, related these to the categories and, based on
this, revised and extended our theoretical framework, which lead to introducing a number of theoretically generalizable propositions. This data structure can be found in appendix 3. Although we strived towards interviewing a diverse crowd and to reviewing the data with a critical but open mindset, we could quickly and clearly identify emergent patterns already after analyzing the first interviews.

3.7 Methodological Limitations

To begin with, we stress that case-based studies like this one can be regarded as one of the more risky strategies due to its potential and historical lack of rigor and systematic reasoning (Yin, 2009). Despite this awareness, we chose this method because of the fit with the empirical data where we had the chance to go in-depth. We also stress that this study does not seek to replace existing models and theories but rather tries to complement the field by broadening the understanding by adding new dimensions (Yin, 2009). A drawback that often comes as a result of going in-depth with the data is the lower number of respondents than in a more quantitative approach (Desencombe, 2009). We have tried to work around this limitation not only by including a relatively high number of respondents but also by spending over two months at the company so we were able to really soak in and study more aspects such as people's behavior and the organizational culture. However, we think it is important to stress that in social science research in general, being purely objective is a non-attainable goal since every person is inherently viewing the world based on his or her own mind frame (Feyerabend, 1955). Yet, this is something we have tried to have in mind during the research process.

Moreover, when working with qualitative data, there is a risk for biased, overlooked or misinterpreted observations (Merriam, 2009, Saunders et al., 2009). We agreed that an appropriate way to minimize this limitation was conducted by doing as many interviews face to face with both authors attending.

Another point to highlight is that the interviews took place in the Swedish language despite the fact that one of the authors was not fully proficient in Swedish. There is thus a risk that one author was better at identifying non-verbal cues and ‘reading between the lines’. This because the qualitative research is more dependent on a researcher’s interpretation and his or her ability for making logical
inferences compared to quantitative research (Yin, 2009). We bypassed this problem by clarifying this in the beginning of each interview which lead to occasional pauses when clarification or switching to English was needed. An unexpected positive effect of this drawback was that we experienced that the respondents deliberately slowed down when they were talking, which enabled the respondents to be clearer in their explanations and allowed them to take more time to reflect on the questions. In hindsight, this drawback seemed to have less negative impact on the study than initially anticipated.

Because of the confidential nature of information we processed when investigating the innovations and technologies that were not yet on the market, it was imperative that this information did not leak to the customers or competitors. For this reason, we signed a confidentiality agreement prior to the study, where we pledged not to spill any information to people who are not authorized to know. We want to stress that the confidentiality of the data and subsequent treatment has not impacted the quality of our study.
4. Findings

*In this chapter we describe the different parts of our initial theoretical framework that will be evaluated together with the data on the concepts gathered from our interviews. The findings clarify our empirical results and we will go more in detail regarding the relationships between these in the following chapter.*

*“Knowledge is a treasure, but practice is the key to it”*

Lao Tzu

4.1 Description of the Potential and Realized ACAP

In terms of potential ACAP, we noticed in our interviews that some teams were relatively good at acquiring and assimilating knowledge from parties outside the team. These teams were often working on a project that had similar characteristics to one or more teams and thereby had knowledge inflow from these teams. Other examples of taking in external information was most often by close cooperation with customers or suppliers. Especially suppliers turned out to have a high impact on the a team’s external knowledge inflow, particularly when an innovation that a team was working on was relatively new and little information was available within the own organization. Teams that took in less external knowledge often worked on innovations that were very unique and unrelated to innovations that other teams were working with. Another explanation was that these teams generally worked separate from other teams and involved fewer team members than the other projects. This was reflected in the following quote:

*“Some people within Atlas Copco are very specialized and have the knowledge mostly in their heads. They can be very locked up on their own ‘island’ without communicating much to other people.”*

Project member A, Project 7

Only very few people we interviewed seemed hesitant to take in new information and they also reflected upon colleagues belonging to other teams as having no resistance towards taking in external knowledge, despite that there were for example monetary incentives regarding patents. We also saw that teams doing well in acquiring knowledge generally had members that were active, had a great deal of personal drive, and took initiatives, like one of the project managers noted:
“*The key success factors in projects is to have people who are very engaged in a project and believe in its outcome.*”

Manager A, group level

“*People with a strong personality or perception can strongly influence teams.*” Project member A, Project 4

Another factor that influenced teams’ potential ACAP was connected to the continuity of the project. Within the organization, it sometimes happened that projects got paused for a certain amount of time, usually in order to free up resources for other projects that had a higher priority. When a project resumed after being paused, it happened that some of the existing knowledge and information was outdated; knowledge carriers left the company or the regulatory environment changed. This meant that information was hard to retrieve and even if it was found, it could be no longer relevant. This was also caused by the fact that the company did not have advanced routines for storing information, causing projects that got paused to be ‘forgotten’.

“There are no routines after a project has been paused in order to retrieve the knowledge. There is a ‘pause-report’, but still it will be much easier to restart a project after three months than after a longer time because then most people that worked with it will still be in the company. However, there is not clear structure for this. Until now, there has not been problems with lost knowledge and when [a project outside this study] was restarted this was lucky mainly due to the people were still in the company.”

Manager, support function

4.2 Description of the Potential and Realized DCAP

We identified that there was generally a gap between potential DCAP and realized DCAP in teams. The vast majority of respondents had little or no resistance towards helping or instructing other people. In fact, they told us that they were able and willing to spread their knowledge and perceived that their team’s knowledge would be of help for other teams in the organization (potential DCAP). Yet there were only a few teams that turned their potential DCAP into realized DCAP. These teams typically held meetings where they presented their findings and learnings for interested parties in the organization. Since there were little formalized routines regarding these seminars and since the
attendance varied, the knowledge did not always reach the recipient that could potentially make most use of it but still contributed to general knowledge base of the organization. This way of learning and communicating reflected the organization’s mindset; knowledge transfer was mostly reliant on the ripple effect following individual efforts to spread knowledge, rather than on formalized and tailored flows of knowledge between specific senders and receivers.

“Transfer of knowledge goes through personal contacts, through actively taking contact with people that have more knowledge than yourself.”
Project member B, Project 5

As stated before, most team did not succeed in realizing their potential DCAP. The most extreme examples of this was two projects that were initially driven by only one or two project members who were working in isolation, partly because of the unique innovations they worked with, but also because these individuals had much freedom to steer their own projects that lead to little knowledge transfer to other teams.

“The greatest challenge with the project has been that only one person was working on the project from the start and if more people had been involved from an earlier stage, it had went both easier, faster and less time consuming to come up with a good, simple solution from the start.”
Project leader, Project 4

Another factor playing a role in the lack of realized DCAP was the fact that time pressure made team members prioritize the progress of their own projects, rather than investing time and energy in helping other projects move forward. This was mentioned by many respondents such as the one below:

“[About updating databases, ed.] I am not doing it as I should, the mantra from the boss is: focus on the most important first, namely deliveries. This often becomes catch-22, if guidelines were to be properly updated we could more efficiently run our projects. This is a little bit like running with the bikes on our backs, instead of taking the time to put the bike down and then bike away.”
Project member A, Project 8 and 9
Furthermore, there were no clear incentives in the company that would encourage individuals to spread their knowledge to the organization; such an action was rather a result of their own drive to help others. The gap that we described was smaller when we studied the dissemination of knowledge within a team since team members were usually good at spreading their own knowledge during group meetings or brainstorm sessions. Although the encouragements for holding these types of sessions varied between the teams, the general tendency was that transfer of knowledge only took place within a team due to closeness between team members and was also carried out informally.

“I like to have transparency in the group, and the members wants to learn good and bad learnings from projects with each other. On the other hand, this does not really happen outside the own team.”
Project leader, Project 7

If this dissemination of knowledge outside the team happened, it had two main effects. Firstly, it improved a team’s own knowledge inflow. More specifically, we observed that when a team was able to identify another team’s need for knowledge, the actual knowledge outflow (realized DCAP) from one team to another team increased. However, a receiving team first needed to create awareness amongst other teams so these teams in turn could tailor their knowledge flow back to the particular team. The fact that this knowledge flow was tailored towards a team’s need was important because of the high technological complexity of the innovations. Awareness could be raised by disseminating information regarding a project’s challenges and progress through various channels. In short: when a team disseminated information externally, it also posed itself as potential receiver of knowledge and increased awareness amongst other teams regarding the information they needed.

“The team has been dependent on searching information and knowledge from outside the team. It was an open mentality in the group. (...) I have also invited to seminars for others to give input on our work. (...) Solutions were applied from other teams, for example from [Project 1].”
Project leader, Project 6

Moreover, disseminating knowledge improved other teams’ knowledge inflow. When teams were good at disseminating their knowledge, others could benefit from it. In general we saw that the
respondents were better at transferring knowledge to people within their own functional group. For example, when a hydraulic engineer was working with a certain issue, that person assisted other teams working with similar issues by spreading information:

“Information from our team was of value for other teams, for example the knowledge we gained on certain parts on the hydraulics we shared amongst at least the hydraulics people.”
Project member B, Project 2

Taken this together, the DCAP effect showed to create a paradox; by disseminating information, a team increased its chances to get a reciprocal knowledge flow back, thus teams had to realize their external DCAP in order to increase their potential ACAP. However, we experienced that teams faced difficulties disseminating information to other teams since they were unaware of another team’s need for knowledge. Hence the paradox followed that a team could send knowledge more easily if they first received information about other teams’ needs. Yet, in order to receive information from other teams, they first had to send out their own knowledge. To conclude, without first receiving, they did not send and without first sending they did not receive.

“Project groups need to take initiative themselves to ask other groups for input, it is not something that comes naturally. Though, this would have been very helpful, as was shown in [Project 8].”
Project leader, Project 8 and 9

“You need to know people inside the company in order to find information, that in turn makes you able to communicate (...) This is our Achilles heel.”
Manager, product category level

4.3 Description of the Social Integration Mechanisms
We treated social integration mechanisms alike across the various project teams since these mechanisms were organized on an department level and hence all teams had similar potential to take advantage of these.
4.3.1 Boundary Spanners
Throughout the interviews, we identified that there were certain individuals that took a more central role in connecting the team to their external environment. Sometimes these people were identified explicitly by interviewees, other times we were able to pinpoint these individuals in the interview based on how they described their way of communication and working. As an example, these people could say:

“(...) I knew about this project [Project 7] that started the cooperation so that they [Project 7] did not have to redo the same development twice. It also helped that team to save resources (...)
Project member B, Project 7

Often, these individuals were included in the ‘core project group’, which included a few roles of the team members that often remained stable over the course of the project, such as project manager or technical project manager. Experienced individuals most often naturally got assigned to these roles since they had been with Atlas Copco for a long time, sometimes up to 20 years, but occasionally these people did not have a formal key role yet still took a central role in the team because of their knowledge or network. These boundary spanners had two distinguishing characteristics that were vital in bridging the team to other parties inside and outside the organization: a large network through which they knew where to find knowledge as well as had a lot of knowledge themselves.

“If you need to get information it is common to go to a person who has been working with Atlas Copco for a long time, and ask that person if a certain project has been carried out before.”
Project member B, Project 6

Through their experience they managed to get to know the company, its members, and the departments as well as the external environment such as the customers, competitors and similar industries and they could use their knowledge in order to solve problems within the team. Their experience also enabled them to communicate more easily and aided in accessing various databases and other online and offline knowledge repositories. Often these people knew which pitfalls in projects to avoid, what technologies were present in which machine or what materials were suitable in which type of mines.
“People with a lot of knowledge make sure that ‘general knowledge’ is being used within the project so that ‘simple mistakes’ are not being repeated, such as not using certain components or materials. These are people that know this by previous experience and through contacts.”

Project member A, Project 3

One general theme was to include the market department, which task in R&D projects was to speak for the customer’s wants and needs. When the market department was involved to a high extent this lead to more knowledge inflow into the team. This department often handled the communication with the team through key persons in the project that ensured that the talk between these two entities could run smoothly.

4.3.2 Cooperative Environment

We identified that the working environment was very appreciated by individuals and was often referred to as a people-oriented culture similar to a small firm. During the time we spent in the company we often saw that people spent considerable time with each other on lunch breaks and informal coffee breaks where they seemed to appreciate each other’s company. We also observed that this working place had a positive working atmosphere where people seemed proud of their work and accomplishments, which we interpreted was one of the reasons why employees often stayed with the company for a long time. We could not identify mistrust amongst employees, nor was there prestige connected to possessing a certain type of knowledge or other personal barriers towards exchanging knowledge.

“Most knowledge sharing goes face-to-face, people sit down to talk to each other in order to learn about topics they are most knowledgeable about.”

Project leader, Project 3

“The atmosphere within Atlas Copco is very supportive.”

Project manager, Project 5

People expressed that they could easily approach each other for help and it was said that they were willing to spend time helping other individuals. Despite this, it was surprising to see that only one of the teams that we examined had been effective at actively spreading their knowledge to other
teams and the organization, which contributed to the knowledge inflow of two other teams. We likewise found it noteworthy that the eight other teams that we studied only to a moderate extent actively spread their knowledge, despite their positive attitude and the cooperative environment. Most respondents instead prioritized their own project goals before helping other teams, which could for example come as a result of time pressure. They also said that they did not engage in this because they did not know who the potential receiver of the knowledge was and that there were only few formal procedures for spreading knowledge, instead this was to a large extent reliant on employee’s own initiatives. For example one respondent said:

“Telling other people and share knowledge only happens when there is time. Nobody checks whether it is done or not. If one can spend 20 hours on a project and that person spends all these 20 hours on it, there is no time left to share knowledge with others.”

Project member B, Project 2

The interviewees also mentioned that there were little cross-functional roles that could potentially bridge the various teams. However, within the functional groups, such as hydraulic engineers, there were knowledge exchange meetings that were appreciated since it enabled them to solve challenges and problems. Taking this together, we observed that this high-trust cooperative environment mostly contributed to a flow of knowledge on an individual level, that to a great extent only took place if one person or in specific cases teams initiated it. On the other hand, we observed that the structure of the organization impeded cooperation since teams were structured in such a way that they worked very independent of each other.

4.3.3 Knowledge Transfer Facilitators

The organization has a number of databases and shared network drives in which documentation of each project is uploaded, but due to the complexity, restricted access and a lack of a user-friendly interface these databases appeared inefficient. Some teams noted that they used databases and intranets extensively and also added project documentation in a structured manner after project completion but more often than not, respondents complained about the complexity of the databases and were less motivated to contribute to them with their knowledge. What was noteworthy was that virtually all teams had different ways to document and store information and we could not
identify any unified strategy to store or locate knowledge within the company, which was accurately reflected by one respondent stating:

“There is a lot [knowledge] available but I never look at it. There are so many databases and portals, people can’t even be bothered to look into that.”
Project member A, Project 5

Both through verbal and nonverbal reactions from respondents we observed widespread frustration regarding this matter. Therefore, we decided to also include IT people in our study as we wanted to hear their description about how the company worked with documentation. From interviewing these people we likewise interpreted a great deal of irritation. The main reason for this was that there was not a common strategy for documentation and the individuals, teams, and department could basically decide both if and how to store information. This created a documentation mess that few people could navigate, yet we noticed that respondents that had been with Atlas Copco for a long time managed this better than newcomers. For example one of the IT person’s expressed:

“(…) we have no clear directives from above but management rather tells us: do a little bit of this and a little bit of that just as long as it gets good (…), neither management says how we should organize information (…) as well as the organization has not stated how we should find information; we do not know where the information exists in this large network.”
Employee B, information technology

This made documentation from projects hard to structure and this could therefore, only to a limited extent, contribute to organizational learning. After finishing a project, only a few teams organized so-called ‘lessons learned’ sessions which were aimed at informing other groups on successful and less successful practices. Everyone who was interested could join these sessions, but these meetings were rather unpopular and attendance was driven by individual initiatives, not by formal structures. For example, one respondent stated this by saying:

“There are not that many [ways of sharing knowledge] available. There are databases within Lotus Notes [E-mail/database program] but it is difficult to find what you need. There is no fixed way of saving and storing information. I discussed mostly with [name], face-to-face, informal. There is some information stored in drawings and
... technical specifications but much information is ‘in the heads’. This is also the reason why spreading this knowledge can be difficult. Little is actually documented.”
Project leader, Project 1

The vast majority of respondents said that they used emails if they wanted to gain quick information about certain topics of which they expected that someone in particular knew about.

“Email is very effective to share information and knowledge as long as you do not send it to too many people. For example: sending out a question to a few project leaders often yields helpful answers.”
Project member A, Project 6

In other instances, most information was shared during coffee breaks or simply by talking to colleagues that were sitting at the adjacent desk. ‘Hallway talk’ played a central role in informal knowledge spreading since this enabled people to connect, also referring back to the open organization climate discussed earlier. Many referred to this way of communicating as being a result of a company history that still embraced the business culture of a small company:

“There are many creative people and (...) we are a little bit like a ‘workshop-company’ in which little information has been documented (...) Previously, when this was a smaller organization, the more ‘relaxed’ way of doing things was a better fit.”
Project leader, general

By immersing ourselves in the company and by participating in coffee breaks and lunches, we discovered that people who had been in the company for a long time both often and broadly used informal ways of communication to acquire and spread knowledge. For example, during one of the coffee breaks there was one person who told his colleagues about a certain customer issue that his team had encountered earlier that week. This lead to a discussion amongst the colleagues where people advised how the issue could potentially be solved, based on their previous experience with similar situations and increased the awareness of certain solutions for problems within the organization. In our interviews we noticed the value of these informal sessions:

“On Fika [coffee breaks, ed.] there is also a lot of knowledge flow.”
Project member A, Project 6
4.4 Innovative Output
When analyzing the project teams of our focus, we analyzed to what extent the projects were able to reach their goals. We based this on descriptions of project members as well as members from other project teams, project documentation that was given to us from R&D managers and our accumulated input from managerial layers in the organization. In certain projects, the initial expectations were not reached whereas in others they far exceeded the goals. Below, the nine projects are further described in detail:

**Project 1** was intended to investigate if it was possible to replace the engine in an existing machine with an engine based on a new technology. This innovation can be typified as new technology development since a technology was to be employed that was not previously used within the company. The project was carried out in cooperation with one of the subsidiaries abroad and additional knowledge was brought in by one of the suppliers. The project was very successful and exceeded the initial expectations of performance:

“Estimation: 2.5-3h of use; Test result: 4.5h of use.”

Project documentation

**Project 2** had as a goal to further productify the output of project 1. With previous findings, a number of prototype machines were built and tested with a potential customer. Although this project is still in progress, it is in line with the planning made beforehand and can so far be regarded as successful.

“We are in line with the planning, I am happy with the performance of the team so far (...) the communication has been clear”

Project leader, Project 2

**Project 3** was initiated in order to implement major changes to the drivetrain of a machine. The goals were to save fuel, to shorten a machine, and to build the product in modules that could easily be added, removed or changed depending on what the customer wants. This technology is also relatively new to the company and therefore was challenging to realize. Although this innovation is currently being tested, the performance does not fully live up to its expectations:
“Machine operational, but not with full performance. Major remaining issues: Stability and fine-tuning of control system.”

Project documentation

Project 4 was initiated to make the process of rock reinforcement in mines more automated and safe. In order to obtain this, the team tried to develop a machine that could autonomously carry out the process so that no manual labor would have to be involved in this dangerous process. This project could also be classified as a whole new technology since there were many completely new parts that needed to be developed for this machine. This project did not yet reach its goals and is currently ‘paused’ so that the people working with it can spend time on other projects instead. One of the argued reasons for this was the project set up too big goals instead of breaking it down to a multitude of different innovations and in addition that in the beginning only one person was working with this innovation. The project manager (that was introduced to the project team after it had already been going on for a number of years) explained:

“There was one person was driving the project for 9 months full time, it was his idea, he was not very open. He was allowed to be very free and had no clear goal picture or requirements (...) Today we would have started a different project in order to learn the same thing, not a whole machine but rather break it down in small parts.” Project member A, Project 4

Project 5 aimed at considerably increasing the speed on this rock reinforcement process since this is typically a very time-consuming process. The machine that would enable this would look the same as incumbent machines but would be filled with new technologies so that it could do the process faster. Similar to project 4, this project can also be regarded as very novel for the company and therefore very complex because of the high need of integration of multiple parts that were all complex to develop. The project is still under way and will most likely not hit its target under the planned time frame although it might eventually be successful if the company decides to spend more resources on it.

“There was no person bridging the customers (...) many times it became misunderstandings. Also we have been dependent on a subcontractor that has been unwilling to share their knowledge(...) this expertise was never transferred to Atlas
Copco that stopped the project. (...) The project will probably not hit targets (...) I am not happy with the performance of the team.”
Project member, Project 5

**Project 6** intended to increase knowledge in order to eventually build an existing machine on a new technology, which means that fuel consumption would go down and the exhaust pipe emissions would be minimized. Although this project did not yield a finished product, it generated a lot of new knowledge within the company that can later be used in order to productify this technology. The project could therefore be regarded as relatively successful in terms of expanding the knowledge base, but not successful in terms of putting a product on the market.

“Our technological aims have been reached. It was as lagom [lagom in Swedish means the right amount of something, ed.] successful as technology development can be’. No patents have been filed, but this is also a very bothersome process. I am satisfied with the team’s performance.”
Project member A, Project 6

**Project 7** had the aim to reduce lead times of machines and to save money by making local adjustments to machines centrally, before shipping them to the country of destination. This meant that multiple countries had to send the requirements that they had for their machines and instead of doing these adjustments themselves, they would receive their machine with these changes already done. This innovation was more a process innovation than a product innovation and was therefore not completely novel for the company. This project could be regarded as very successful, since the initial goals have fully been reached.

“The project’s financial result was better than expected: lead time went from 3 weeks to one day, costs went from 600,000 Swedish crowns to 21,000 Swedish crowns.”
Project leader, Project 7

**Project 8** started in order to significantly increase the capacity of one of the best-selling mining trucks, which would enable Atlas Copco to position itself ahead of the competition. Although this innovation was built on an existing machine, this innovation required a complete overhaul of the components, frame, and the machine in general, which essentially meant that a whole new machine was being built. After a while, it turned out that the project goals had been too high and that it was
impossible to obtain them without spending a vast amount of resources on this project. The project was therefore stopped and most of the team transitioned to project 9.

“[Project 8] was started after a few people initiated the project but was stopped since it was too much risk and too difficult to realize. A key to failure in [Project 8] was that there were very few people involved in the project in the very beginning that only included two people working on it.”
Project leader, Project 8 and 9

Project 9 also pertained to increase the capacity of a truck, but this project made a more incremental step vis-a-vis a previous model. It would still give Atlas Copco an advantage over their competitors but it would be a less significant lead compared to project 8. Thus, this innovation was less novel but still required the team to significantly change a number of components and technologies in the incumbent highest-capacity truck. This project is still ongoing, but is on track of meeting its goals and delivering a moderately novel innovation to the company. Most of the team members were transferred to this project from project 8.

“The knowledge has been transferred, In [Project 8] it was almost the same people, so the knowledge was in the head of the people (...) I think the success factors was a tight team that is used to work together and where everyone knows what each and every one is good at.
Project member A, Project 8 and 9

4.5 Overview of Concepts, Themes and Theoretical dimensions
In appendix 3 is a table showing how we treated the data we collected. As earlier described in the data and methods section, we adapted an approach that was developed by Gioia et al. (2013). The first column represents the most pivotal quotes from our interviews. The aggregate theoretical dimensions follow from our initial theoretical framework. The second order themes and first order concepts follow partly from established theory and partly from the data collection.
5. Analysis

In this chapter we describe the relationships between theoretical concepts and main findings from our empirical data. We concentrate our discussion around our findings, and put forth theoretically generalizable propositions that can be used for further theoretical testing.

“Knowledge has to be improved, challenged, and increased constantly, or it vanishes”

Peter Drucker

5.1 Potential should be turned into realized

As described in the findings chapter, both ACAP and DCAP showed a gap between the potential and realized capacity although DCAP saw a larger gap than ACAP. Reflecting back to Zahra and George (2002), we adopted the term ‘efficiency factor’ in order to describe the extent to which teams were able to realize their potential to take in external knowledge and to spread their knowledge within and outside their team. To be able to leverage potential into realized is one of the key success factors that we identified in projects that was described as successful.

The teams of our focus had a varied output in terms of innovative success. These projects had been ongoing for a long time with no clear outcome and there were also projects that were far more successful than anticipated. In our initial theoretical framework we theorized that innovate output is related to the realized ACAP and DCAP and in line with most extant research on knowledge transfer (Kogut and Zander, 1992; 1996; Grant, 1996; Hansen, 1999; Dunning, 2000). We saw that teams who were able to capitalize on their realized ACAP and DCAP indeed outperformed teams that were less able to do so. We also identified that realized ACAP had the largest influence on a team’s innovative output, whereas realized DCAP had less impact, although it was still important. The reason for this could be explained by that fact that within a team, the members all had a very specific field of expertise and were mostly concerned with their own part. Thus, if a hydraulic engineer would disseminate his or her knowledge within the own team, this would benefit others only to a certain extent, since this knowledge is so specialized and only applicable to topics directly related to hydraulics.
Still, teams that managed high levels of realized ACAP and DCAP were good at taking in external knowledge, disseminating this within their teams and also spreading issues they were working with as well as learnings from their projects back into the organization. For ACAP, we saw that teams that took in much information usually applied most of this knowledge in their project, implying a low gap between potential and realized. This can be explained by the fact that within the organization most transfer was initiated on purpose and not a result of an ‘accidental’ spillover. Teams that failed to apply external knowledge to drive their projects forward usually also failed to take in this external information in the first place.

For DCAP, it could be observed that people were usually willing and able to transfer their knowledge both within their teams and to the rest of the organization, yet did not engage in this very often. We have seen some evidence that a higher amount of potential DCAP lead to a higher amount of realized DCAP but this was dependent on a number of circumstances. We observed that these circumstances were in line with Zahra and George (2002) and related to the extent to which a company manages to leverage on the social integration mechanisms in order to increase the efficiency factor. In successful teams, we identified that disseminating knowledge onto the organization usually also increased the knowledge flow back into the team, as previously described in the findings. This reciprocity of information flows has been reported extensively in previous research (Dyer and Nobeoka, 2000; Dhanaraj and Pharke, 2006; Phene and Almeida, 2008). To summarize, ACAP and DCAP constitute a team’s knowledge transfer and this will positively impact a team’s innovative output. Our first proposition is therefore:

Proposition 1: The more a team engages in knowledge transfer, the better its innovative output.

It is therefore of high importance that the teams try to increase the efficiency factor with which they absorb and disseminate knowledge since this will positively impact their performance. In the next section, we will look at mechanisms that can raise this factor.

5.2 How to increase the Efficiency Factor with Social Integration Mechanisms

As reflected both by theory and findings, several mechanisms can increase the efficiency factor. As previously described, we have not operationalized the efficiency factor but rather analyzed the
extent to which we saw that teams were able to realize their potential ACAP and DCAP. Operationalizing this term could be done by measuring ACAP and DCAP based on scales used in the sources provided in appendix 2 but this process is beyond the scope of our study.

5.2.1 Boundary Spanners
These people could increase the cooperation and involvement with other departments, teams and individuals. Generally, we saw that more of the potential capacities became realized when the boundary spanners had a more influential role in the project.

Within this company, we observed that knowing where to find knowledge was critical because of the technological complex nature of knowledge. As it turned out, boundary spanners usually knew where to find information because of their extensive network through which they could approach knowledge carriers. As described, boundary spanners also possessed a lot of knowledge themselves and knew how to apply and recombine it (Kogut and Zander, 1996) in order to boost the amount of potential ACAP that was realized. We therefore expect that:

Proposition 2a: The more involved boundary spanners are in a project, the higher the efficiency factor between potential and realized ACAP

When it comes to DCAP, Minbaeva and Michailova (2004) already stated that individuals will be more likely to share their knowledge with others if they expect a knowledge flow back and if “one believes that the particular piece of knowledge is worth sharing” (p. 667). The role for boundary spanners we have identified here is that they were able to link the sender of a certain type of knowledge to a receiver. Because of boundary spanners, we saw that individuals that were willing and able to transfer their knowledge actually engaged in doing so since they could find potential receivers in the organization. We therefore argue that boundary spanners have an ability to pinpoint people in need for certain information and therefore state:

Proposition 2b: The more involved boundary spanners are in a project, the higher the efficiency factor between potential and realized DCAP
5.2.2 Knowledge Transfer Facilitators increase the Efficiency Factor

Within the firm, it could be identified that most transfer of knowledge happened on individual initiatives through boundary spanners, which is very similar to what Cohen and Levinthal (1990) write about a firm’s ACAP: “The firm’s ACAP depends on the individuals who stand at the interface of either the firm and the external environment or at the interface between subunits within the firm.” (p. 132). They furthermore argue that relying too much on these types of employees is not sufficient and our empirical findings support this; although this means the transferring of knowledge was in some cases successful, it was a rather inefficient way since individuals had to go out in the organization individually, collect information, carry it back into the team and then disseminate it. We saw that successful teams had a different approach to knowledge transfer; they were generally better at identifying knowledge sources and engaged in knowledge transfer with these sources on a team-to-team basis. For example, they initiated informal contact with individuals in the department and could navigate and consult databases easier than others. Projects that were less successful usually worked more isolated, involved fewer people, were occasionally paused and used less documentation. In line with Zahra and George (2002), we observed that the above mentioned facilitators enabled teams to apply knowledge coming from their external environment. When knowledge was requested by other teams or individuals this provided a platform for employees that were actually willing to transfer their expertise to be able to engage in teaching and instructing. Thus, it can be argued that:

Proposition 3a: The more extensive knowledge transfer facilitators are employed, the higher the efficiency factor between potential and realized ACAP

Proposition 3b: The more extensive knowledge transfer facilitators are employed, the higher the efficiency factor between potential and realized DCAP

5.2.3 Cooperative Environment increases the Efficiency Factor

As described before, during our time we spent on site the company in addition to interviewing people, the firm was identified as a cooperative environment in which people could easily approach each other in case they needed help. Still, since some projects were very different from each other it caused people to work separately, which was an obstacle for acquiring and spreading knowledge since this structure impeded teams from knowing what was going on in other projects or other parts
of the department. Thus, we saw that by and large the ‘soft’ values (ease of approaching people) of the cooperative environment helped people in turning their potential capacities into realized but that the ‘hard’ characteristics of the environment (the way teams were structured and organized), did not contribute to this since to a large extent did not foster cooperation. In line with Grant (1996), we therefore argue that it is likely that a cooperative environment, both in terms of formal characteristics and in ‘soft values’ will serve as a breeding ground for knowledge transfer:

*Proposition 4a: The more cooperative an environment is, the higher the efficiency factor between potential and realized ACAP*

*Proposition 4b: The more cooperative an environment is, the higher the efficiency factor between potential and realized DCAP*

The effect of the cooperative environment was rather similar to the boundary spanners effect on the efficiency factor in the sense that this enabled transferring knowledge, but rather inefficiently. Similarly, we saw that the cooperative environment mostly impacted person-to-person knowledge transfer, seldom a team-to-team knowledge transfer. This implied that flows of knowledge almost exclusively flew through a person and additionally were usually initiated when a person explicitly asked. This person then in turn had to take this individually acquired knowledge to the team where he or she was working in and subsequently apply it and/or disseminate it. Although this way of spreading knowledge worked, the whole company was even reliant on it, it was not a very efficient way of transferring knowledge. In order to raise the efficiency factor, a company could have knowledge transferring facilitators in place that can also enhance team-to-team transfer and integrate more formal structures.

5.3 Extension of the initial Theoretical Framework

After reviewing both existing literature and the empirical findings with help of our theoretical framework, we noticed a number of additional relationships between first order concepts that we have not yet covered. In order to identify these, we firstly address DCAP, secondly treat ACAP and lastly elaborate on the social integration mechanisms.
5.3.1 Extensions of DCAP

Through our data, we realized that a distinction needs to be made within the concept of realized DCAP since the dissemination of information took place in two different ways: internally within the team and externally, from the team onto to other teams and/or the organization.

5.3.1.1 Internal DCAP

Internal DCAP was largely encouraged by the project leader and was carried out by, for example, brainstorming sessions in order for team members to bring in new ideas and combine existing knowledge. As we already concluded before, this had a positive effect on the knowledge transfer within the team, however, the impact on team performance was not always apparent since project members often worked with very specialized tasks. The knowledge that was relevant to spread usually included general insights in the innovative process itself or project organization, rather than deep technological knowledge.

5.3.1.2 External DCAP

External DCAP could be described by the amount of knowledge a team transferred to other parts of the organization that had two main implications. The first refers back to the earlier mentioned concept of reciprocity. A team that was good at disseminating their knowledge to the organization around them raised awareness amongst other teams regarding the issues they were working with, which increased the likelihood that they would receive knowledge back from other parts of the organization that fitted their demand.

Proposition 5: The higher a team’s realized external DCAP, the higher a team’s potential ACAP

On a more general organizational level, a team’s DCAP lead to another team’s potential ACAP since they provided other teams with knowledge that could potentially be used in their projects to solve issues.

Proposition 6: The higher a team’s realized external DCAP, the higher other teams’ potential ACAP
5.3.2 Introduction of a Time Component

As stated in proposition 6, teams were able to profit from the realized DCAP of other teams. However, we identified that teams that were working with very novel innovations were usually more dependent on the ability to absorb information that came from outside the company since in these type of projects it was more difficult to find synergies and knowledge within the company. Hence, the more novel the innovation was, the more the required knowledge differed from the existing knowledge base, thus the more advanced the ACAP routines had to be, which is also theorized by Lewin et al. (2011) and Lewin and Massini (2003). With the support from theory and our data, we propose that knowledge originating from a different, external context is more difficult to understand and apply and may therefore change the realized ACAP of a team. Realized ACAP can therefore be divided in an internal and an external component. The role of boundary spanners will then also differ. Boundary spanners namely aided in ‘translating’ external knowledge to be more easily accessible for a team but as stated before, in novel developments, the knowledge could not always be found in-house. This created a need to look outside of the company in order to obtain this, for example at suppliers, customers, competitors, related industries and consultants. We found a boundary spanner’s role in new technology development was different compared to new product development or product improvement. In the former case, a boundary spanner could be a person with a lot of knowledge or network connections whereas in the latter two, a boundary spanner could be a person that has been with the organization for a long time and knew which people had been working with certain technologies previously. Lewin et al. (2011) and Zahra and George (2002) both support this and adopt the distinction by Rosenkopf and Nerkar (2001), stating that the locus of acquiring knowledge shifts from internal sources to external sources when an innovation is more radical. This differing role is also supported by Cohen and Levinthal (1990) when they argue that when external information is similar to existing knowledge, it is easier to assimilate. In novel innovations however, new knowledge is less related to ongoing activities and this thus increased the need for boundary spanner involvement in the innovative process. There may therefore be a time element involved in our model where the goal of an innovation is not only an output variable, but also a variable that proactively impacts a team’s composition. Although we have seen indications of this concept, it is beyond the scope of this study to incorporate this in our revised theoretical model but could instead be considered in future research.
5.3.3 Introducing the revised Theoretical Framework

The aforementioned analysis and propositions, with which we extend our theoretical framework, can be represented visually as follows.

![Diagram of Revised Theoretical Framework]

Figure 3: Revised Theoretical Framework
6. Conclusion

_In this chapter we describe our main findings that have resulted from analyzing the theory together with our empirical data._

_“Knowledge is power”_

_Francis Bacon_

6.1 Concluding remarks

Following this study’s purpose, we addressed the concepts of ACAP and DCAP including the various sub-concepts, and contributed to theory by analyzing how these enabled a team to reach their innovative output. Additionally, we have seen how social integration mechanisms can enhance a team’s ACAP and DCAP and additionally introduced two sub-dimensions of DCAP. In this study we focused on a team level, an area that we have argued is of high importance to understand but has largely been neglected by academia, which have traditionally focused on organizational-level dynamics instead. The next sections will further explain this by answering our research questions.

6.2 Research Question 1

_How does a team’s Absorptive and Disseminative Capacity (ACAP and DCAP) affect their innovative output?_

When working with innovations, external information should be absorbed and applied in the team in order to fulfill the goals of the project. This knowledge can originate from other parts of the same company or at other companies such as supplier and customers. When teams are able to turn potential ACAP and potential DCAP into realized ACAP and DCAP, they manage to bring in, understand, transform and apply external information, and share this information amongst the team members so that the whole team can profit and thereby drive their projects forward.

The teams will not solely contribute to their own output but will also inform other teams what they are working with, so that they will receive a reciprocal flow of knowledge back, which they can in turn use to reach the goals of the innovation. On a more aggregate level, this will contribute to the innovative capacity of the firm as a whole, since teams with high levels of realized ACAP and
DCAP can use the learnings from their projects in order to assist other teams and avoid making similar mistakes. Thus, the more teams realize their ACAP and DCAP, the more knowledge transfer and the better the innovative output will be.

We have also seen indications that boundary spanners and ACAP may be more or less outward-looking depending on the type and novelty of innovation that a team is working with and the amount of knowledge that is already available within the company.

6.3 Research Question 2
What is the role of Social Integration Mechanisms in enhancing a team’s ACAP and DCAP?

One of the surprising findings of this study is that even though employees were willing and able to share their knowledge with other colleagues, this was not a guarantee that it would also be initiated. For this reason we found that the social integration mechanisms were fundamental in order to turn potential ACAP into realized ACAP and, even more, to turn potential DCAP into realized DCAP.

Boundary spanners can help to reduce the gap between potential and realized ACAP and DCAP because their embeddedness in and experience with different environments. They can ‘translate’ external information so that a team is able to apply it in their innovation. They can also enable individuals that are willing and able to spread their expertise to actually engage in helping other individuals in teams. This involvement is especially needed when an innovation is completely new to the company and little knowledge is readily available inside the organization. Through his or her network, a boundary spanner can connect an innovation development team to external parties.

In addition to this, an organization should have formal and informal knowledge transfer facilitators in place such as brainstorm or teaching sessions through which they offer a ‘stage’ for people to spread their expertise and identify which people are in need for information. This will allow willing and able people to transfer and assist organizational members to applying new, external knowledge. During our research, we noticed that these facilitators were largely carried out on a person-to-person basis, which, although effective, was not efficient. Facilitating team-to-team knowledge transfer would therefore be a more efficient way to enhance a team’s ACAP and DCAP, as we have seen in our empirical findings.
Finally, we found in Atlas Copco that a cooperative environment enabled people to trust and easily approach each other in case they needed help, which in turn created a breeding ground for knowledge transfer. This mechanism showed to be of fundamental importance since there were little formal structures for team-to-team knowledge transfer. This also entails that organizations should be structured in such a way that cross-functional and cross-departmental roles are present that can potentially increase the efficiency of knowledge transfer amongst teams as well as other parts of the organization.
7. Limitations and Future Research

There are limitations with this study that we think are important to highlight in order to be transparent with regard to the study quality. In addition, we propose suggested directions for future research and go through the implications of this study for practitioners.

“Knowledge is the future, for tomorrow belongs to those who prepare for it today”

Unknown

7.1 Limitations

The research gap regarding knowledge transfer on a team level is partly a result of the fact that the concepts of ACAP and DCAP have been mainly researched on an organizational level. Since we have not tailored these theories to fit to the team level we reserve the right to that some of the theories we considered fit better on the level on an organization rather than individuals and teams. Furthermore, we addressed only three different social integration mechanisms that we assumed were most relevant to this study and knowledge transfer. It could be that there are more social integration mechanisms that can lower the gap between potential and realized capacities, which we have not covered.

Regarding the success of the teams that we researched, we identified the following limitations. Firstly, the teams varied in their progress: we included both ongoing, paused and finished projects in our study, which potentially comes at a cost of comparability since these projects took place on different points in time. This limitation followed from our choice of comparing projects with various degrees of success, which forced us to look at historical and paused projects as well. Secondly, we evaluated the projects partly based on measures that were self-reported from team members and reports from peers, such as managers and colleagues. Both sources carry the risk of not reflecting an objective measure of success, but rather success as it is perceived by the person who is reporting it. It may therefore be that innovative success includes more factors than the ones that we have covered and these factors may have a different explanation that the one that we have given.
7.2 Implications for Practitioners

For managers working in R&D settings or in knowledge-intensive industries, this study has a number of important implications to consider. Firstly, the fact that employees may have the willingness and ability to spread their knowledge does not guarantee that they will actually engage in transferring this knowledge with their colleagues. Similarly, employees that take in new knowledge may not always apply this into their daily work routines. It is therefore important for companies to have advanced systems in place that will assist motivated employees to help others and to create understanding about knowledge that is available within and outside of a company. Boundary spanners could be used for this means and should thus be encouraged to employ the full potential of their existing knowledge base and their network in order to drive projects forward.

Managers should also consider that different characteristics of R&D projects may put different demands on a team when it comes to taking in external knowledge. A company should be able to facilitate teams to take in and apply knowledge that comes from other teams, departments, suppliers, customers or even competitors.

Lastly, knowledge transfer can be impacted by the environment and culture of the company and this creates a need for companies and managers to create a high-trust environment in which employees feel free to approach each other and ask for assistance. The resulting flow of knowledge within and between teams will ultimately give a positive contribution to the innovative capacity of individual teams as well as the organization as a whole.

7.3 Implication for Future Research

This study has only scratched the surface when it comes to discovering social dynamics in knowledge transfer and innovation, and we therefore see our research as a starting point for further development of this theoretical field. Future research could contribute to theoretical development even more by operationalizing the concepts of our framework and by taking our study as a point of departure for a more quantitative method that can use our propositions as potential hypotheses. The previously indicated time issue could be addressed in a longitudinal study where an interesting approach could be to follow teams working with an innovation for a longer time. Furthermore, as stated in the limitations, there are a multitude of factors that could potentially impact innovative
output of innovation development teams, which might also be a future research direction. The concepts that we covered in our study could also further be developed, for example by focusing a study on one concept in particular and doing an in-depth study of the composition of this concept. For example, regarding the concept of ACAP, Volberda et al. (2010) wrote that higher levels of ACAP are not necessarily better than low levels ACAP; there should be an optimum level. This falls in line with the weak-tie theory where it is argued that an intensive flow of knowledge also increases the amount of redundant information that is being transferred. An interesting research direction could thus be to look at possible optimal levels of ACAP and potentially DCAP in general and the role of weak ties within knowledge transfer (Levin and Cross, 2004).

When it comes to boundary spanners, future research could use a similar approach as Reagans and McEvily (2003) in order to identify what players in a network are central and how their ACAP and DCAP differs from players that are more on the periphery of a network. This could also shed light on the extent to which knowledge transfer is a reciprocal process, a thought that is already given some attention by Liao et al. (2006) and Lane and Lubatkin (1998). This also opens opportunities to view innovation within a firm as a network of innovators, which has gotten extensive attention on a firm level, but less on lower organizational levels of analysis (Gupta and Govindarajan, 1991; Dyer and Nobeoka, 2000; Dhanaraj and Pharke, 2006).

All in all, this field of study offers ample opportunities for advancement of research and provides an elaborate base of interesting new dynamics to explore.
8. References


Merriam, S.B., 1998. Qualitative Research and Case Study Applications in Education. Revised and Expanded from “Case Study Research in Education.”. ERIC.


## Appendix 1: List of Interviews

<table>
<thead>
<tr>
<th>Number</th>
<th>Role of interviewee</th>
<th>Project or department of interviewee</th>
<th>Date of the interview</th>
<th>Duration in minutes</th>
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<td>2</td>
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<td>3</td>
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<td>4</td>
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<tr>
<td>26</td>
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<td>13-3-2015</td>
<td>60</td>
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<tr>
<td>27</td>
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<td>Project 7</td>
<td>31-3-2015</td>
<td>60</td>
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<td>28</td>
<td>Project Member B</td>
<td>Project 7</td>
<td>13-4-2015</td>
<td>60</td>
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<td>29</td>
<td>Project Leader</td>
<td>Project 8 &amp; 9</td>
<td>16-4-2015</td>
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<td>30</td>
<td>Project Member A</td>
<td>Project 8 &amp; 9</td>
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<td>35</td>
<td>Employee C</td>
<td>Information Technology</td>
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</table>

Table 1: Overview of the Interviews. The first column is the number of the interview. The second column describes the respondent’s role, the third column describes the respondent’s team or department in which he or she works.
# Appendix 2: Interview Guide

<table>
<thead>
<tr>
<th>Concept</th>
<th>Example questions</th>
<th>References</th>
</tr>
</thead>
</table>
| Potential ACAP    | • How actively do you/team interpret information from outside of the team?  
• Are individuals in the team willing to apply knowledge from other teams, customer or other external parties? | Jansen et al., 2005         |
| Realized ACAP     | • To what extent is information coming from outside the team (for example, by involving external parties or members from other teams) being applied in the project?  
• How do teams apply/ integrate knowledge from external parties? | Jansen et al., 2005         |
| Potential DCAP    | • How well are team members able to teach and instruct others actively so that they will not make the same mistakes?  
• How willing are you to talk about the good and the bad things of the project? | Bock et al., 2005           |
| Realized DCAP     | • How actively do people actually engage in helping others (e.g. teaching, instructing, describing) (both within and outside of the team) with their expertise?  
• How actively have people from your team helped other people in solving problems? | Van den Hooff and Van Weenen, 2004 |
| Boundary Spanners | • What is the degree of involvement of key individuals who take a central role within R&D?  
• Can you give examples of a person who connects teams to teams, teams to customer, customer to Atlas Copco? | Tushman, 1977  
Tushman and Scanlan, 1981 |
| Cooperative Environment | • Do people generally do what’s the best for Atlas Copco?  
• How protective/attached do people become to their own projects? | Kankanhalli et al., 2005  
Ko et al., 2005 |
| Knowledge sharing facilitators | • What offline and online means of communication are there so that people can share knowledge and ideas (formal and informal)?  
• To what extent are Best Practices documented in manuals, guidelines, blueprints etc.? | Schulze and Hoegl, 2006 |
| Innovative Output | • To what extent did you achieve the technological objectives?  
• To what extent did you achieve the intellectual objectives? | Schulze and Hoegl, 2006 |

Table 2: Interview Guide. This table presents a selection of questions that we asked in order to establish a clear image of the respondent’s perception of the concepts. These questions could either follow by adapting survey questions from previous research or from formulating questions based on main theoretical concepts in prior studies. The references are examples of articles where we based these questions on.
Big customers are all located far away that makes collaboration harder. – Manager product category level

The supplier of batteries supplied AC with additional knowledge and information. – Project member B, Project 1

People in the project are their own knowledge bank, but they also collaborate with suppliers and service to gather information. – Project member A, Project 1

Currently most information is shared by talking to people and finding the right documents on the intranet, like a small study. – Employee, support function

You always hear what is going on and it is easy to get information, even from the manager. He knows a lot of things about AC so it is easy to go to him for questions. – Project member B, Project 2

Suppliers also get approached since hydraulics depends on the components. These components are specially made for machines, so I can ask them what solution in terms of hydraulics fits best. In other cases, I can also use own knowledge or look at existing machines that work. – Project member B, Project 2

There were for example a lot of people from the team that worked with [Project 6], which is based on a similar technology. These people were recommended by the project leader from that team and then moved to [Project 2]. – Project leader, Project 2

The team has been dependent on searching information and knowledge from outside the team. It was an open mentality in the group. (...) I have also invited to seminars for others to give input on our work. (...) Solutions were applied from other teams, for example from [Project 1]. – Project leader, Project 6

There have also been occasions that other people have been invited to participate in the team and give input and ideas based on their expertise. – Project member A, Project 5

The project group had a big baggage and they could apply the project members’ previous knowledge to the project. – Project leader, Project 8 and 9

The team has been dependent on searching information and knowledge from outside the team. It was an open mentality in the group. (...) I have also invited to seminars for others to give input on our work. (...) Solutions were applied from other teams, for example from [Project 1]. – Project leader, Project 6

In this new project team, half of the people were from the first team so that they can transfer the things they have learned. – Project member A, Project 8 & 9

People are generally open to show each other how things are done and to help one another. – Project member A, Project 3

I like to have transparency in the group, so I would share everything that I would hear that is positive or negative. – Project Leader Project 7

I perceive that there is a willingness to share knowledge. However there are not very good formal structures in place to do this. Project member A, Project 4

People may also be very caught up in their own field of expertise, which will make them less likely to [...] share. – Project member A, Project 3

Database access is partly restricted, not everyone [else; other teams] is able to see it. – Manager A, group level

The greatest challenges with the project has been that only one person was working on the project from the start and if more people had been involved from an earlier stage, it had went both easier, faster and less time consuming to come up with a good, simple solution from the start. – Project leader, Project 4

Transfer of knowledge goes through personal contacts, through actively taking contact with people that have more knowledge than yourself. – Project member B, Project 5

Project groups need to take initiative themselves to ask other groups for input, it is not something that comes naturally. This would have been very helpful, as was shown in (Project 8). – Project leader, Project 8 & 9

Lessons learned from unsuccessful projects must be communicated out as well as the things that have really worked well. Today, things are today not communicated out generally. – Project member A, Project 2

One person who was part of both this and [Project 6] had experience with a certain technique they used in [Project 6] but it did not go that well. He brought this to the table in [Project 1] and explained that they should not use it. – Project leader, Project 1

After finishing the projects, there is some form of presentation on departmental meetings to show what has been done and what the result has been. - Project member A, Project 8 & 9

This is also because these people have made a lot of connection in their career up to that point (...) They go around various projects and answer questions. – Manager A, group level

Knowledge acquisition

Knowledge assimilation

Potential ACAP

Transformati on of knowledge

Realized ACAP

Exploitation of knowledge

Willingness

Ability

Knowledge Sending

Realized DCAP

Instructing

(Meta)knowledge

Boundary Spanners

Organizational Mechanisms
“(...) I knew about this project [Project 7] that started the cooperation so that they [Project 7] did not have to redo the same development twice. It also helped that team to save resources (...)” – Project member B, Project 7

<table>
<thead>
<tr>
<th>People with a lot of knowledge make sure that ‘general knowledge’ is being used within the project so that ‘simple mistakes’ are not being repeated, such as not using certain components or materials. These are people that know this by previous experience and through contacts. – Project member A, Project 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>You need to know people inside the company in order to find information that in turn makes you able to communicate. This is our Achilles heel. – Manager product category level</td>
</tr>
<tr>
<td>If you need to get information it is common to go to a person who has been working with Atlas Copco for a long time, and ask that person if a certain project has been carried out before. – Project member B, Project 6</td>
</tr>
<tr>
<td>Most knowledge sharing goes face-to-face, people sit down to talk to each other in order to learn about topics they are most knowledgeable about. – Project leader, Project 3</td>
</tr>
<tr>
<td>The atmosphere within Atlas Copco is very supportive. – Project manager, Project 5</td>
</tr>
<tr>
<td>There are many creative people and (...) we are a little bit like a ‘workshop-company’ in which little information has been documented (...) Previously, when this was a smaller organization, the more ‘relaxed’ way of doing things was a better fit. – Project leader, general</td>
</tr>
<tr>
<td>There are no structures and there is no time to spread information between teams. – Manager product category level</td>
</tr>
<tr>
<td>Telling other people and share knowledge only happens when there is time. Nobody checks whether it is done or not. If one can spend 20 hours on a project and that person spends all these 20 hours on it, there is no time left to share knowledge with others. – Project member B, Project 2</td>
</tr>
<tr>
<td>Fika [coffee breaks, ed.] is only for the local department, which is why organizational structures are limiting the knowledge flow. – Employee, Support function</td>
</tr>
<tr>
<td>The majority of knowledge transfer goes through interaction, and it does not really matter how much actually gets documented. – Project member A, Project 1</td>
</tr>
<tr>
<td>Most knowledge sharing goes face-to-face, people sit down to talk to each other in order to learn about topics they are most knowledgeable about. – Project leader, Project 1</td>
</tr>
<tr>
<td>Email is very effective to share information and knowledge as long as you do not send it you to too many people. For example: sending out a question to a few project leaders often yields helpful answers. – Project member A, Project 6</td>
</tr>
<tr>
<td>How I find out about information is above all via email and to some extent also telephone with external suppliers. – Project member A, Project 1</td>
</tr>
<tr>
<td>(...) we have no clear directives from above but management rather tells us: do a little bit of this and a little bit of that just as long as it gets good (...), neither management say’s how we should organize information (...) as well as the organization has not stated how we should find information, we do not know where the information exists in this large network. – Employee B, information technology</td>
</tr>
<tr>
<td>There is a lot [knowledge] available but I never look at it. There are so many databases and portals, people can’t even be bothered to look into that. – Project member A, Project 5</td>
</tr>
</tbody>
</table>

“(...) Project 8 was something new and was completely unique. From that we did not have any similar machine available, it was so much bigger than anything else we did before (...). Project 9, on the other hand, is more like an upgrade of an existing product (...). – Project Member A, Project 8 and 9

<table>
<thead>
<tr>
<th>Here no existing solutions (new technology development) exist, which demands that one have to think outside the box. – Project leader, Project 4</th>
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<tbody>
<tr>
<td>There is nothing similar. Regarding some parts you can ask [others], [but often] you don’t find anything. You can go around and ask but nobody knows, you don’t find anything on the internet, you don’t find anything on YouTube, you just don’t find anything. – Project member A, Project 5</td>
</tr>
<tr>
<td>The project is ongoing and the concept didn’t deliver the expected performance. However, the project has generated a lot of valuable learning regarding bolts, robotics arms etc. – Manager, Technology Development (in writing)</td>
</tr>
<tr>
<td>Our technological aims have been reached. It was ‘as lagom [the right amount of, ed.] successful’ as technology development can be’. No patents have been filed, but this is also a very bothersome process. I am satisfied with the team’s performance. – Project member A, Project 6</td>
</tr>
<tr>
<td>The guy who wrote down the goal was a bit of a dreamer. – Project leader, Project 1</td>
</tr>
<tr>
<td>The outcome is in line with the planning and we have developed the machines in collaboration with the market department and the customer. – Project member B, Project 1</td>
</tr>
<tr>
<td>The goals of this project weren’t reached in the sense that we wanted to have a test machine in the field, which didn’t work. But with some other testing we still discovered things that could and could not be done. There was proof that certain things can be done, that we can do this technology. – Project member B, Project 6</td>
</tr>
</tbody>
</table>

Table 3: Data Structure. Quotes, concepts, themes and dimensions are represented in this table.