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**Understanding the Complexity of Reusing
Knowledge across Contexts
- A situated learning perspective**

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Abstract

There is a prevailing belief today that knowledge is one of the most important sources of an organization's competitive advantage. Through attempting to transfer and reuse knowledge organizations try to prevent the reinvention of the wheel. However, these attempts have proven to be problematic in the past.

The purpose of our study is to contribute to the understanding of what makes the transfer and reuse of knowledge a difficult and complex task. We aim to do so through looking at an initiative to replicate Six Sigma results at a large Scandinavian manufacturing company.

Taking a situated learning perspective, we analyze how people work and interact in communities of practice when carrying out improvement work.

Results show that in such an environment, knowledge is contextual and has to go through a process of transformation to be understood and valued by another community. To enable such a process to take place it is important to shift emphasis from transferring knowledge through hierarchies and formal descriptions to activities that connect and expand communities of practice. Suggestions for such activities are given to management.

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Björn would like to dedicate this thesis to his parents. Thank you for always supporting me!

Markus would like to dedicate this thesis to Linda. To put it simply, thank you for being the person that you are.

<div align="right">Göteborg, December 2006</div>

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1   Introduction

There is a prevailing belief today that knowledge is one of the most important sources of an organization's competitive advantage (Watson & Hewett 2006, Blackler 1995). This belief stems from various convictions, such as the increased number of knowledge workers (Blackler, Reed & Whitaker 1993), that competitors cannot replicate an organization's knowledge, and that knowledge is what holds the organization together (Brown & Duguid 1998). However, as Szulanski's (2000, p. 10) points out "mere possession of potentially valuable knowledge somewhere within an organization does not necessarily mean that other parts of the organization benefits from that knowledge". Indeed, even though they realize the value in knowledge, many organizations feel that they don't know what they know and that this leads to reinventing the wheel (Szulanski 1996). Reinventing the wheel leads to the need to create new knowledge over and over again in innovating and solving problems, which is seen as innefficient, difficult and costly (Szulanski 1996).

The increased value placed on knowledge has led many organizations to spend considerable efforts on attempting to access, nurture and develop their internal knowledge (Koenig 1999). These efforts are usually reffered to as *knowledge management*, where the overall aim is to enable everyone to gain from the knowledge of those working in and with the organization (McKenzie & van Winkelen 2004). The increased interest from practitioners have resulted in a vast amount of research within the field of knowledge management (Nonaka & Takeuchi 1995, Blackler 1995, Davenport & Prusak 1998) and given rise to a lot of hands-on books on how to manage knowledge properly (e.g. Tiwana 2002).

One of the most important areas within knowledge management is the attempt to facilitate the reuse of knowledge through transferring knowledge to other parts of the organization (Argote, Ingram, Levine & Moreland 2000, Nahapiet & Ghoshal 1998). Argote et al. (2000) point out that increasingly global operations, as well as the increased number of joint ventures, strategic alliances, and mergers and aquisitions place an increasing demand on companies to transfer knowledge. The transfer of knowledge can be described as the process through which one individual or group is affected by the experiences of another (Argote & Ingram 2000). Traditionally, organizations have had a strong tendency to focus their transfer efforts on codifying knowledge, through for example creating best practice descriptions, and using databases and information technology tools to store and disseminate this knowledge (Argote & Ingram 2000, Davenport &

Prusak 1998, Cabrera & Cabrera 2002, Bechky 2003).

However, widespread evidence of failed attempts to transfer knowledge, such as in General Electric and IBM (Szulanski, Jensen & Casaburi 2003), and the loss of productivity during the transfer has shown that successful knowledge transfer and reuse can be difficult to achieve (Argote et al. 2000, Szulanski 1996). Studies on the attempts to transfer knowledge has pointed to various reasons for this difficulty, such as the inability of the recipient to accept the knowledge as meaningful, the complexity involved in transferring knowledge from another context (Szulanski 1996, Dixon 2002), as well as a negative attitude to knowledge that originates outside one's own institution (Lichtenthaler & Ernst 2006).

The purpose of this paper is to contribute to an increased understanding of why knowledge transfer is a difficult endeavour. In order to fulfill this purpose, we performed a study at Vinol[1], a large Scandinavian manufacturing company, where Six Sigma management is unsuccessful in attempting to reuse knowledge through the transfer of Six Sigma project results. In this study we set out to answer two main questions:

- Why is transfer not happening to a larger extent?

- How can the organization enable the transfer of knowledge?

In the following chapter we introduce a number of previous studies and theories in order to form the framework for our study. In the third chapter, we give an account of the different phases and decisions involved in the process of conducting this study. In the fourth chapter, we describe our main findings. In the fifth chapter, we analyze our findings with the help of prior studies and relevant theories. The sixth and seventh chapter offer overall conclusions and recommendations respectively.

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[1]The company name, as well as names mentioned in interviews have been changed to maintain confidentiality.

2 Theory

In this chapter we aim to describe our theoretical view on the problem we are studying. The chapter begins with a background and overview of knowledge management before moving on to establish connections between replication, knowledge transfer, and learning. We then introduce a traditional perspective on learning and the constraints it provides in relation to our study. Lastly, we describe a more suitable perspective for understanding our research problem and discuss the theoretical implications it has for how to view the situation and problem of our case study.

2.1 Knowledge Management

Koenig (1999) and Trigg (2000) provide interesting insight into the birth and evolution of knowledge management through connecting it to the intellectual capital movement, the development of the corporate intranet, and Business Process Reengineering. Koenig (1999) discusses how the poupularity of intellectual capital in the early and mid 1990's increased the view on knowledge as an important organizational resource. Attempts were made to measure the intellectual capital of the organization and even though these attempts were not very successful, they helped to instill the importance of valuing and nurturing knowledge. Subsequently, the corporate intranet emerged, which made it possible for organizations to spread information and knowledge to distant spaces. Koenig (1999), Trigg (2000) as well as Kalling & Styhre (2003) all discuss the relationship between Total Quality Management (TQM), Business Process Reeingineering (BPR) and knowledge management. Here, while TQM was concerned with quality and BPR introduced new processes that took advantage of information technology, knowledge management goes one step further by also including and addressing the knowledge that exists within an organization. Koenig (1999) goes as far as saying that Knowledge Management is a reaction to BPR. As such, its emergence was a result of the rejection of BPR because of its lack of focus on people and knowledge. In summary, knowledge management offers a perspective on how to view organizations through its emphasis on the internal resources and assets as the main sources of competitive advantage.

The idea of knowledge management received wide interest in the academic community from around 1995 through publications of researchers like Nonaka & Takeuchi (1995), Blackler (1995) and Davenport & Prusak (1998). Since then, a vast amount of research in this field has emerged and different views and concepts on what knowledge management is and what it can

and cannot accomplish has been formulated and established. Although our intent here is by no means to give a full review of the different views on Knowledge Management, a few definitions can give an insight into how the concept is seen.

- "Knowledge management is the generation, representation, storage, transfer, transformation, application, embedding, and protection of organizational knowledge" (Schultze & Leidner 2002, p. 218)

- "Knowledge management is a framework, a management mind-set that includes building on past experiences and creating new vehicles for exchanging knowledge."(O'Dell & C. Jackson Grayson 1998, p. 6)

- "Knowledge management is "hands-on" to understand, focus on and manage systematic, explicit, and deliberate knowledge building, renewal and application." (Wiig 1997, p. 471)

2.2 Replication and Transfer

Just as there are many definitions of knowledge management, the concept is seen as consisting of many activities and focuses. To escape the reinvention of the wheel by reusing existing knowledge throughout the organization is often seen as one of the most important tasks of knowledge management (Szulanski 1996, Argote et al. 2000, Kogut & Zander 1992, Nahapiet & Ghoshal 1998, Nonaka 1994, Watson & Hewett 2006).

Management responsible for the initiative discussed in this study presented the wish to reuse knowledge through replicating results from Six Sigma projects. We therefore start out by investigating the notion of replication through relating it to the common and traditional notion of knowledge transfer. As stated in the introduction of this paper, Argote & Ingram (2000) describe knowledge transfer as the process through which one individual or group is affected by the experiences of another. In a similar fashion, Szulanski, Jensen & Casaburi (2003) and Szulanski (1996) discuss the relationship between knowledge transfer and replication and argue that the transfer of best practices can be conceived as replications of organizational routines. Szulanski (1996, p. 28) defines the transfer of best practices as "the firm's replication of an internal practice that is performed in a superior way in some part of the organization and is deemed superior to internal alternate practices and known alternatives outside the company." Here, practice is seen as a routine use of knowledge, which often includes knowledge embedded

in individual skills and collaborative social arrangements (Kogut & Zander 1992). Seeing these connections between replication and transfer it becomes important to analyze how the transfer of knowledge can happen and the problems that come with it.

Szulanski (1996) highlights that the word "transfer" implicates that the movement of knowledge is a distinct experience and depends on the characteristics of everyone who is involved. As such, transfers of practices implies the exchange of knowledge between a source and a recipient.

There are various thoughts and theories concerning the difficluties with knowledge transfer. Szulanski (1996) studied a series of knowledge transfer projects and identified some factors that made knowledge stick in certain places within the organization. These factors included the inability of the recipient to accept the data as meaningful, data which needed more effort to collect than what appeared to be worth investing, and data which did not appear to be something that needed to be paid attention to. Szulanski (1996) concluded that the main reasons knowledge tend to stick in pockets within the organization were associated with the characteristics of the context.

Dixon (2002) argues that even though lack of motivation or incentives are often seen as reasons for why an organizations knowledge is not being transferred and reused, it should rather be attributed to the complexity of receiving knowledge. Examples of why this complexity arises are the difficulties of comprehending knowledge offered from a different context and meaning, as well as the need for a relationship with, and confidence in, the provider of the knowledge.

The "Not Invented Here (NIH) syndrome", which is often referred to as a negative attitude to knowledge that originates outside one's own institution (Lichtenthaler & Ernst 2006), is another commonly used explanation for why transferring knowledge is difficult to attain. An example of the NIH-syndrome would be people belonging to one project team or business unit being hesitant to accept and absorb knowledge developed in another project team or business unit. Although there are not many research studies offering empirical evidence for this attitude, Lichtenthaler & Ernst (2006) summarize the two main studies as carried out by Katz & Allen (1982) and Mehrwald (1999). These studies offer some insight into the existence of the NIH-syndrome and its potential causes. Katz & Allen's (1982) study highlight that routines and rigid roles are developed in stable groups due to the aim of reducing stress and insecurity in the working environment. These stable roles and routines are disurbed when confronted with

knowledge from an outside institution. Furthermore, Mehrwald (1999) drew similar conclusions, but also pointed out the effect of having no or negative experiences with external technologies and the social environment of an individual.

It is widely acknowledged that another important reason for the failure of knowledge transfer is the tendency to focus on codifying knowledge through structures and processes, such as standard operating procedures and routines, and transferring this codified knowledge using technological tools. (Argote & Ingram 2000, Davenport & Prusak 1998, Cabrera & Cabrera 2002, Bechky 2003). This focus becomes problematic when considering that research shows that a large amount of knowledge is embedded in the social practice, which is made up by people (Kogut & Zander 1992, Teece 1998, Nonaka & Takeuchi 1995, Szulanski 1996, Szulanski, Jensen & Casaburi 2003, Brown & Duguid 2001). Therefore, it is important to have a basic understanding of some relevant classifications and distinctions of knowledge.

Nonaka & Takeuchi (1995) classifies knowledge as either explicit or tacit, which has become the most commonly used distinction. Knowledge that has been codified into words and stored in places such as books, databases, and policy manuals are seen as explicit (Nonaka & Takeuchi 1995). As such, the knowledge is formal and easy to spread. Tacit knowledge, on the other hand, is seen as knowledge with a personal quality, which is rooted in a specific context and difficult to put into words. As a result, it is also difficult to share it with others (Nonaka & Takeuchi 1995). Another common distinction of knowledge is between know-what and know-how (Brown & Duguid 2001, McKenzie & van Winkelen 2004). This distinction shows that in any situation, it is necessary to draw on knowledge of what to do and on how to actually do it. Brown & Duguid (2001) argues that know-what is mostly explicit knowledge that can be shared by a lot of people. Know-how, or being able to put know-what into practice, on the other hand, is embedded in work practice, has unique characteristics and can be hard to spread or coordinate.

2.3   Transfer and Learning

Acknowledging the difficulties and complexities involved in attempting to transfer knowledge lead to studies that serve to develop a better understanding of the human aspects involved, such as the way individuals and organizations learn (Nonaka & Takeuchi 1995, Argote et al. 2000, Dixon 2002, Tagliaventi & Mattarelli 2006, Bechky 2003). These authors have implicitly

connected knowledge transfer and learning, noting that learning is an important subject of study to understand factors affecting the transfer of knowledge. Argote et al. (2000) state that through knowledge transfer, one unit learns from the experience of another unit in the organization. They argue that knowledge transfer in organizations can be further understood by focusing on the underlying psychological learning processes affecting it. Furthermore, Nonaka (1994) developed a knowledge creation spiral where explicit and tacit knowledge of individuals interact in four conversion modes. In the socialization mode, tacit knowledge is converted into other tacit knowledge. In the externalization mode, tacit knowledge is converted into explicit knowledge. In the combination mode, explicit knowledge is converted into other explicit knowledge. In the internalization mode, explicit knowledge is converted into tacit knowledge (McKenzie & van Winkelen 2004). Nonaka (1994) states that learning can be related to the internalization mode, when people internalize new understanding through a process of experimenting or 'learning by doing'. As such, it is not enough to send Six Sigma project results throughout the company. However, when workers reuse the knowledge embedded in these results in their everyday work, Nonaka & Takeuchi (1995) would argue that it has been internalized and that learning has taken place. Furthermore, Dixon (2002) discusses how an organization learns through the interaction between different individuals. Here, learning is seen as the collective construction of meaning through dialogues between different members of the organization. Each member relates and compares their own knowledge or understanding to what is offered by the other members, a process in which a new meaning is constructed.

Seeing the connection between transfer of knowledge and learning, it becomes important to gain an understanding of how individuals as well as groups of individuals learn. This understanding can then be used in the analysis of our empirical findings to explain why problems are occurring and what the organization can do to facilitate transfer of knowledge to enable organizational learning.

2.3.1   Cognitive perspective on learning

In exploring how an understanding of learning can affect they way transfer of knowledge is seen, we first turn to introduce the cognitive perspective on learning, which is seen as the traditional perspective. In this perspective, learning is viewed as the process of individually acquiring knowledge. Knowledge can be acquired through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Here, knowledge is viewed as a

collection of entities that is contained or resides in the mind of the learner. (Kolb 1984)

Because of the centrality of acquiring knowledge, the cognitive perspective on learning has been discussed as belonging to the acquisition metaphor of learning (Sfard 1998, Elmholdt 2003, Paavola & Hakkarainen 2005). Sfard (1998) notes that the traditional conception of learning has always been viewed as an acquisition of something, as shown in for example the Collins English Dictionary definition of learning as "the act of gaining knowledge". The act of acquiring knowledge thus implies that an individual takes one or more entities of knowledge from the outside and then becomes an owner of these entities by putting them into his or her mind, or by filling the container (Elmholdt 2003). Furthermore, Sfard (1998) discussed the role that concept development has played in the view on the process of learning. Here, concepts are seen as an entity of knowledge that can be acquired, refined, and combined by an individual to create a greater amount of knowledge. Whatever form the entity of knowledge might be in, it is seen through the cognitive learning perspective as an acquired commodity that can later be applied by the individual.

Once an individual has acquired an entity, this piece of knowledge, like any other commodity, can also be shared and transferred to others (Sfard 1998). It can be seen as something fairly unproblematic to turn individual knowledge into organizational knowledge by taking an entity of knowledge from one person and transfer it to other people. As such, taking the cognitive perspective, attempts to transfer knowledge have historically been focused on codification, storage and retrieval of knowledge through technology based approaches (Davenport & Prusak 1998), as well as routines and standard operating procedures (Bechky 2003).

The cognitive perspective on learning can also be related to what Brown & Duguid (1991) discussed as having a canonical view on how work is carried out in an organization. This view assumes that complex work practices can be abstracted into a set of straight-forward canonical steps that are easy to understand for others and as such can easily be used and applied. Taking this view, organizations believe that by offering thin representations of work in manuals and databases, filtering information through hierarchies, having job descriptions and offering training courses, learning will take place.

Limitations of the cognitive perspective on learning   Even though the cognitive perspective on learning is deeply rooted in history, the shortcomings it presents have been pointed out from many directions (Handley, Sturdy, Fincham & Clark 2006, Brown & Duguid 1998,

Blackler 1995, Bechky 2003, Duguid 2005). Many of the points of criticism are important factors when considering how to study the movement of knowledge from one context to another. One common criticism is that the focus on acquiring entities of knowledge overlooks the importance of knowledge that is socially created in work practices (Handley et al. 2006, Brown & Duguid 1998, Blackler 1995). Indeed, several studies have shown that this social type of knowledge is what makes codification, transfer, and replication of knowledge complicated and problematic (Kogut & Zander 1992, Nonaka 1994, Nonaka & Takeuchi 1995). Brown & Duguid (1998) criticize the thought of knowledge as simply being the property of individuals. Accepting this thought would imply viewing an organization as consisting of individuals who act in isolation, and believing that the main challenge of the organization is to find this knowledge. However, taking this view overlooks knowledge that is created and exists within groups of people (Brown & Duguid 1998). This type of knowledge is usually of the know-how type and embedded in collective work practices (Brown & Duguid 1998). The shortcomings of the cognitive learning perspective became furthermore apparent in a study made by Orr (1996), which focused on examining the work practices of copy machine technicians. Even though the study focused on relatively isolated workers, it was shown that the collective know-how, often created through technicians sharing stories or inviting each other to solve problems together, played a highly significant role. Orr (1996) further describes the misfit between the company's attempt to transfer knowledge to other technicians through formal abstractions, such as manuals and training courses, and the reality of the work, where social interaction and know-how played a vital role in solving problems with machines. Bechky (2003) further points to the importance of realizing that knowledge is created through social practices that exist in a certain context. As a part of the process, a certain meaning and understanding within that context becomes attached to the knowledge. This meaning doesn't necessarily make sense in a different context, which consists of different people and social practices. Dixon (2002) adds to this point by describing that it is not possible for the receivers of knowledge to access the situations and practices that created the knowledge. Therefore, it is difficult to understand and make use of it.

In this regard, the social interactions and the know-how parts of knowledge are vital in studying attempts to transfer knowledge since an understanding of them are necessary for the practice to be successfully carried out in a different environment. Furthermore, the context must be accounted for, since the idea of knowledge transfer implies that knowledge should move between different contexts. Taking a cognitive perspective in studying knowledge transfer would largely overlook the social practices within different contexts in which knowledge is embedded.

As a result, we turn to the situated learning perspective as our main framework for analyzing our findings.

2.3.2   Situated perspective on learning

The situated perspective on learning, as put forward by Lave & Wenger (1991), focuses on informal social interactions, as compared to a formal process of cognitive transmission from one individual to another. These types of interactions achieve learning of what is necessary to know about the complexities often found in practice. As such, at the center of situated learning theory is practice, how people act and interact in a social setting in order to accomplish their work. Through these practices, individuals combine, refine, and modify knowledge (Wenger & Snyder 2000). Lave & Wenger (1991) further demonstrate that through engaging in social practices, learning becomes grounded in context. This context is seen as a community in which participants must learn how to deal with and make sense of different tasks. Lave & Wenger (1991, p. 98) see the community to imply "participation in an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communities". As such, learning happens through an evolving form of membership in a community.

To describe and analyze how people become members of communities, and subsequently learn, Lave & Wenger (1991) developed the concept of legitimate peripheral participation. Once a person gets access to, and becomes a participant in the periphery of a community, it becomes necessary to learn how to work and interact within the community. This learning develops until the person becomes a full member of the community, which is represented by, for example, a shared identity and trust. In the process of moving from a peripheral participant to becoming a full member, understanding and meaning becomes locally and socially constructed within the community. Generally speaking, this is also the way how communities are formed. A community might start with two members and then slowly expand to a bigger community as more and more people become a member through legitimate periphal participation. Realizing the importance participation has in understanding how knowledge is used and how learning takes place in an organization, it becomes important to study how it unfolds to create common and situated practices.

Lave & Wenger (1991) propose to study communities of practice to gain a better

understanding of learning and knowledge in organizations. It is important to note here that different interpretations of what constitutes a community of practice have been developed since then (Brown & Duguid 1998, Wenger 1998, Wenger, McDermott & Snyder 2002, Cox 2005). In surveying the different interpretations, we have chosen to make use of Wenger, McDermott & Snyder's (2002) representation of three main characteristics of communities of practice since we believe that they best serve out purpose of gaining a better understanding of what constitutes a community of practice. Wenger, McDermott & Snyder (2002, p. 27) highlight three fundamental elements that all communities of practices share. First, there is a *domain* of knowledge, which defines a set of issues, or the topic the community focuses on. The domain provides a common identity and purpose to its members, which in turn gives a meaning to their actions. Second, there is a *community* of people who care about this domain. The community is characterized by intimate and open interactions, where members are willing to take part in exchanging ideas and thoughts. This in turn forsters relationships and a sense of belonging in the community. This sense of belonging is seen as an integral part of learning. Third, there is a shared *practice* that the community develops to be effective in their domain. The practice is the specific and situated knowledge that is shared, developed, and maintained within a community, such as stories, tools, information, language and documents. (Wenger, McDermott & Snyder 2002)

Learning from other communities through a process of transformation Participation in a community of practice leads to a local construction of understanding. As a result, what is thought of as a similar activity is actually performed differently in practice in different contexts (Bechky 2003). Thus, communities can be expected to have different domains of knowledge and heterogeneous ways of learning or attaching meaning to this knowledge. This local construction of understanding in communities, and the differences in understanding it creates, goes against the metaphorical notion of knowledge transfer (Bechky 2003, Carlile 2004). Bechky (2003) points out that knowledge transfer implies that expressions of knowledge all have a single meaning. As such, it is assumed that the knowledge that is expressed and transferred has the same understanding both at the sending end and the receiving end. The apparent differences between communities in how they make sense of knowledge brings out a new complexity that must be considered when investigating how communities can learn from each other. In the following, we describe how learning between communities can be seen as a process of transformation.

Boland & Tenkasi (1995) argue that each community within an organization develops specific knowledge and for a community to learn they must have the ability to take the per-

spective of another into account. Perspective taking is a process of exchanging, evaluating, and integrating knowledge between communities (Nonaka & Johansson 1985, Shrivastava 1983), in which the specific thought worlds of different communities are put out in the open and made accessible (Boland & Tenkasi 1995). For this process to proceed, the organization must enable individuals or groups to make representations of their understandings, and make it easier for others to recognize and accept the differences in these representations (Boland & Tenkasi 1995). In other words, for perspective taking to happen, it is necessary to first create a common understanding of the knowledge so that it can be incorporated and made sense of in the local context (Bechky 2003, Carlile 2002, Carlile 2004).

Bechky (2003) studied misunderstandings between engineers, technicians and assemblers and found that they solved such problems through the co-creation of common ground. Solutions that served to co-create common ground, such as tangible definitions, were focused on invoking the differences in contexts, which made it possible for people from different communities to understand each other. Carlile (2002) saw similar findings in his ethnographic study of four different functions involved in new product development. Here, it was found that knowledge was heavily embedded in practice, which made accommodating knowledge from another practice very difficult. In both these cases, boundary objects (Bechky 2003, Carlile 2002, Carlile 2004, Wenger, McDermott & Snyder 2002), such as models and maps (Carlile 2002), prototypes and drawings (Carlile 2004), or a well written contract or design proposal (Wenger, McDermott & Snyder 2002) played a vital role in accommodating similar understandings across practices. In addition, Wenger, McDermott & Snyder (2002) discuss the importance of activity and coordination at the boundaries of different communities of practice. Here, connection activities, such as shared projects and people who are part of several communities can assist in making knowledge understandable across communities.

Once a broader and shared understanding is achieved, and the knowing of another community is exchanged, evaluated, and integrated into the local community through perspective taking, the communities' understanding transforms. This can be seen as a deep kind of learning, where new insights and developments are created (Wenger, McDermott & Snyder 2002). As Bechky (2003, p. 321) reports from her study: "An individuals understanding of the product, process, or organization was expanded, not merely by the introduction of new knowledge, but by placing that knowledge within her own locus of practice in such a way that it enhanced the individual's understanding of her work world, enabling her to see that world in a new light." Carlile (2002, p. 454) came to a similar conclusion in his study, reporting that "knowledge was

integrated [..] and more novel forms of knowledge were jointly transformed at the boundary". These examples show how the interactions with other, different communities, transforms the understanding of individuals and communities.

The situated learning perspective can also be related to what Brown & Duguid (1991) discussed as having a non-canonical view on how work is carried out in an organization. This view sees work not to be simply about the task itself, but also about maintaining social relations. Through working on problems together, exchanging stories, people become successful at what they do. Having this view on the organization implies that the focus should be shifted from abstracted accounts of work to paying attention to the people and the activities they engage in.

3 Methodology

In this chapter we aim to provide an account for the journey we have gone through in performing our research. We do so through a chronological discussion, describing how we came to study what we studied, and how we acquired and analyzed the data. This discussion provides an insight into what we did, how we did it, and why we did it. Before moving on, we wish to highlight some activities that have taken place throughout this process that, although of the highest importance for our process, would be redundant to explain in each of the following sections.

It is our firm belief that many of the best ideas are created through discussions between people. Therefore, we attempted to take every opportunity to reflect and discuss. This resulted in many informal and creative discussions between the two of us, with our tutor at the university, with our tutor and other employees at the case company, and through taking part in workshops at the university. These discussions have provided us with many useful ideas and insights that have helped us throughout the study.

3.1 Choosing our interest and finding a case

In order to be able to deliver an interesting report, it was vital for us to agree on a topic that would be interesting to study for us. Therefore, we decided not to rush into a decision but rather to perform a broad literature review to search for interesting theoretical fields. After this literature review, a series of discussions led us to identify knowledge management as our main interest. We decided that we would like to study a problem within the area of knowledge management in an organization and the next step was to search for a company that faced a problem within knowledge management and was willing to provide the support necessary to conduct a successful investigation. At this point in time, our program of study was involved in a project with Vinol. Finding Vinol interesting, we approached one of its top managers, who gave us a commitment and provided us with a few problems that the Vinol was currently facing. The problem of reusing knowledge was interesting to us since we were aware of that it is a common knowledge management initiative that causes difficulties in many organizations. In the summer, one of us worked as a summer intern at Vinol and found out about a current initiative to address the problem of not replicating results from Six Sigma projects. Vinol believed that if they could develop a process for this to happen, they could learn from that process and implement similar processes to replicate other types of knowledge within the organization. We were able to get

the commitment to focus our investigation on this problem and initiative. However, in order to carry out a meaningful investigation we needed access to a fairly confined setting where enough Six Sigma projects had been closed. As the largest number of projects (18) had been completed in the factories located in one Scandinavian city, and considering the limited time allotted for the investigation, we chose to perform our study in this city.

3.2 Gathering data

The main bulk of our empirical data was collected through 19 semi-structured interviews with 17 different employees; two Six Sigma managers, four group or division managers, three process and product developers, two Black Belts, one manufacturing manager, three channel managers, and two technicians.[2]

Most of these interviews lasted at least one hour. To be able to go back and listen to the interviews again, and to be able to include quotes in our paper, we recorded all of them. We also took notes during the interviews to remember interesting points. After each interview we had a discussion which mainly focused on the points written down earlier. This allowed us to discuss important matters while they were still fresh in our minds. From the beginning, our intent was to transcribe all the interviews because it would make it easier to go through them again, and also to pick out quotes . However, after transcribing nine interviews we decided that it was not going to be the best use of our remaining time. Therefore, we took more extensive notes during the rest of the interviews and had longer discussions afterwards.

We can see these interviews as being conducted in two rounds. In the first round of interviews we wanted to get a better understanding of the initiative and the overall context of our study. Here, we interviewed one manager in the knowledge management department and one in the business development department, to put the problem into a context. In addition, we interviewed Six Sigma management driving the initiative, as well as Six Sigma employees in the factories. Based on these interviews, as well as surveying the literature related to our case, we were able to frame our study. We decided that our main interest was to study how people learn and created our first version (but not our last!) research questions. Although this first round of interviews pointed to some of the possible problems, we wanted to ensure that we did not

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[2]As the majority of our interviewees happened to be men, we will hereafter refer to such a person using the pronoun *he* whenever applicable. Furthermore, the term *manufacturing employees* will be used as a grouping of the manufacturing manager, process and product developers, channel managers, and the technicians.

draw any conclusions before interviewing the employees that were supposed to reuse Six Sigma results. Therefore, we kept the research questions broad, which would help us to go into the rest of the interviews with an open mind. It is important to note here that although this first round of interviews focused on increasing our understanding of the initiative and the context of our study, it also provided us with important empirical data.

Since we were interested in the way people learn, we decided to continue with the qualitative method in the second round of interviews. This was the natural choice since it would allow us to gain a deeper understanding of what people do to carry out their job, as well as how they do it and why they do it that way. Although we brought in some prepared questions for these interviews they served more as a tool to guide an open discussion.

In order to choose a relevant sample of interviewees in the factories we first discussed who could potentially be seen as reusing Six Sigma results, as well as influencing it happening. With our limited knowledge of the work in the factories and the problems employees are facing, we were unsure about this target group. Management driving the initiative had the intent that every position were potential "reusers". We saw it as important to attempt to develop our own opinion during the study and decided to set up interviews with different organizations, departments, and positions in order to get a broad understanding of the situation.

We first asked our interviewees to tell us about their background, what they do in their current role, how their role fits into the organization, and how they view their own department. This allowed us to get a better understanding of the activities and context of their work. Secondly, we aimed at finding out more about their approach to solving problems. This was important since the idea from the people driving the initiative was that Six Sigma results should be used as a resource when an employee is facing a problem. Lastly, we had discussions around how they view Six Sigma in general, and the replication initiative in particular. This allowed us to get an insight into the relationship between their everyday work and the initiative to replicate Six Sigma results.

It is important to note here that although these interviews allowed us to gather the majority of our data, there are other important sources that have played a role throughout the data collection process.

During the summer, one of us worked as an intern in the knowledge management department at Vinol. This experience allowed observations of behaviour and attitudes of people,

which added to our understanding of how people at Vinol get their work done. At several occasions we had very fruitful informal meetings and discussions with our tutor and other employees at Vinol, as well as with other students currently carrying out a case-study at Vinol. Lastly, data given to us by Vinol, such as presentations, and data collected on the intranet, added to our overall findings.

3.3 Analyzing the data

After gathering the data, we needed to explore what we had found out and how to analyze what it meant. We read literature (e.g. Silverman 2005) and talked to our tutor at the university about ways to categorize data gathered from qualitative studies. It became important for us to choose a strategy that made our findings reliable and valid. To present reliable findings we wanted to make sure that we found and analyzed data that were repeatedly expressed in interviews. With regards to validity, we had in mind the following question posed to qualitative researchers, as expressed by Silverman (2005, p. 211): "How are they to convince themselves (and their audience) that their findings are genuinely based on critical investigation of all their data and do not depend on a few well-chosen examples?"

Having these two points in mind, we decided to first go through our transcripts, as well as tapes and notes from interviews we did not transcribe, and for each comment we asked ourselves what it was an example of. This led to the establishment of certain categories. We then went through each of the established categories and deleted comments that did not appear frequently. This left us only with recurring comments, which improved the reliability. Also, we made sure that each category did not contain comments from just a few interviews. This improved the validity since we ensured that we did not come up with categories that represented one or a few persons attitudes. Having our research questions in mind, we then looked at the relationships between comments within a category, and the relationship between different categories. This led to creating our final categories as presented later in our empirical framework. Throughout this categorization, we read more intensely about theories and studies related to what we had seen. This assisted us in defining the categories and creating our empirical story of what we had seen.

Before starting to analyze the empirical data, we researched different theories and studies to decide on a more narrow "lens" or perspective to use for our theoretical framework.

This theoretical perspective assisted us throughout the analysis to understand and explain what our findings meant and how they served to answer our research questions. Based on the main arguments in the analysis, and the answers they provided to our research questions, we could finally draw our conclusions and make recommendations to our case company.

4   Empirical data

The purpose of this chapter is three-fold. First, we present an introduction to our case company Vinol and describe how its overall strategy has put an increased focus on the importance of knowledge. Second, we introduce the initiative that has been the focus of our investigation, including information about the relevant setting. Lastly, we aim to give an overview of the main findings from how work is carried out in the factories.

4.1   Vinol and the change in strategy

In the introduction chapter of this paper we provided evidence showing that the business community is seeing knowledge as a main source of competitive advantage. In this section we will highlight how Vinol has evolved in a way as to attempting to redefine itself. One result of this redefinition is a much stronger focus on knowledge as an important resource.

Vinol is a global leader within its area, manufacturing and selling components, solutions and services related to many different types of applications and markets. The history of the company started in the beginning of the 20th century, when an engineer found a solution to an agitating industrial problem. This engineer, seeing the early success of selling the product that had solved the problem, decided to start travelling to see where else this business could be established. The continuous development of the organization since then has led to the establishment of global operations and employment of thousands of people.

4.1.1   From selling components to offering solutions

During the last two decades, the company has seen increased competition and pressure from low cost providers and growing competitors. With its long history, for Vinol, a natural reaction to the increased competition was to attempt to leverage on the internal accumulation of engineering knowledge to offer specialized high quality products to a global market. For many years, workers offered complementary after-sale assistance to their customers. As the internal knowledge of providing services grew, Vinol decided to make it part of their business by offering various service solutions. As new major low cost labour markets evolved, and some of the key competitors merged, the company decided to attempt to redefine itself a few years ago. The vision was

changed to reflect a wish to transfer the knowledge of the company to customers. The change in strategy accompanying the new vision became focused around becoming more of a solution provider as compared to selling and servicing components.

As a part of this strategy, five platforms were identified to represent the different capability areas within the organization. The organization had in the past been focusing mainly on developing and selling from each platform individually. Management in Vinol believes that the current focus on developing solutions, however, demands an organizational alignment that supports cross platform integration. A common explanation from managers is that a person used to developing and selling only one component or product now has to extensively learn from other units and divisions within the organization, as well as from the customer.

4.1.2   The attempt to find new ways of working

Vinol is currently divided into three divisions. This structure represents the types of customers that the company targets and works with. Vinol has a network structure, where work teams and departments within a division often consist of employees residing in different parts of the world. Each division runs their own business to achieve the vision, mission, and strategy set by the company. The group office offers support to the divisions to enable them to run their business effectively. Several managers at the group office have highlighted that while they provide support to divisions, the formal power when it comes to running the business lies strongly within each division. They further believe that this decentralization, with the power and freedom residing in divisions, has led to the establishment of different ways of working in each division. Many different systems and processes have been developed and used in different divisions. In addition, according to managers, collaboration and learning across divisions is limited.

Along with the change in strategy, management describes the wish to change the mindset of the workforce towards becoming more solution minded. Here, becoming solution minded is thought of as demanding an increase in collaboration and learning from other units and divisions. In light of this demand, management at the group office describes an intentional move towards attempting to get the divisions to work more closely together. A number of initiatives have been taken on a group level to make this happen. For example, a Group Knowledge Management department was established in 2005, focusing on creating systems and processes to facilitate knowledge integration and collaboration. Another example of such an initiative is the

current attempt to develop five main business processes that should run across the divisions.

In summary, it is evident that Vinol believes that leveraging on its knowledge is the key to differentiation and competitive advantage. Vinol tries to implement this strategy through an increased focus on developing solutions for the customer built on a variety of knowledge from within the company. As a result, the organization believes that it is vital to work closer together and learn from each other.

4.2 Six Sigma and reuse

The initiative that we focus our study on, the attempt to reuse knowledge through the transfer of Six Sigma project results, can be seen as another example of an initiative resulting from the increased importance of leveraging on the knowledge that exists at Vinol. Before going more into detail about the initiative, we will describe Six Sigma and the Six Sigma organization within Vinol.

Six Sigma was first developed by Motorola in the 1980s and has become a very popular approach (Antony & Banuelas 2002). Six Sigma is a data-driven methodology, which aims to improve processes by solving problems (Snee 2004). The name is taken from statistics, in which the Greek letter sigma (σ) denotes the deviation from the norm. When operating at six sigma, only 3.4 errors per million units are allowed to occur (Snee 2004).

DMAIC (Define - Measure - Analyze - Improve - Control) is a measurement and statistical driven methodology that is used in Six Sigma to solve problems in existing processes. Each letter in the abbreviation represents a phase in the methodology. The first phase includes defining the process that should be improved as well as defining the beginning and the end of the project. In the second phase, the performance of the chosen process is measured using certain tools. The data collected in the measurement phase is then analyzed in the third phase with the goal of identifying root causes of the problem and necessary steps to improve the process. In the fourth phase, the process is improved by developing solutions to deal with poor performance. The last phase includes controlling the process to ensure that the improvements are sustained. (Sherman 2006)

Six Sigma was first started in one of the divisions of Vinol in 2003, before rolled out in the whole organization in 2004. Top management in Six Sigma points to several reasons

for choosing Six Sigma in particular. One of the main reasons was increased pressure from customers. Several of its big customers, especially in the United States, had implemented Six Sigma and believed it had helped them tremendously. As a result, customers believed that if Vinol would implement it as well they would in turn see benefits, such as lower prices, better quality and better service. In addition to customer pressure, some managers in Vinol who had tried the Six Sigma methodology in their work were convinced that it was an effective way to solve problems and saw big potential for inclusion on a wider scale. Furthermore, the methodology, training and supporting structure of Six Sigma is attractive to Vinol. This is mainly because it is believed to be a good fit with the individual development perspective, helping people to be more attractive in the workplace.

The aim of Vinol is to use Six Sigma as a business improvement tool rather than a quality improvement tool. In this sense, when searching for and selecting projects, the aim is to look at all processes in the organisation to find business opportunities. This includes both manufacturing and transactional processes. As a result of this thinking, Six Sigma is placed in the Business Development organisation. Management believes that most problems in their organisation are historically and currently solved based on "what someone believe is right" or "gut feeling", leading to temporary and inefficient solutions. In contrast, the Six Sigma methodology is seen as a proven way of providing evidence for the reasons behind problems and then finding the most suitable solution based on these reasons. As a result, a more sustainable solution is created that futhermore enables the process to run more efficiently. The vision in the organisation is to have a Six Sigma mentality in everything they do. The idea is that through applying the methodology and using the tools it automatically it gets embedded in the way they do business.

Vinol has decided to include all the traditional roles that come with Six Sigma. Currently there are one Group Champion, approximately 50 Champions, 6 Master Black Belts, 150 Black Belts, and 900 Green Belts active throughout the organisation. The Group Champion is responsible for the overall deployment of Six Sigma in the organisation. Among other things, this entails ensuring that the report structure is there, that the right number of people are trained, that the training is done in a good way, and that projects are of high quality. The Champions are responsible for the deployment of Six Sigma in a certain business unit, which can span several countries. These Champions usually has non-six sigma responsibilities as well, such as an overall process development responsibility for that business unit. Master Black Belts are spread out geographically and do not belong to a certain business unit. Their main role

is to offer support to belts that are running projects, and they spend most of their efforts on training, coaching and mentoring. Black Belts are employees taken out of their regular line job to spend about two years as a full time Six Sigma project manager. Each Black Belt belongs to a certain organization within a business unit but is allowed to run projects in other organizations within the same business unit. The training is extensive, including statistical tools and project management skills. In figure 3, we provide an overview over the organizational structure within Six Sigma:
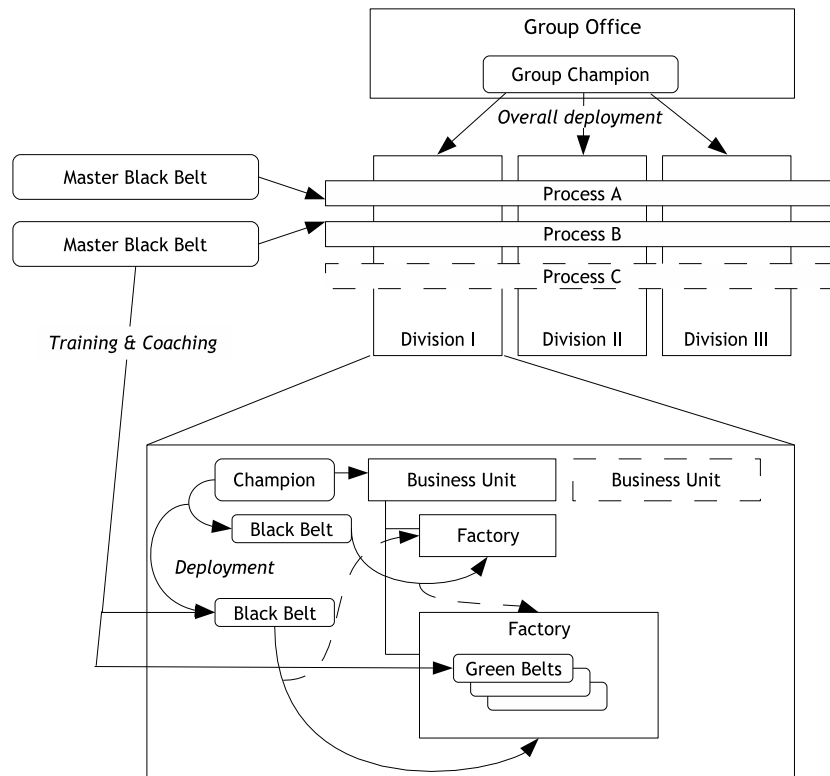
Figure 1: General Six Sigma organizational structure

During their time as a Black Belt they are supposed to run a minimum of two projects per year. Green Belts on the other hand, never leave their line position. They go through shorter training and are required to run a smaller scale project in order to become certified. In addition to these roles, there are other actors involved in a Six Sigma project. The Process Owner is the person who is responsible for the design of the process to be improved. With the expertise this person holds, he or she will provide support to the project team. The Project Sponsor, who is usually a manager, is the owner of the "burning issue" that must be addressed by the Six Sigma project. This person has the authority to decide on resource allocations for the

project and is ultimately responsible for the successful completion of the project. The Six Sigma Steering Group is the management team responsible for running the Six Sigma initiative within a certain organizational boundary. This group select and prioritise projects and are involved in selecting Black Belts. The controller provides financial support for the belt running the project and defines and confirms the economical gains in the project. The Project Team members do not have to be trained Belts. However, they have good business process knowledge and general knowledge about Six Sigma. Figure 2 shows the different roles involved in a Six Sigma project:
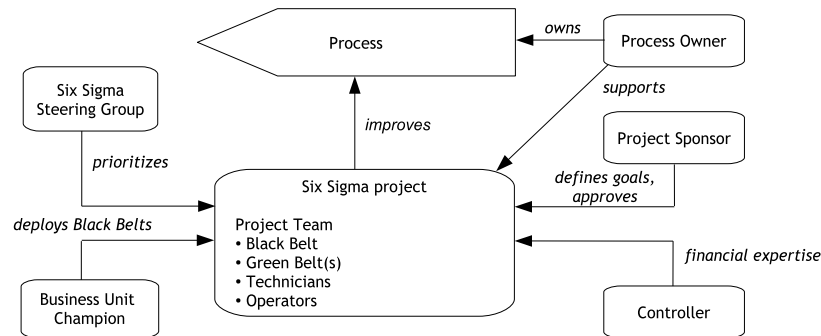

Figure 2: Six Sigma project structure

The Six Sigma methodology is applied only when the cause of the problem is unknown. In addition, it has to be possible to collect enough data to carry out the project and there has to be a clear link to the strategic and operational objectives. Projects run by Six Sigma belts are of a great variety. Examples of projects run in Vinol include reduction of energy consumption in a manufacturing channel, improving delivery time, improve the efficiency of sales representatives and decrease administrative work in handling orders from customer.

In running projects, the Belts in Vinol follow the DMAIC methodology introduced earlier in this chapter. Within each phase there are certain tools that have to be used and reports that have to be written and put into a Six Sigma database. At the end of the project, the Belt presents the work done and the results achieved.

The Six Sigma organization has developed a follow up database where all current and completed Six Sigma projects and the data related to them are stored. Here, among other things, one can find a list of all the Black Belt and Green Belt projects, the status of each project, names of people involved in projects, planned and (if completed) confirmed savings, the number of projects per division and business unit per year, and project documentation, such as project charter, a description of the use of the different tools in the project, a final report, and

sometimes an executive summary. The executive summary consist of the problem statement, the goals, the customer satisfaction benefits, the financial benefits, main points found in each phase of the DMAIC methodology, key learning points, and to whom knowledge gained from the project has been shared. It is possible to search for projects in this database by division and process.

Management in Vinol believes that employees throughout the organization often reinvent the wheel. They feel that people faced with any kind of problem are too quick at coming to a solution, and that they are reluctant to use a solution that has already been established. In response to this belief, the organization attempted a few years ago to create a process for spreading what was called "better practices". However, the organizations was unsuccessful in establishing the system in the organization and after a period of approximately two years it was labelled a failure and shut down.

Also Six Sigma results are viewed by management as a "better practice" since they are based on a rigid methodology of how to solve problems. Similar to the "better practice" initiative described above, Six Sigma management wants the results of Six Sigma projects to be of value for other parts of the organization, wherever it is applicable. For example, someone in Thailand who is facing a problem should reuse results from a previous Six Sigma project that was done on a similar problem somewhere else in the world. It is then possible for everyone to access the database to find out more about the different projects.

However, the group Six Sigma Champion performed informal audits in the organization, asking employees if they have used results from Six Sigma projects. Here, it was found that results from Six Sigma projects are not being reused. As a consequence, an initiative to increase the reuse of Six Sigma knowledge through the transfer of project results in the organisation was started. The Six Sigma database is seen by Six Sigma management as an important tool to facilitate transfer and the plan is to make better search functions for people to find out what has been done previously and who to contact. In the closure phase, the belt and sponsor are supposed to put reuse opportunities and the business process of the project into the database. Using that information, an automatic mail is sent to relevant people in the organization alerting them of the closed project. Other activities look slightly different depending on the division. For example, one division places responsibility on the Champions to filter down information about closed projects to ensure that people are not overwhelmed with irrelevant information. The Champion tries to establish two-way communication and commitment by asking for feedback

on whether people are interested or not. Broadcasting is another activity that will be taken on by the organization. Here, the Champions or overall process owners will be alerted by the database of projects that are interesting for a certain local process. They will then establish teleconferences with the local process owners to tell them about the project and discuss whether they can replicate it. Other activities are designed to create awareness, such as having posters in the workplace showing a summary of the state of an ongoing project, and posted sessions, in which people from different levels are invited to a presentation where the belt uses a poster to illustrate what a project was about.

Even with these activities, management feels like further study is necessary to solve the problem. Thus, Six Sigma management wants to get a better understanding for why the reuse of project results is not happening to a larger extent than it is today, as well as what they can do to facilitate this happening. Having a better understanding, they wish to come up with a process of enabling reuse, which itself could potentially be reused in spreading other types of better practices within the organization.

4.3   The manufacturing site

As stated in the methodology, our focus for this study is confined to the operations in one Scandinavian city. As such, all Six Sigma projects in our study is within manufacturing. Seeing Six Sigma as a part of the broader concept of improvement work, an emphasis is put on how improvement work is structured within the factories of Vinol.

There are three main factories distributed onto several buildings. One of the factories is smaller than the others and acts as a supplier for the other two, which in turn assemble the end-product. In each factory, there are several channels. A channel represents the smallest organizational unit within the factories. Within a channel, there are several machines organized in production lines manufacturing a certain range of products. It is possible that there is more than one production line per channel. The channel manager as head of the channel is responsible for delivering a certain amount of manufactured products in a certain time. Thus, there is a high pressure to focus on keeping the efficiency of the channel high. Furthermore, the channel manager is responsible for managing up to 50 people within his channel which is considered as a very time consuming task. The workforce in a channel consists of operators who actually operate the machines and one or more technicians who assist the operators and the channel manager in

more technical issues. The technicians are supposed to secure the production through solving problems occuring in the production lines assisting the machine operators in case they can't fix the problems themselves. In addition, the technicians run improvment projects such as improving parts of machines and are team members in bigger projects such as building up a new production line.

In the two bigger factories, several channels make up a so called manufacturing area. All channels within a manufacturing area manufacture a similar type of product. A manufacturing manager coordinates the activities within the manufacturing area, coaches the channel managers and serves as a mediator between the factory management and the other departments in the factories on the one hand, and the channels on the other hand. Being part of the management board, the manufacturing manager also represents the interests of the manufacturing area within the factory and tries to a get approval for the investments needed for his area. Furthermore, the manufacturing manager is the manager of the technicians working in the channels of the manufacturing area. In some manufacturing areas, the technicians are assigned to a specific channel whereas in others they are assigned tasks in different channels according to their competence areas. The smaller one of the three factories is not organized in manufacturing areas as there are only three channels. Here, there is no intermediate layer between the channel managers and the factory management. Thus, the technicians are directly assigned to a channel and it's channel manager. A lot of the technicians are trained Green Belts or are currently participating in the Green Belt training. Figure 3 shows the organizational structure in the factories:
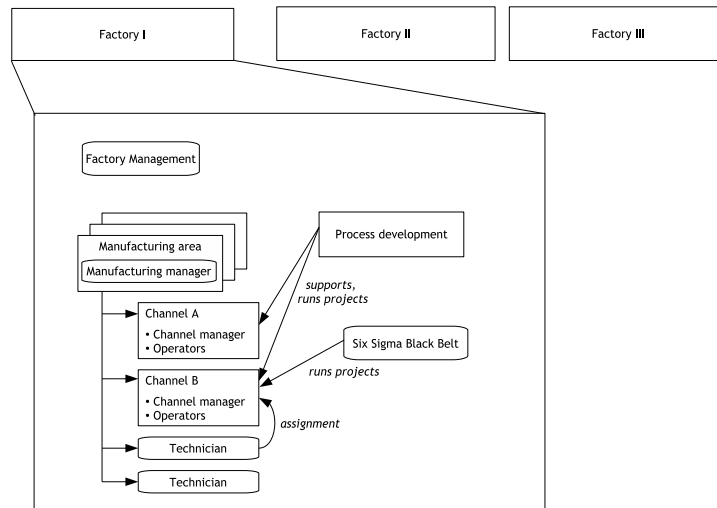

Figure 3: Organizational structure in the factories

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As described before, the technicians run smaller improvement projects in the channels. Projects going beyond a certain scope, which can not be handled by a techician or a single channel, are carried out by a special department within each factory - the process development department. Here projects requiring bigger investments, such as building up a new production line, purchasing a new machine or bigger changes in the setup of existing production lines, are carried out. The process development department thus sees itself as a kind of consultancy supporting the manufacturing areas and channels in their work. Each project is carried out by a project manager from within the process development department. If there are resources left, the process development department tries to run projects with the more strategic focus of improving existing processes. A so called "Zero-Loss" study, for instance, aims to investigate reasons for production halts and erroneous products occured during the observation of the production process for a certain period of time. However, often there are not enough resources left to run such studies as regular projects tie up most of the resources.

What projects to run, and what unit should run them, is decided in a process involving several organizational levels. First, each channel maintains a list with improvment needs and prioritizes them according to the channel's needs. Smaller fixes are carried out directly by the operators in cooperation with the technicians. Slightly bigger tasks might become a project for a technician within a channel. In case a technician is a Six Sigma Green Belt, he might choose to run the project using the Six Sigma methods or to apply the complete DMAIC-cycle if it is applicable for the task at hand. One channel manager explains:

> "Most often it starts with problems that we feel that this issue is a problem and we have work with it. So it is very, not very proactive, we don't go out and look for projects to solve. [..] But in those meetings we pick up problems and we assign someone to solve them. [..] We try to keep it so that the one who finds the problem should also solve it, or at least be a part of solving it. And also in top of this we have sometimes project groups when we see that this is a big problem that has to be focused. So we can start up a project group."

Those improvement needs, however, which are too big regarding the amount of re- sources needed, are taken up one organizational level. In the factories where channels are subsumed in a manufacturing area, these tasks are then discussed and prioritized within the manufacturing area. The manager of the manufacturing area then is responsible for getting

the resources needed for the projects with the highest priority within the manufacturing area. These projects are then discussed together with the process development department and the Six Sigma community in a quarterly meeting in order to determine who should run the project.

Vinol has developed it's own model defining the way projects are supposed to be run. However, it is not seen as strict methodology, it is seen as providing more of a toolbox containing different tools for running a project. Still, there are certain requirements regarding documentation of the projects and there is also a database where this documentation should be stored. Furthermore, the model provides categories for classifying projects according to their size, ranging from a so called "Class A" project defining the biggest category over middle-sized "Class B" to smaller "Class C" projects. When discussing the projects as mentioned above, the people involved in these discussions try to determine if a project should be run according to the company's project model or by applying the Six Sigma methodology depending on the type of the project. In case of a decision for the company's project model they furthermore try to determine which class the project belongs to. The process development department's policy is to handle all projects classified as class A or B. Smaller class C project are sometimes also handled by the process development department and sometimes given out to technicians. In case of a decision for the Six Sigma methodology, the Black Belt assigned to that factory discusses the possibilities of running that project with the other Black Belts and the Champion in order to determine the availability of resources such as a Black Belt carrying out the main work and supporting staff.

4.4   Work in factories

Knowing the basics with regards to the strucure of the setting and improvement work, we now turn to present the main findings related to working in the factories and how Six Sigma is seen.

4.4.1   General work environment

Vinol has a long history of being in the forefront of the industry, producing innovative and high quality components. As a result, the company has a heavy focus on engineering and a very large proportion of the employees have an engineering background. In our sample of the people we interviewed in the factories, for instance, all people had an engineering background. Until a

few years ago it even was an requirement for higher management positions to have completed an engineering degree.

A more general observation we made was that employees are given a lot of freedom in the way they carry out their work. Certain things, as in every company, have to be done of course, but in general there a very few specific rules or written instructions defining how certain tasks are supposed to be carried out. A channel manager, for example, is responsible for the channel as a result unit. He has to achieve certain goals such as a high efficiency. But how he achieves those goals (e.g through focusing on certain improvements or buying certain machines) or how he designs the different roles in his channel, is very much up to the channel manager. The amount of freedom also can cause problems as the following quote of a channel manager shows:

> "In most areas it is very much up to the channel manager. We have been discussing this quite much for a couple of years within the factory and so on that that is a problem because it is hard for new channel managers as well. So even if you have been a channel manager in a another channel, when I move I still have to learn a lot of new tools and so on."

Also the technicians have a lot of freedom in how they run the improvement work. Naturally, they work in close cooperation with the channel manager but the way they carry out the projects, and which methods they choose is up to them. The amount of freedom given to employees is also reflected by a great variety of machine types in the channels. A channel manager explains:

> "But for instance [..] the two channels here have the same bottleneck machine with different types of control systems. And so the machines are very dislike anyway, even though from the beginning it was the same machine. That is because channels develop on their own. It is very much the channel manager in the channel that requests PRT to solve their problems. So if we update a machine it is not by default that every machine is upgraded like that because it is needs and demands issues ... so after a couple of years, even if you started out with the same machine they will look very different."

4.4.2 Interaction

Starting with the channels as the smallest organizational unit and escalating up to the factory level and above, there is a meeting structure aimed towards filtering up and down information: Among the operators in a channel, there are four types of representatives in each shift. One for quality, one for the supply chain, one for personnel issues and one for technical issues. The technician in a channel has meetings with the technical and the quality representative in each shift whereas the channel manager is more connected to the supply chain and personnel representatives. In these meetings, current issues are brought up and discussed. The technician(s) and the channel manager also have regular meetings in order to coordinate their actions. The channel manager then has regular meetings with his manager, the manufacturing manager. In these meetings issues concerning the whole manufacturing area are discussed about once a week and once a year a business plan for the next year will be created together. The manufacturing manager then is part of the management board of the factory where all manufacturing managers meet with the managers of other areas like quality and process development. However, it seems that there are not many meetings where more than one organizational unit e.g. different channels or manufacturing areas from different factories come together. In regards to process development, however, such a process was started:

> "I mean, the formal interactions within my role as process development manager is that this year we had ... this year had two meetings with the other factories' process development managers, this year. Which is very good. It also opens up for informal conversations and you have a face to the name."

Still, in general our impression was that such meetings mostly are held on special issues such as when the outcome of a planned change affects or depends on another unit. A process devlopment manager also noticed boundaries between organizations:

> "That's actually exactly what's happening with our channel we're building up and moving: [another unit] is doing exactly the same thing. Slightly different concept, but we're in the same factory, same type of [product] but they're in a larger dimension. We are cooperating, but not in a formal way. It's more the project leader and the team around it. Which tells a lot about the influence of what organization you belong to. We're working in the same factory but we're somehow tied to our organizations,

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so to speak.”

Contacts with customers (i.e. the consumers of a channel's products) are also scarce and sometimes cease completely as reported by a channel manager:

“It's very little contact with my customers and so. My customers are all situated in the other factory and we have had some meetings . . . but very little and I don't feel that they are really interested in those meetings so it went down.”

Informal interaction sometimes appears to be hindered by the way people are placed within a factory. Offices are often scattered around in big factory buildings and it is possible that a channel manager and the people in his channel sit a few hundred meters away from the next channel. Factory management, including the process development department and the Black Belt assigned to that factory, usually sit separately from the channels at another office space. The following quote of a channel manager exemplifies one of the problems related to little interaction:

“So we tried to make this stone-holder ourselves and we didn't really know how and when it was almost ready we understood that there was somebody with a PhD in stone-honing working just 20 meters from here, [..] and we didn't get his expertise. So then we re-worked the project and we took him in and it went well. But it cost a lot of money before that. But we didn't know and no one told us and he's just a couple of meters away and you're eating in the same restaurant.”

Interaction outside this more local environment seems to be mainly based on a personal network of colleagues our manufacturing employees have worked with before or gotten to know through other occasions as e.g. in the case of a channel manager:

“. . . that is more if I have been working in a another factory and I know some people within my personal network then I might know that he has a machine and more like that. That was how it developed with the channel boards. Because we knew that there was a guy in another factory working on it and being interested.”

When it comes to knowledge about other factories, manufacturing employees felt that they had knowledge about other areas in regards to what processes existed while not being sure about the details of how work is being carried out, e.g. what improvement efforts were made in detail, how improvement efforts are prioritised and with which strategy they are approached:

> "Let's say we know what we have in here in the factories, that's for sure. Well, not for sure but basically we know what kind of equipment, what kind of processes we have fairly well. Then when it comes to what we have in the next year or in the coming years, we have a good idea but probably not good enough. I think that's a weakness, I mean we could improve that situation by just having more informative meetings between the factories and central process development. [..] we tend to look into our factories like this [showing blinders] and when it comes to future plans it's …you never know when it will be implemented, you are short of time, you tend not to follow it actively so it's …you know once a year you know basically what's going on but not in detail."

This process development manager is able to benefit from coordination meetings mentioned further up. For the channel manager in the follwing quote, however, it seems harder to get an insight into other factories:

> "…actually I have small insight in other factories or other manufacturing areas because as a technician and in this management position I have only working been working in this manufacturing area."

4.4.3 Improvement work

Improvement work is an essential part of the work of the people we interviewed. A lot of different organizational levels are involved in this work and there are also different types of improvements. The organizational levels involved include channel technicians, channel managers, manufacturing managers, the process development department, Six Sigma and employees on a divisional level. Improvement work can be everything from small fixes at a certain machine over improving a whole part of a machine to projects aimed to purchase a new machine or to build up a whole new channel.

Some characteristics of how to approach improvement work seem to be common among the different types of projects and the organizational levels involved. We found that there is a tendency to rush into solving problems and projects quickly. Furthermore, problems are often fixed without really investigating the root cause. A channel manager describes his impression in the following quote:

"...it is also, I wouldn't say culture because that is too strong, but we have a history of being very non-pro-active, that we have been solving the same problem over and over again. And of course, changing to a more pro-active way of improving takes time. Because, actually, in my point of view, it takes more time to solve a problem directly. But you gain that time because you only do it once then. But you stand there and you see kind of a simple problem, simple, just do it like this and then it's ok. But the risk is that the next time it pops up, you don't remember how you solved it or you haven't secured that this won't happen again. So it's a quite common problem."

Another channel manager made a similar observation in connection with the service department which assists the channels in maintenance and repair:

"All the small improvments that you do everyday, you don't have to invent by yourself the wheel all over in 15 places. It should be enough to do it in one place. And I believe also Vinol Service [..] they have also a big role to play there. They come and fix one machine or improve but then they go in the machine that looks exactly the same and they don't do that there, they just fix it for the moment."

Moreover, the fact that a channel is a result unit and thus is a place "where the money is produced" (as put by a manufacturing manager) seems to put pressure on channel managers. Having efficiency as the main performance indicator further adds to that pressure. This also seems to lead to a more reactive instead of pro-active behaviour (here a channel manager describes meetings with other channel managers and the manufacturing manager):

"We have an agenda, but we are never following that system, if you ask the other guys here, channel managers, they think ... that our meetings are really ... because there are always something that has happened which has to be fixed that we are discussing

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in these meetings. There is an agenda where we shall discuss customers, quality and
so on . . . but we never do.”

Not only within the channels but also in process development, project managers seem
to tend to rush quickly into a project, as a process development manager explains:

“We have a feasibility study or pre-study. You have a preparation, the implementa-
tion and closure phase. And it’s during the pre-study where you do all the work, or
you should do the work. [..] Then it’s just to follow the plan, if you’ve done a good
pre-study. And that’s what we’re working with. How do we perform it good? We do
perform good pre-studies but not good enough, I think because we’re always ... we
run a little bit late. And running a late means that you, most of the time, your cost
comes with it. So to me to run a ... that’s what I mean with pre-study. Not just
thinking this is the way, you should know it’s the right way to do it before you start.”

Gathering information   The way manufacturing employees tend to approach projects and
problems also affects the way they look for information which could be of use for solving the
problem. The same process development manager as above continues:

. . . “What if I should just read it open-minded and look for a suitable application area
for a process that I find? I think it’s a matter of spending time doing it and decide
to use time not to be 100% productive on the sheets, so to say. [..] Somehow I think
there are systems to find information, the tricky part is to make people like me and
other people to look for information. I mean we do look for information when it’s
absolutely necessary.”

Most of our interviewees considered looking for information and similar problems as
an important thing to do, still it didn’t seem important enough to actually engage more in such
activities. Time was repeatedly mentioned as standing in the way, e.g. in the following quote
by another process development manager:

“. . . but then you have to put some time into discussing what projects have you ran
and what can we learn from them. And unfortunately we don’t have that initial time.
So we just start our project and we have to fix the problems by ourselves.”

A channel manager made similar observations:

"Because we can see that often someone is doing something good and has been doing that for half a year, because just by accident you see that this is good, I do this too. I think that you don't finish [..] and then tells everybody else "this is how I did it". And I think it is common that the first step should be to look at how has others solved this problem, and I think very often you go right on to solving the problem and create something new."

In the last quote, two interesting aspects are mentioned: First, problems seem to be often tackled without first looking if something similar already has been done before and second, there does not seem to an established way to actively share solutions with colleagues. The second aspect was also noted by other channel managers:

"That will be more on a random . . . if I find a problem and i think that more channels in my group has the same problem, i try to listen to them or solve it together or create a group and solve it together. Or if I find a solution of a problem that I might think someone else has I inform them in our manuscript meeting. But that is more, we don't have a routine for how do we pass this forward. It's randomly."

As becoming visible through the quotes above, it does not seem common to look for similar solutions unless really needed. The approach of most of the manufacturing employees then is to contact people in their personal network instead of using databases. In general, databases do not seem to be used in that regard to a high extent, they were hardly mentioned by manufacturing employees when speaking about this context. A process development manager also shows a preference for personal contact:

"Well, the easiest way is just a phone call and asking: "Have you done something similar like this?" Or, may be to have access to their project list, what they have done. Then if you see something that might be interesting you have to make a phone call. May be that's the easiest way."

Talking to people to find out more about a certain issue seems to be important, also for the channel manager in the following quote:

"The problem is: it's easier to take a short time with someone you know, sit down and hear about it, then you can make the judgement: is this further interesting or not? But if there is someone you don't know you need to make a booking with that person for a meeting and may be it's nothing. You can't use it."

4.4.4 Making sense of Six Sigma

The following paragraphs are intended to show how Six Sigma is seen within Vinol. The paragraphs are divided into two sections, which represent different perspectives on Six Sigma. The first perspective describes how the Six Sigma organization, it's members and it's projects are understood. The second perspective then depicts views on how the results of Six Sigma projects can be used.

Views on the Six Sigma methodology and Six Sigma projects Six Sigma is something relatively new within Vinol. As a result, a lot of the manufacturing employees still try to figure out how to integrate Six Sigma into their work, as for instance, a manager of the process development department:

"In my department we have the target that this year all people should be Green Belts. We will not succeed, we will have three people out of eight. [..] And the reason for this is the techniques and also finding out: What should we use Six Sigma for? How should we use it? It's a great toolbox, I think. And my personal point of view is that we should have it within our projects as a perfect way of doing a pre-study. You do it in a systematic way, you separate thoughts from facts, you have an analysis and then you validate it. And that's the end of Six Sigma. And that's when the project starts, the implementation phase starts. So to me it's ... for my perspective it's the perfect way ... the perfect competence for my people."

In his perspective, Six Sigma represents a pre-study as a part of a bigger project and is less covering the implementation phase. Another process development manager also still tried to figure out how to use Six Sigma in his context through ongoing discussions with the Black Belt assigned to his factory. For him as well, the question was either to use Six Sigma as part of a project or to run a certain project completely by the Six Sigma methodology. Also for the

channel manager quoted in the following, Six Sigma is not something he deals with in his daily work-life as he is still unsure who is supposed to benefit from Six Sigma projects:

> "I haven't seen the whole range of Six Sigma project that has been done but I think that some of them should be of more interest to me. If it's financial or economical issues ... but mostly what I have seen has been very much technical nature. So it could be more interesting to a production engineer and in a sense [..] most of them have a Green Belt education or Green Belt training and have a closer, to say, contact with Six Sigma than a manager. But I think that might change in the future as well because many of the Black Belts today will probably come back to the production in some sense and then you have competence in both places and you have the interest for each other's work. As it is now, it is very much that they are a group of people in another location but they will be integrated in the company."

Generally, manufacturing employees saw Six Sigma as a good way to provide verified explanations through applying a well-structured methodology as opposed to fixing a problem quickly based on gut-feeling, as the manufacturing manager in the next quote puts it:

> "It would be especially great for the technicians working in the manufacturing units. To use these disciplines in their daily work. To begin with very strict and if not always applicable, you always have tools to verify and to find out: What needs to be done? What's the cause really? Instead of old experience and gut-feeling, that nobody can explain to you ... We do the same, sometimes."

Furthermore, Six Sigma is seen as well documented as it follows a the same methodology in every project. Providing more facts to support a suggestion also has advantages in convincing other people of that suggestion as a Black Belt notices:

> "I mean Six Sigma is fact based and sometimes the operator says: I notice this machine is the problem. We have to change it. We have to have a new machine here. Yes, but did it help if you say so? Did it help? What did your manager say? No, he doesn't listen. But may be if you have some more facts of the problem and say: This costs us this amount of money and my solutions costs this and the payback

time is this. Please let me do it. Then it's may be another question. [..] Everyone
has his own thinking about what's wrong so let's find out what's really wrong."

Using results of Six Sigma projects   Similar to the outcome of improvement work in
general, the results of Six Sigma projects are considered as something valuable and worth making
use of in more than one instance as for example by a channel manager:

"Because when you get a problem that has to be solved I think you in some way will
solve it and get information and you are discussing with people and people that know
more about Six Sigma than I do and I get help. But I think that we have a lot of
problems that we haven't time to work on, which are already solved maybe in other
areas. And very easily can be fixed here too."

However, different views exists on the way of how make use of the results of the
projects. In one instance we got to know of, a Black Belt project carried out in one of the factories
raised the interest of the Six Sigma Champion and higher managenent as it was considered as
having achieved good results. Soon, Six Sigma management took the decision to start a new
project to improve a similar process involving similar machines in another factory by replicating
the original project. As also this project yielded good improvements, it attracted the interest
of the division management. There, the decision was taken that also factories in other cities
should investigate the possibilities of applying the results of the project in their factories. Thus,
the Black Belt who carried out the projects was requested to lead a workshop together with
people working in the other factories. The participants of the workshop, however, realized that
there would be certain difficulties involved in replicating the project in their factories. Further
analyzing these difficulties, they identified the lack of "guidelines supported by coaching" and
"implementation tools" as the main obstacles for replication. Implementation tools here denote
a flexible and easy to understand model taking into account the particularities of the different
factories.

While the project described above attracted the interest of management and then
was designated for replication, the channel manager in the following quote also sees it as a
responsibility of the Belt carrying out the project to actively promote the project:

"When Claes in my case is closing his project with my honing machine I don't see that

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he actively is spreading out that information. Only when another channel somewhere around the world and they start a Black Belt project, they probably can get that information but not before, so they have to start one project to get information, and that is not good I think."

A Black Belt, on the other hand, sees the project sponsor as being responsible for replicating the project:

"The sponsors for the projects are very important. We have been told that it is the sponsor role to replicate [..]. The sponsor role is not good actually. They come to the meeting and they go for the presentation: "Yeah this looks good". And if you ask them: "Do you have this sponsor guide?" - "Yeah!" - "Well, where is it?" You don't know if it is a question - "Ahh, it is not important". It is more or less like that. We are starting to think that the final presentation of the project should be done by the sponsor."

A process development manager realizes that he could take a more active role and look for Six Sigma project interesting within his area:

"I am not saying that all Six Sigma projects are applicable to my area but if I would go through it I'm sure I could find some suitable project where I say, ok, [..] this was a successful one. I recognize the problem, [..] this solution looks very much like it could be applicable. [..] It would be difficult just to take the the study and implement it but at least to have an idea: this is possible to solve, this is the way to do it, we may have to adjust it a little bit for our process. Let's do another Six Sigma project but we know . . . I mean it's worth doing."

The process development manager above realizes that it is not just taking the project and to implement it again as it has to fit another context. The channel manager in the following quote sees the same problem:

"But then again, there is still the problem that you need to get the information, which has been done. To get that information we need to find out quite much about each

project. Can this project fit my problem, in this way? Because sometimes you hear about projects that sound interesting and we might do the same thing here, but it is hard to find that information because I need to find out who is the Black Belt for that project or the sponsor and also, I am not sure about it, but as far as I know there is no list of performed Six Sigma projects."

Although the channel manager in this quote didn't know about the Six Sigma database, all other manufacturing employees did. However, if used at all, the database mainly was seen as a way to look up information about who ran a certain project in order to be able to establish a contact and to discuss with that person. Contrary to using the database, hearing about a project from other people seems to be a more common way of getting to know about a Six Sigma project. A process development manager shares this view and sees that as a starting point for further investigations:

"If you have heard something from these meetings or other projects within the factories here or within other factories, you investigate it. It's not so pro-active, it's more using the knowledge you know and you've heard something you look then you look into it. But of course, you haven't heard everything."

Furthermore, other interviewees mentioned the lack of a good search function, keywords or the lack of a classification according the type and the area of a project as something which could be improved in order to get them to use the database. A Black Belt even sees the database as being mainly designed for Six Sigma management and Black Belts:

"It is made for Black Belt or managers to see how many projects, how many Black Belts, how long is the project time and so on, but it is not really made for benchmarking. It is a follow up system I think. How many Black Belts do we have now, how many Green Belts?"

5 Analysis

To answer our two research questions, we are now going to analyze our empirical findings. Seeing learning as a prerequisite for the transfer of knowledge, we try to get an understanding of the way our interviewees learn by analyzing the way work is carried out. Next, we discuss the implications of the findings in relation to the transfer of Six Sigma knowledge. In the last step we aim to investigate whether the measures of Vinol to enable the transfer of knowledge match the understanding of the way learning takes place, as seen through the first two steps of the analysis. Out of this discussion, we are then able to provide insights into how the organization can enable the transfer of knowledge.

5.1 Learning within the factories

From what we have seen through our experiences within the company and through interviews, there is a lot of freedom in how to carry out the work in the factories. There is no enforced "one way" of running projects, and a manager might be constrained by *what* to do, but has a lot of freedom in choosing *how* to do it. Different channels also have different types of machines. Sometimes this is caused by a manager choosing to update certain machines. However, it is also a function of how for example a certain technician has solved problems that continuously appear with machines. Since they have different ways of working, they will make changes to machines in different ways. Furthermore, the wide variety of improvement work that is done, usually affects machines and will cause them to be altered in different ways. As a result, two channels that acquired the same machine at some point in time, will eventually have differently functioning versions of that machine.

Another aspect is that there is often a pressure to solve problems with e.g. machines quickly. Thus, problems are often solved only temporarily without first getting a deeper understanding of the problem. Furthermore, it does not seem to be common among our interviewees to pro-actively search for information which could be useful for solving the problem. A common explanation for this behaviour was that there is not enough time to do so as it is difficult to find something to benefit from since problems are considered as specific. Faced with a problem they were not sure how to solve, manufacturing emploeyees prefer to ask someone in their personal network who they know has an understanding of this type of problem. Since they see their work as specific, the people they end up asking usually belong to the same work group. Also, we

found very few examples of interactions between different work groups within manufacturing. Meetings were usually confined to the same unit and there seem to be a reliance on information to filter down through management hierarchies. Commitment to continously interact informally with other units was also not seen.

Brown & Duguid (1991) shed light on these findings by noting that members of a community of practice are bound together by a shared practice. Interactions with other workers leads to learning what is necessary to know about the complexities found in practice. This practice is not constant, rather it is evolving constantly as it is socially constructed (Brown & Duguid 1991). For Wenger (1998, p. 47), practice includes "both the explicit and the tacit. It includes what is said and what is left unsaid; what is represented and what is assumed". In our case, having not very much interaction with other work-groups and having a lot of freedom in how to work and to solve problems makes it relatively easy for the members of a work-group to develop their own way of working and thinking. As practice is collectively constructed by the members of the work-group, such a setting leads to a specific practice in each work-group.

As an outcome of this local construction of practice, most of the work-groups had their own local database or network share where they stored documents needed for their daily work or where data about efficiency, quality or the like is retrievable. Wenger (1998, p. 59) notes that out of a practice in a community, various "abstractions, tools, symbols, stories, terms, and concepts" evolve. These reflect the way practice is perceived by the members of a certain community and match their way of working (Wenger 1998). Wenger (1998) introduced the concept of "reification" to illustrate this process. The documents stored there are products of a certain community practice, they are not given by the organization. Also, it is not only the database itself which is an abstraction of practice but also the various documents stored in such a database. These abstractions are developed locally by the community itself and enables its members to fulfill their tasks given "from the outside", by the organizational structure.

As we have seen above, workers in the factories work and solve probems together with their closest colleagues. As a result of their local focus they identify themselves with their local unit. People we interviewed generally had a clear picture about which people are closely related to their work. Also, the role of newcomers is sometimes still unclear as the following quote of a channel manager shows:

"We haven't really had the discussion or the close work together with the Six Sigma

> *people because when Peter started we weren't really sure about his role. Is he going to be one of us in our factory or is he . . . will he jump from different projects and will be here just for a short while."*

Wenger (1998) used the term identity to denote the way people identify other members of a certain community, as well as how people see themselves as members or non-members of communities. Both sides of this view are reflected in the quote above: it is not only the speaker who had problems in identifying to which community Peter would belong to but also Peter himself who, at that time being new to the factory, must have had problems in figuring out his identity. Depending on how both of them define their and other's identity, they will participate differently depending on the community they are part of.

As we have shown, practice is evolving constantly within and is socially constructed by the members of each work group. The degree of freedom of work within Vinol further facilitates the construction of local practices. This whole process can be seen as "perspective making", a process of learning in which "a community of knowing develops and strenghtens its own knowledge domain and practices" (Boland & Tenkasi 1995, p. 356). In learning, the work-groups develop their own perspective and practice, which enables them to work together efficiently by speaking a common language and having a common view on their work.

5.2 Communities of practice within the factories

Seeing that manufacturing employees learn and identify themselves within confined work groups, we now set out to show how these groups can be looked upon as different communities of practice. In identifying the different communities of practice, we focused on the context of improvement work and Six Sigma. As such, we have chosen the ones most relevant for our study, acknowledging that there might well be other examples of communities that are not covered here.

All of the communities of practice we identify in the following are in some way formed by and confined to an existing organizational structure. This observation is especially interesting as communities of practice are often opposed to formal units or other forms of organizational work groups (see Wenger, McDermott & Snyder (2002, p. 42) for a comparison). Wenger (1998) sees communities of practice as more informal. Moreover the self-selection of members of a is seen

as one characteristic of a community of practice whereas in more formal work groups members are selected e.g. by a manager. However, we do not see all organizational units automatically as community of practice. Sometimes the community of practice is only a part of an organizational unit, sometimes there exists no community of practice within an organizational unit.

Furthermore, there is no stable community of practice we got to know of spanning multiple organizational units like different manufacturing areas or factories. As members of a community of practice are supposed to be self-selected, it might seem natural to assume that at least some communities spanning over organizational boundaries would evolve. The fact that we did not come across such communities more often could be explained by the fact that practice is seen as being confined and specific to one's own work group respectively community of practice. This view makes it difficult to engage with members of other communities.

As our empirical study comprised several organizational levels, we were able to get an overview of how manufacturing employees within the factories of Vinol work and interact. Using Wenger, McDermott & Snyder's (2002) three fundamental characteristics of a community of practice, namely *domain*, *community* and *practice* as an explanatory framework, we can identify the following communities of practice:

5.2.1 The channels

Domain   The main interest for everybody in a channel is to keep the machines up and running in order to be able to deliver the requested amount of final products and to achieve a high efficiency. However, as Wenger (2004, p. 3) states: a domain gives a community its identity and this identity is defined "not just by a task as it would be for a team, but by an area of knowledge". As the issues described above can be seen more as tasks or goals than as *areas of knowledge*, it is not these tasks enowing identity to the channel as a community. For the channel to attain these goals, however, the members of the channel have to know the machines they are using inside out as problems need to be fixed quickly. Referring again to Wenger (2004, p. 3) describing the domain as an "area of knowledge that brings the community together", we can see knowledge about the machines in the channel, the manufactured product and processes as the area of knowledge forming the domain of the channel.

Community   The community is "the group of people for whom the domain is relevant" (Wenger 2004, p. 3). In a channel, this would be the channel manager, one or more technicians, the channel workers and among them, the representatives for different areas. The technicians play a special role here. As described above, technicians are either assigned to a specific channel or rotating depending on the task at hand. In the former case, they are part of the community of the channel they are assigned to, in the latter case, they are a member of multiple communities. Thus, the technician(s) as well as the people in the other positions mentioned form the communnity for whom knowledge about the machines and the processes in the channel is highly relevant. The relationships within the channel communnity are close, at least among the "core-team" around the channel manager, the technician(s) and the representatives as this "core-team" has regular meetings where current issues in the channel are discussed and it is also working together closely to resolve these issues. As sometimes up to 50 or more people work in a channel, however, it might become difficult to keep close relationships with everybody as work is organized in shifts so members of separate shifts might not see each other for weeks. Therefore, relations among employees not belonging to the "core-team" might be more loose. Depending on the assignment of the technician(s), the channel's relation with it's technician(s) varies, too. As one productioon manager put it:

> "...I've got two technicians or ...engineers so to say, connected to me and they are really valuable, I think. In the other manufacturing areas the technicians or the engineers are connected to the manufacturing manager[3] ...and I like that because the become closer to the channel and more interested and so on."

Although often connected to the same manufacturing unit and being located in the same factory, the community of a channel is clearly limited to one single channel. Although seeing some improvements in this regard recently, a channel manager realizes:

> "In all factories there are walls between channels. We are continuously trying to tear them down. Also in my area I have three lines, there are walls between although we are the same channel. If you compare to another channel, the walls are higher and thicker and so."

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[3] "connected to the manufacturing manager" here means that the technicians are not connected to one specific channel but to the superordinate unit, the manufacturing area, and are therefore rotating among different channels.

Furthermore, interaction of channel managers with other channel managers is limited to the same manufacturing area in formal as well as informal meetings taking place occasionally. Other members of the channel community are hardly interacting with other parts of the factory either, except for the technician(s) which might rotate between different channels.

Practice According to Wenger (2004, p. 3) practice is a "set of frameworks, ideas, tools, information, styles, language, stories, and documents that community members share". In a channel, the channel manager maintains a list of issues to work during regular meetings with technician(s) and representatives. The ongoing work in the channel is then centered around these issues. Documents accompanying work on the issues are stored in a local channel database. Working together around the issues, the members of the channel community "accumulate practical knowledge in their domain" making "a difference to their ability to act individually and collectively" (Wenger 2004, p. 3). Over time, the channel community develops a better understanding of how the machines and processes within the channel work and develop knowledge on how to fix problems together.

5.2.2 The manufacturing areas

Domain The domain, the area of knowledge giving identity to the community of practice of the manufacturing area consists of topics like management of the great amount of people working in the channels and the issues occuring in the daily operations as already discussed above. The channel managers in the same manufacturing area also share a common interest which is to deliver the requested volume of a certain products. As the products produced in the same manufacturing area are the same or at least similar in each channel (whereas the machines might not be) there is some amount of knowledge relevant for all channels connected in the same manufacturing area.

Community As already partly visible through the description of the domain, we do not see all the people working in a manufacturing area as part of this community as operators working in one channel do have no or not much contact with their colleagues working in another channel. Instead, we see the channel managers working in the same manufacturing area as the main members of this community. Work relations between these channel managers are closer in some manufacturing areas, in others they work more separate. An example of the former category is

represented by the following quote of a channel manager:

> *"Now as you see, we have moved in here, so we are four channel managers in our unit in the same room and that is really . . . One year ago I was alone in here and then the other channel managers were spread out in the building. So today I am working very close to my deliverers and also to the channel manager which is responsible for a channel similar to mine."*

In addition, there are other persons, residing more on the periphery of this community. There are the technicians who, again depending on their role, are either more connected to a specific channel or more to the manufacturing area. For them, the domain as defined above is not as relevant as for the channel managers. However, they play an important role in the daily operations. Also depending on their role they have a closer or less closer relation to the channel managers. Furthermore, there is the manufacturing manager. The reason for not seeing its role as central to this commnity lies in the nature of how the role of the manufacturing manager is defined: it is a more strategic role meant to coordinate and prioritize activities in the different channels as well as deciding on future investments. Therefore, the manufacturing manager fulfills, from the perspective of this communtiy, more of a coaching role and is less involved in the daily operations of the channels. Generally speaking, the relations within this community are less close than in the community of practice of the channel discussed before. Although sharing a similar domain, there is little interaction with other manufacturing areas other than through the manufacturing manager or on the basis of the personal network of the channel managers.

Practice   The practice this community develops, is partly about machines and how to fix them. More than that, however, it is about organizing the daily work, it is about how to be a manager of 30-50 operators. The accumulated experience of each channel manager contributes to the body of knowledge the whole community possesses and can make use of, if these experiences are shared.

5.2.3 Six Sigma

Domain Here, the area of knowledge is clearly the Six Sigma methodology with its DMAIC-cycle and all its statistical methods. As Six Sigma is still relatively new within Vinol, there is not much experience in general about this area. Thus, it is still an area of knowledge that "that needs to be explored and developed" (Wenger 2004, p. 3). Not only because it's new to Vinol in general, but also because it required every Black and Green Belt to learn something new as they were not used to work in this way before.

Community As stated before, there are about 150 Black Belts and around 900 Green Belts in total in Vinol. However, we do not see all of them as part of one single community. Contrary, we see mainly the Black Belts in the three factories we focused our study on as part of one community. Until now, the Black Belts form a rather small group. Though normally working in different factories, those Black Belts meet on a regular basis (once every week). Moreover, their projects are not limited to the factory they are attached to: it is possible and common, that they get assigned to a project in another factory. This context makes it possible for the Black Belts to stay in close contact and enables them to know the projects going on at the moment.

   Still part of the community, but located more at the periphery of it, are the Green Belts working in the factories. As Green Belts are not full-time assigned to Six Sigma projects, Six Sigma is not central to their work. Moreover, their organizational position varies and could be everything from a process devlopment manager to a technician. However, they still share a common domain of interest and they still "speak" the Six Sigma language.

Practice Six Sigma projects are supposed to run for about 4-6 months in Vinol. During that time, the Belt running the project has to go through the DMAIC-cycle and apply statistical methods and other tools in order to deliver the desired results. It is this body of knowledge, the knowledge about how to run Six Sigma projects, about which method needs to be applied which gets developed further continously and forms the daily practice of the Six Sigma people.

5.2.4   The technicians

Domain   As the name of the position already denotes, technicians are mainly concerned with technical issues. Through ensuring a production with as less interruptions as possible, they play an important part in keeping the efficiency in a channel high. In order to fulfill their tasks they have to have a good knowledge of the different machines, operating systems and procedures in the channels. Furthermore, when running their own project as a project manager, they also have to have knowledge in managing such projects. Another relevant area of knowledge is the Six Sigma methodology more and more technicians are trained in.

Community   When being assigned to one specific channel, a technician develops a close relationship with the people in that channel. However, the community sharing the domain described above to a even greater extent is formed by the other technicians in the same manufacturing area. They often share an office and help each other out in solving issues they have problems with. Links to technicians in other manufacturing areas are less strong than within a manufacturing area and mainly established through a personal network. Moreover, the technicians work together closely with the operators and technical representatives in a channel.

Practice   Through helping each other out, the technicians in a manufacturing area develop a shared approach of dealing with technical issues in their daily work. Also through exchanging knowledge in regards to running projects - e.g. what tools and methods to use and how to use them - a shared practice is established.

5.3   Knowledge flows between communities of practice

As concluded so far in this chapter, the development of a local practice and a shared understanding of work enables people within each identified community of practice to communicate and work with each other. Through using the same tools and ways of working, the members of a community thus share the same perspective on their work.

The basic idea behind the initiative of transferring Six Sigma results is to prevent the re-invention of the wheel through leveraging on existing knowledge of such results already present within the company. However, for transfer of Six Sigma results to take place, these

results must be understood by the community wanting to reuse.

5.3.1 Relations between communities of practice

In order for reuse to take place across several communities of practice it becomes important to investigate the relationships between the different communities and how it makes sense for people to transfer and integrate others knowledge. Relating to Six Sigma, it became clear that for most of the manufacturing employees Six Sigma is not a central part of their everyday practice. Every community of practice we identified besides the Six Sigma community has a lot of work going on which is not dependant on, or directly related to Six Sigma. Channel managers and technicians for example, focus much attention on running efficient day-to-day operations. When working on improvements they usually don't run Six Sigma projects, even though Green Belt trained technicians sometimes use tools from the Six Sigma methodology. Instead, they mainly get in touch with Six Sigma through projects that a Black Belt or Green Belt runs in their area once in a while. Also, certain roles, such as the channel manager can act as a sponsor in a Six Sigma project. Also the Six Sigma database does not seem to be part of the practice in most of the communities as the majority of manufacturing employees either heard about the Six Sigma database, but had never used it, or even didn't know that a database tracking Six Sigma projects existed. When asked about what databases they were using in their daily work, the Six Sigma database was often not mentioned at all or not until asking directly about it.

In addition to the Six Sigma methodology and database not being a central part of practice in other communities, the manufacturing units see their work and how they carry it out as quite specific and not easily comparable with other manufacturing commmunities. They seldom interact with people from other communities, which further adds to strengthening their local knowledge domain and practice.

Taking these findings into consideration, neither Six Sigma nor the practice of another manufacturing community represent something reified through the practice prevailing (Wenger 1998) in the community of practice our interviewees belonged to. The Six Sigma methodology and the database is only a reification of the practice of the Six Sigma community. In this community, the methodology is used by the Belts as part of their practice and the database as a tool to document and coordinate the projects they run. The scarce work and interactions with Six Sigma and the other manufacturing communities are not enough to make other communities'

work a part of their everyday practice.

5.3.2 Perspective taking and transformation

Due to the reasons stated above, manufacturing employees did not feel that they had a good understanding of how things were done in other communities. To analyze how it makes sense for people to take in knowledge from another community, we can look at typical examples representing how most of the manufacturing employees saw themselves integrating Six Sigma knowledge. Generally speaking, all our interviewees were positive towards Six Sigma. It is seen as providing good results and solutions which are actually statistically proven good solutions. Documentation of projects is regarded as being good as well as the fact the project has to be carried out in a structured way. Still, most of our interviewees found it fairly difficult to understand and integrate the knowledge and wanted to speak to another person to gain a better understanding. As one channel manager explains:

> *"Today I had contact with the Black Belt that I know in our organization and asked him to find out more about that project. In the future maybe I am that skilled myself so I can contact the guy who has run that project, but today I don't have that."*

The channel manager wanted to speak to a Black Belt in his organization about the project. This Black Belt has an insight in both practices, the practice of the Six Sigma community and the practice of the channel manager's channel. Carrying out a project in one channel for several months allows the Black Belt to participate in the practice of this channel and thus becomes to acquainted with the way people work in this channel. Therefore, he is able to mediate between the two different communities of practice by creating a common ground of understanding. Had the channel manager had a good insight himself into the Six Sigma practice he could have have contacted the Six Sigma Belt who ran the project directly.

Wenger (1998) classifies such encounters as boundary relations between different communities of practice. If the boundary relation is mediated by people, it can be seen as brokering (Wenger 1998). Wenger (1998, p. 109) sees brokering as a complex task involving "processes of translation, coordination, and alignment between perspectives". It thus becomes a means to bridge the gap between "abstract accounts and situated demands" (Brown & Duguid 2001, p. 42). In our case the Six Sigma documentation can be seen as the abstract accounts. In

the example above, the Black Belt acts as a broker translating the Six Sigma practice into the practice of the channel manager's channel. More generally, in order to bridge this gap, Brown & Duguid (2001, p. 50) suggest to support learning about another practice by "fostering access to and membership of the target community-of-practice".

Having multimembership in different communities thus becomes important to be able to act as a broker. Looking at the communities of practice we identified earlier, there are possibilities for establishing multimemberships between the Six Sigma community and manufacturing communities. Black Belts, for instance, are assigned to one specific factory. Although they might do projects in other factories as well, they have their office in the factory they are assigned to and do most of their projects in this factory. This allows them to become a part of the local practice in several manufacturing channels while being a part of the Six Sigma community at the same time. Working this way leads to the potential to achieve multimembership in several communities, which in turn makes them suitable for taking on the role of a broker.

Even though the the possibility of using the Six Simga Black Belt as a broker exists, reuse of Six Sigma results is not happening within Vinol. However, as local practice is considered as specific, it becomes hard for the manufacturing employees to see how a project run in another manufacturing unit could possibly be implemented in their own unit. Therefore, it becomes necessary to also enable multimembership in different manufacturing communities. If this is made possible, employees can start to see in which ways the practice of other communities is similar to their own. When manufacturing employees want to learn something about how another manufacturing community did something, they relied on contacting people on their personal network. This could be e.g. old colleagues from another channel as in the case of the channel manager quoted in the following:

> "...first I would ask my close colleagues in the same manufacturing area. And of course use your personal network. And people you know that are working, so it is more depending on your network to where you turn for getting help. I haven't tried ...we have a tool for finding people but we don't work with any tool for it, it is very personal. [..] Because it is hard as well. I think that in a database you can find the competence. But when I turn out to ask someone I turn to someone that I think has an interest in it as well. So I know that this has been worked on, so he has the competence and the interest on working on these kind of issues."

People within the personal network have developed a shared practice together as they often have worked together. Having been part of each other's practice in that way, allows the parties involved to develop a better understanding of each others practice (Bechky 2003, Carlile 2002, Carlile 2004). Even though this is the way it makes sense to people, we did not see many occasions of multimemberships between manufacturing communities. Instead, interaction is limited to occasions where another unit is affected as e.g. a customer of a process but is hardly happening on a more horizontal level. We only came across one example where a community reached beyond a manufacturing area:

> *"So we have started a group ... how many are we? Six different channel managers from different channels in the organization [..] and we meet four times a year just to share our knowledge and experience. [...]"*

This group was started as an initiative of the former manager of the channel manager quoted here and is not something which set up by Vinol on a wider scale. The channel manager's share, to a certain extent, the same domain and practice and are thus able to integrate knowledge from another channel into their own.

In addition to learning through personal interaction, another example of how manufacturing employees saw learning from another community taking place was brought up in the workshop where several employees from different factories came together with a Black Belt to discuss how they could go about replicating his Six Sigma project in their own units. Even though again personal interaction in the form of coaching was considered as necessary it was also requested to develop implementation tools to guide the replication process. They developed the idea that these tools could be models that were independent of critical inputs, and as such could be used to guide implementation in any context. These types of tools has been discussed by researchers as boundary objects (Bechky 2003, Carlile 2002, Carlile 2004, Wenger, McDermott & Snyder 2002, Brown & Duguid 1998). Brown & Duguid (1998, p. 104) notes that through such objects "communities can come to understand what is common and what is distinct about another community, its practices, and its world view." In doing so, they can play a vital role in fostering common understandings between different communities.

Therefore, in order to be able to understand how knowledge from outside the community would fit into their own practice they wanted to know more about how this knowledge came to be created. In essence, this can be seen as the wish to engage in perspective taking (Boland

& Tenkasi 1995) in which a person or community wish to access the thought world of another community. Here, this thought world represents the "know-how" (Brown & Duguid 1998) of the other community.

The need to access the "know-how" presents a major obstacle since this knowledge tends to reside in confined communities and do not spread easily, thus being "sticky" (Szulanski 1996). As Dixon (2002) further points out it is not possible for the receivers of knowledge to access the situations and practices that has made the knowledge. The know-how must therefore be extracted from the community for knowledge to circulate (Brown & Duguid 1998).

As shown in this section, people feel that in order to access and understand the know-how they want to interact with someone who's practice they understand. When they don't understand the practice of the community who holds the knowledge they need to to find someone who has an understanding of the other context and can mediate between the two communities, thus acting as a broker. Also, they see the possibility of using boundary objects to create a common ground between communities. Once this common ground is established, perspective taking can be carried out successfully. This process of perspective taking enables an understanding of how the knowledge can be incorporated into the local practice (Bechky 2003, Carlile 2002, Carlile 2004) and transforms the way work is carried out. This transformation can be seen as a deep kind of learning, where new insights and developments are created (Wenger, McDermott & Snyder 2002), which can enable the community to see their world in a new light (Bechky 2003).

5.3.3 What is Vinol doing?

The Six Sigma database is seen by management as a powerful factor in enabling replication to happen. During a Six Sigma project, the Belt running the project is requested to document the work being carried out in the Six Sigma follow-up database. Though there are certain requirements on what information to put into the database, the amount of information available depends to a certain extent on how much time the Belt spends on documenting. But is the information really sufficient to enable perspective taking and transformation?

When talking about the Six Sigma database, manufacturing employees did not see the database mainly as a tool helping them to find out what results a certain project delivered or how it was carried out, they saw it as a way to look up information about who was involved in

the project in order to be able to contact that person. The following quote made by a channel manager highlights this point:

> *"Well, we can see what projects have been done but often you have to know about it before you go into the database but we can see what's the final conclusion of it and who, which person did run the Six Sigma project and you can start discussing with him: What do you think we have to do here where we have these problems?"*

However, even if they knew who to contact, some of them were hesistant to just call these persons as they wanted to know beforehand if this contact is really able to help them and is interested to do so. Furthermore, they felt like they would have to know something about a certain project before using the database to look that project up. Thus, manufacturing employees do not find that the information available in the database can provide an extensive account of the work done during the project. Brown & Duguid (2001) discussed this divergence between the practice described in manuals and the actual practice in terms of canonical and non-canonical accounts of work. As Brown & Duguid (2001) show through analyzing Orr's (1996) study of copy-machine workers, canonical accounts of work are often not sufficient to be of help for the actual practioneers. In our case, the canonical accounts of practice represented in the database do not seem to draw a picture clear enough of the actual practice. Being unable to evaluate the knowledge they are not able to see how "know-how" from that context can fit into their own practice clear enough to allow a process of perspective-taking to happen. Thus, it is not a successful means to bridge the gap between "abstract accounts and situated demands" (Brown & Duguid 2001, p. 42).

In order to stimulate reuse of Six Sigma projects, several other measures are taken by Vinol. One such measure is to send out an e-Mail after a project has been completed to parties who could possibly benefit from the results. This measure might be able to rise a certain amount of interest among the receivers of the e-Mail. However, it still relies on information available in the database and does not help to bridge the gap between the canonical account of practice as stored in the database on the one hand and the actual practice on the other. Furthermore, as shown in the last section, we see "perspective-taking" as a prerequisite for being able to understand how knowledge from another context can be integrated into one's own. However, the information about the project as sent out by the e-Mail might not allow the receivers of the e-Mail to take perspective and to see possibilities for integration as the e-Mail only represents a

canonical account of practice.

In addition, the organization in the factory counts on disseminating information up and down through hierarchical levels. The manager of a certain unit is supposed to take up interesting projects and to discuss these ideas with the superordinate unit. The idea might then be taken up to the next organizational level or be filtered down again. Certainly, this is a way of spreading ideas within the company and might rise interest about projects which otherwise nobody would have ever heard of. In the end, however, it will still require to connect people who carried out that specfic project with those who are interested in it in order to provide a better understanding of the context in which the project was carried out. Moreover, this way of disseminating interesting ideas and projects relies to a high extent on the managers of the units and not every manager might see this way of spreading interesting ideas as central part of his role.

Similarly, the prevailing idea among people in the manufacturing units of how to replicate projects within Six Sigma is that projects considered worth replicating should be identified and taken up by management (e.g. a Champion) which then decides on which scale to replicate the project. This is dangerous since people are unlikely to proactively search for opportunities on their own. Six Sigma management, however, does spend efforts on attempting to replicate projects this way. For example, Six Sigma champions are supposed to filter down and match relevant projects to manufacturing units. This can be done through what Vinol refers to as broadcasting sessions, where Champions conduct telefonference meetings with the local process owners to tell them about the project and attempt to see if it can be relevant for them. Although this can create some awareness, it is not a personal and interactive way of finding out the know-how from the Belt or project team who carried it out. As a result, it is difficult for people to see how it would make sense to implement it in their own context.

Also initiated by Six Sigma management are the posted sessions. For a posted session, people possibly interested in a certain project are invited to see a presentation by the Black Belt who carried out the project. Although this presentation represents a canonical account of practice, it also brings together people who are possibly interested in a certain topic. In this way, people from different communities are able to discuss the project in terms of their own practice and create a non-canonical understanding of what the project is about and how it could be integrated into their own context. Furthermore, the posted session might extend the participant's personal network through establishing contacts. It is still important to remember

that even though a basic understanding can be developed through such activities, it might not be enough to go back and implement it in their own practice. For example, as the workshop on how to replicate a project mentioned earlier, it was not possible for the people to go back home after the workshop and use the ideas. To bridge the gap between the canonical project descriptions and their actual practice they still requested guidelines supported by coaching and implementation tools.

Summing up, most of the activities carried out by Vinol are not successfully bridging the gap between canonical and non-canonical accounts of practice. The attempts to create awareness through canonical accounts of practice are not likely to get people to engage in perspective taking since it will not be enough to understand the "outside" knowledge and move towards a transformation of their own knowledge. Therefore, it becomes important to facilitate access to the practice of other communities (Brown & Duguid 2001) through aligning these efforts should be more with the way people learn. Social interactions and working more closely across communities will make it possible for people to create a non-canonical account of the practice of another community thus allowing a process of transformation to take place.

6   Conclusions

Our investigation has shown that workers engage in a social construction of practice. Freedom in how to carry out the work, having specific machines, and interacting with people in their local context all plays a part in constructing a locally situated understanding of the particular practice. This situated understanding leads to a common identity, language and view on how to carry out the work. Viewing these socially constructed practices as communities of practice, it is possible to identify several such communities in the factories. Due largely to limited interaction outside of the local work unit, these communities of practice did not extend beyond the immediate work area.

Realizing that learning is situated, as well as acknowledging the different communities that exist, has important implications for the transfer of knowledge. Acquiring an understanding of the knowledge from another practice becomes a prerequisite to be able to see the value it can provide. In order acquire this understanding, it makes sense for the manufacturing employees to engage in perspective taking, in which it is necessary to cocreate a common ground to guide the understanding. To do so, employees mainly want to interact with someone they can relate to and understand. Once an understanding of how the knowledge can fit into their own practice is established, it can be brought back to the community and integrated into the practice. When it becomes integrated, a transformation has taken place in the community, allowing them to look upon their work in a different way.

As such, focusing on the enabling of perspective taking and transformation, rather than mere transfer, is important to enable the reuse of knowledge. However, we found that in the factories of Vinol, the efforts to enable the reuse of knowledge are mostly carried out through canonical accounts of practice, and do not enable the manufacturing emyployees to take the perspective of another community's practice. As a result, employees are likely to refrain from attempting to reuse knowledge, or be unsuccessful if they try.

It thus becomes important to shift the focus towards matching transfer efforts with the way people learn. Facilitating perspective taking through social interactions across communities, as well as through other more non-canonical measures will be important. These measures will create connections between communities of practice, which will enable employees to engage in perspective taking, leading to a transformation of their communities' practice.

7   Recommendations

In this chapter we offer recommendations that Vinol can undertake to enable communities to take the perspective of others, which will subsequently transform their understanding. We argue that the immediate focus should be on activities that lead to increased interactions between people from different communities. When the personal network has increased there are certain things that Vinol can do to facilitate the creation of lively and vibrant communities of practice. The final step is to focus on driving reuse through leadership, recognition, embedding it in processes, and making certain changes to the Six Sigma project process.

7.1   Connecting people from different communities

In giving recommendations we mainly build on ideas of how to cultivate communities of practice as developed by Wenger, McDermott & Snyder (2002). We aim to use those ideas as a foundation for our thinking and adapt the specific recommendations to what we see as a fit for our specific case.

Due to the current lack of interaction between different communities in the factories, manufacturing employees have a poor understanding of how work is carried out in other places and do not identify themselves with other communities. Unless this gap is bridged, not even the best thought out reuse process or most extensive leadership and communication efforts are likely to lead to engagement in perspective taking. In attempting to develop new communities of practice that span across the current ones, it is important to realize that communities are by definition natural, spontaneous, and self-directed (Wenger, McDermott & Snyder 2002). As communities of practice usually evolve from existing networks, the role of the organization thus becomes not to impose a structure, but rather to guide, catalyze, and facilitate the creation and evolution of communities from such networks.

Interviewees who did not have an extensive personal network outside of their communities did not interact on a continous basis with people in other places. Thus, it is important that Vinol focuses on broadening the personal networks of people, as well as increasing the activity in existing personal networks. We see the need for facilitating interactions between communities of the same type within manufacturing (e.g. connecting channels or communities of technicians in different manufacturing areas), as well as between these communities and the

Six Sigma community.

7.1.1 Manufacturing

We see several reasons for establishing interactions between different manufacturing communities. First, manufacturing communities will have employees who have been or are currently part of Six Sigma project teams. Interactions can therefore lead to learning about how those projects were or are carried out. Second, it can enable different communities to see ways that they are similar, which can lead to acknowledging that Six Sigma projects run in another community can actually be implemented in their own community. Third, interaction can make communities aware of the value in learning from each other, which in turn can make them more likely to also approach the Six Sigma community. Fourth, Green Belts are part of manufacturing communities and therefore interactions can lead to learning about their Six Sigma projects. Fifth, in the future many Black Belts will go back into manufacuring communities. Having an established connection to these communities will then enable people to learn more effectively from these Black Belts.

Cross community meetings   Management[4] can facilitate the start of cross community meetings. If a suitable personal network exists, this group can be used as a starting point. If not, management can assist the employee in finding a suitable group and discuss with the other people's manager to get their commitment. Management can give advice on how to run these meetings, such as focusing each meeting on a certain topic and talking about problems they face in this area and what they do about it. Examples of such groups can be channel managers from different manufacturing units, or technicians from different channels or manufacturing units (depending on their assignment).

Cross community workshops or projects   Management can actively seek out problems that are shared between different communities. Such shared problems can also be identified through brainstorming sessions held in a cross community workshop. Each participant of the workshop can then go back and continue on solving the problem in their respective area. If there is a need is to start a project around it, management can assign a cross community project team to solve the task together. One example of this happening was given to us in an interview where

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[4]Acknowledging that management is a different entity depending on the unit

several channel managers got together to start a project to solve a problem that they all shared. As an example of how this could be organized, manufacturing managers could in their meetings identify common problems and assign the responsibility to certain channel managers to establish a workshop or project consisting of members from different manufacturing units.

It is important to note here that established communities of practice are not driven by pre-determined output requirements given by somebody from the outside (Wenger, McDermott & Snyder 2002). However, here we are simply giving advice as to what activities can serve to establish a connection between people from different communities. Once the benefits of being part of such a community become visible, its members are likely to develop their own domain or topic of interest to drive them forward, thus engaging in creating a community of practice.

Work orientation   The work orientation can be used to instill norms in the workplace. By giving employees a thourough work orientation, such as having them work in different manufacuring areas, it is possible to convey that interactions and knowledge about other areas are important to company. Also, it will enable them to get a quick start of establishing a personal network that encompasses more than their immediate work unit.

Work rotation   The organization should promote the importance of people working in different areas. For example, technicians could be given the opportunity to work for a few months in another channel.

Events   The types of these events can be both formal and informal. Inviting a speaker (possibly from another company) who talks about how they achieve collaboration and learning from each other can serve to increase the awareness of the importance of interacting with others. Such speakers can also be targeted to speak to a more confined group, such as all the technicians, about relevant topics. At these events, it is vital that time is also spent on exercises and informal networking that can lead to new contacts. More informal events can also be introduced, such as sports tournaments or common coffee breaks and lunches.

Relationship brokers   Vinol can assign responsibility to certain people who have a wide personal network or are part of several communities of practice to act as relationship brokers. This role would be responsible for actively search for possibilities to connect people in the

factories who has common interests. For example, the relationship broker could become aware of, and connect two employees, or groups of employees, who are both working on solving a similar problem. Also, the relationship broker should be known by workers so that workers know that they can also contact this person to ask if he or she knows about, or can try to find, someone else who has similar knowledge. It is important to note here that we believe that this work will require quite some effort and that it should not just be added as another "supposed to do" on top of a regular position. It shold instead be a main part of someones job duties, and followed up on and recognized as something important.

Partner community   Each community could be assigned a partner community that it collaborates with to exchange ideas. Identifying and assigning such a partner community can provide direction of who to turn to. For example, two channels in different manufacturing areas could be assigned as partners. They could benchmark each other regularly and have formal and informal meetings and workshops.

Leadership   Most of the points identified in this section requires managers to spend time and effort on establishing certain opportunities for their workers to engage in interactions. As such, through spending time and effort management leads by example, showing that interaction is important to be successful. Managers must continuously push for, and make clear the importance of collaboration and interaction. In doing so they should be able to communicate a clear purpose and visions for interaction and collaboration. Providing the time for employees to interact with others is of course vital. Moreover, setting the direction for employees by communicating what they expect with regards to interaction, as well as asking employees questions about what they have learned after engaging in interactions, will create further awareness. Lastly, managers should continuously be made aware of success stories that they can use in their community. Through showing examples of what has been done, and how it benefited them, will motivate people and show them that others are doing it. These success stories can be highlighted in management meetings and taken back to the respective unit.

Leadership will be an important start of a change in culture towards more collaboration. Once the culture starts to change, and people see the value in interaction and collaboration, they are likely to start spreading the word themselves, leading to a reduction in the effort needed from management.

7.1.2   Manufacturing and Six Sigma

The main reason for establishing interaction between manufacturing communities and the Six Sigma community is because Black Belts are part of this community. Knowledge about Six Sigma projects is therefore existing in this community and manufacturing communities can learn about the projects through interactions. Furthemore, interactions can lead to an increased understanding about the Six Sigma way of working in general which can make it easier to understand knowledge from projects.

Take part in projects   People from other communities can be invited to spend for example one day with a Black Belt or Green Belt to see what their projects is about and how they are working with it. For example, Six Sigma can invite a group of technicians who are likely to be interested in the project. As a result, the technicians will also get to know a Black Belt better.

Connection between Green Belts and Six Sigma community   The organization should directly strive for establishing a closer interaction between Green Belts and the Six Sigma community. After the Green Belts ran their initial Six Sigma project needed for the certification, the Six Sigma organization can continuously invite them to informal events and meetings with Black Belts including project closure presentations. Green Belts can also be appointed a continuous mentor, preferably one of the Black Belts, who can offer support even after the first Green Belt project is finished.

Connection between former Black Belts and Six Sigma community   Similar to the last point, the Six Sigma organization should strive to continue to have close interaction with Black Belts once they go back into a line position. Ways of achieving this can be similar to those stated above for Green Belts.

Black Belts   It is very positive that the Black Belts belong to a certain organization, while being allowed to run projects in other organizations. As such, they can get a better understanding for processes and get to know people in other organizations. In a way this represents job rotation as recommended earlier. Here, it might even be possible to consider sending them to different sites for some time to run a project. Furthermore, as more and more Black Belts come

back into a line position, the gap between Six Sigma and the rest of the workers is likely to decrease.

7.2 Facilitating the creation of vibrant communities of practice

When the personal network has broadened and people start feeling at ease with, and see the benefits of interacting with others, Vinol can start to facilitate the creation of lively and vibrant communities of practice building upon the personal networks. In our case we believe that Vinol should strive for facilitating the creation of smaller communities. Thus, we do not see the immediate goal being to establish a vibrant community consisting of for example all the channel managers in the city. However, as time passes, and interaction continuous to be in focus, it is likely that these smaller communities will connect and expand.

Wenger, McDermott & Snyder (2002, p. 50) note that "because communities of practice are voluntary, what makes them successful over time is their ability to generate enough excitement, relevance, and value to attract and engage members." Thus, the organization must realize that if that excitement, relevance, or value doesn't exist, communities will not be created or will be dissolved quickly. Since it usually takes some time for members of a community to realize the value it provides to them, the organization can guide and influence the creation of communities (Wenger, McDermott & Snyder 2002).

The establishment of communities should not be intrusive (Wenger, McDermott & Snyder 2002, Brown & Duguid 1998), where an organization goes in to decide who is going to belong to which community, and what they should accomplish. However, the organization can guide and facilitate the formation and development of communities to help members see the possibilities. Suggestions for such guiding activities are offered below.

A community facilitator could act as an aiding partner, helping informal networks to become communities of practice. This person can motivate and help people to start certain activities, such as regular meetings within their network, capturing meeting notes, build a web portal for the group where they can share information, set up teleconferences, invite speakers to their meetings and have informal workshops.

The facilitator can also assist in making the members realize the possibilities of what the community of practice can achieve. This can be done by bringing in an outside perspective

to educate community members about the role of communities in other organizations. Furthermore, the facilitator can encourage members to have explicit discussions around the value the community provides to each one of them. These discussions can lead to people realizing that the community has made them understand and implement something that another person came up with, that they have improved a certain skill, or that they have a wider network of people to ask when they are facing a problem. This will help the community members and potential members to understand the impact a community can have.

Furthermore, the facilitator can offer assistance in finding links to other communities. The community might be struggling with a problem and the facilitator can point them in the direction to another community who has worked on a similar problem.

Similar to the events discussed earlier with regards to interaction between communities, the organization (possibly through the facilitator) can also facilitate similar events more targeted towards community development. Again, here it is also important to focus on opportunities at these events for more informal interactions, such as private discussion boards on a website, lunches, sports teams, etc.

The organization should acknowledge and foster the communities that exist. One way of doing this is to listen and get an understanding for the problems they are discussing and offering limited time projects that are important for the organization. In working together on these projects, the community members are likely to grow closer to each other, together moving the community forward.

Once communities of practice are developing across work areas, the organization can portray one such community as a success story. This community can present their journey to others and describe how they benefit and see value in the community. This can lead to new communities being established as well as other people becoming interested in joining another community.

7.3 Driving the reuse of Six Sigma results

Once cross-organizational communities have started to cultivate, there is a possibility to drive the reuse of Six Sigma results. This can be done through activities relating to leadership, embedding reuse in processes, and paying attention to reuse in the Six Sigma process.

In driving reuse within the organization, it is important to use terms that reflect the reality and motivate people. At the moment, there is a strong focus on reusing project results through replicating them in other areas. However, in our view, the term replication associates implementing something in the exact same way. This notion is contradictionary to the view of our interviewees of seeing local practice as different from other places, thus making it hard to find something that could fit exactly into their own context. Instead, replication implies that it is the task of management to find the projects that can be replicated and to start replication projects in other areas. Also, the term replication does not imply any aspect of integrating something into one's own ideas. To the contrary, it seems to imply that what is supposed to be implemented is completely the creation of somebody else.

Even if there is no exact replication opportunity, management of Six Sigma also wishes for people to at least look at projects that cover a similar problem to see if there is something they can use or learn from them. However, this wish does not seem to be transparent for people since the focus is on replication. Therefore, we suggest that management instead focuses on communicating the possibility of incorporating others ideas and knowledge to create their own solutions. This will imply not to copy and paste, but rather to use other people's knowledge to complement their own. Seeing it this way is likely to be more aligned with actual practice and more motivational for people. As they start to seek out others ideas and knowledge from projects, they are also likely to find solutions of problems that can be replicated or adapted to fit in their own context. This recommendation plays an important part in driving the reuse through the areas identified in the remainder of this chapter.

7.3.1 Leadership

It is vital that reuse is driven all the way from the top. If it is something that is vital to the organization then all managers should constantly talk about it with their employees. This mean not only top management, but also channel managers, manufacturing managers, etc. These people should communicate why it is important (should not be done in "fluffy" terms, but rather showing the specific employees how they can benefit from reusing) and how it can be done (e.g. showing them the Six Sigma database and how it can be used to search for projects). Referring to success stories and inviting these success story communities can further motivate employees by showing them the possible benefits and how to go about achieving them. This type of communication can be done informally in everyday work, as well as formally in meetings.

In addition to this communication, it is vital that the leader continuously follows up to get examples from employees on what they have reused from outside their community. Last, but not least, the manager should recognize people who have successfully integrated someone's results or knowledge to solve a problem. Follow up and recognition should be done both informally and formally.

7.3.2 Embedding reuse in processes and training

To further foster reuse, it is also possible to formally include steps in processes to facilitate reuse. For example, Vinol tries to promote the use of a certain project management process. In each step of this process there is a toolbox offered to help the people running the project. Different tools that facilitate reuse can be included in this toolbox. This will show the importance of reusing and provide some alternatives in how to do it. The importance of using such reuse tools as a part of running a project should also be covered in e.g. project management training.

Even though it is part of the Six Sigma methodology in Vinol to look for other projects run on a similar problem before, we have found out that not even here the database is commonly used. As such, explanations of the importance of and how to use the database should be communicated to Belts. This should also be followed up by management to ensure that the Belt has looked for reuse opportunities prior to starting up a project. For example, before putting a project idea on the discussion agenda of quarterly project planning meetings within the factories, it could be made a requirement to show other projects that can be of benefit.

The importance of reuse and the tools available to facilitate it should be part of every internal training program offered by the organization. Clear benefits of doing so should be communicated during training. This includes Green Belt and Black Belt training, where methods and tools (including the Six Sigma database) available enabling reuse should be explained.

Another option to instill reuse in work is by assigning parts of the budget to it. This measure will underline the wish to increase reuse further and indicate the emphasis Vinol puts on it.

7.3.3 Improving the Six Sigma project process

In addition to finding out about Six Sigma projects from increased interaction and community building, the Six Sigma database can be accessed to find out what has been done on a certain problem, or just to proactively search for ideas for improvement projects. However, it is important to realize that the knowledge in the database is explicit and additional support will be needed to take perspective on the context where it was carried out. An understaning of this context can be provided by the Six Sigma Belt who ran the project, as well as by the project team members. If any of these parties are part of the person's personal network they are likely to contact them. Even better, if the person is part of any of these parties' community, perspective taking will be much easier once as an understanding of each others local practice has been already established. In any case, the organization must support this perspective taking process that must take place for people to understand how they can integrate it into their own context.

As such, for reuse to happen, resources will have to be allocated to support it. We recommend that the relevant Six Sigma Belt should be held accountable for providing the necessary support asked for by people interested in the project. This includes both answering questions about how they came to certain conclusions, as well as coaching the other party in implementing or adapting the results to their context. Here, it is vital that it is made explicit that this is part of the job of being a Belt. The maximum time the Black Belt can be expected to spend on supporting reuse should also be made explicit. If the project becomes of interest to many people and a lot of support is needed, leading to exceeding this maximum time, a separate project should be taken up by someone else to support the interested parties. Though this person has to work in close collaboration with the Black Belt and the team members involved in the project in order to make use of their experience, it still takes away some amount of the workload off the Black Belt. It must be considered if this extra work should lead to adjustments in other responsibilities of the Black Belt to ensure that the workload does not get too heavy.

The Six Sigma organization should also consider more tangible efforts to aid people who wish to understand how to use knowledge represented in projects. Currently, results of Six Sigma projects are often presented on an executive summary page. In addition, it could be made part of the Six Sigma project methodology to create implementation tools, such as models and drawings that can be used by others. These implementation tools need to be de-contextualized to be able to guide people having for example slightly different types of processes or machines. If this is not possible without knowing the new context, the Belt should work together with the

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interested party to identify how to create implementation tools. Although some Belts currently provide some lessons learned as part of the summary of the project, additional, more extensive guidelines can be added to the final report and presentation. This can include helpful tips for implementation. It is important to note here though, that these tools and guidelines should not be treated as a means to and end. Rather, they are likely to need complementary personal interaction, such as coaching.

The database must be aligned with the reuse strategy of the Six Sigma organization. In doing so, the perception of how the database can be used needs to change. Currently, people who know about the database refer to it as a follow up database and most people are not even aware that there is a search function that can be used to find projects that are relevant. In changing this perception, we believe that it would be a good idea to change the name of the database from Six Sigma follow up database to something that signifies more of a repository of knowledge. Also, the Six Sigma community and management in general must communicate that this database hold value for not only Six Sigma trained employees. Even though Six Sigma use it for documentation and follow up, many different positions could potentially benefit from visiting the database. Such things can help to change the perception that the database is only for management to follow up on Six Sigma projects.

Our interviewees also feel that it is important that there is an easy way to search for projects covering similar problems. One idea is to require the belts to categorize their project from the beginning. Each project could be categorized into a well-defined problem area, which is in turn categorized into either manufacturing or transactional process. It should be possible for users of the database to browse through all these categories, as well as search for a specific problem area. In addition to being able to find a similar problem, people must be able to get quick access to an easy to read summary of the project. This summary should show if the project is related to their problem, the name of the person who performed the project, what unit it was performed in, and links to implementation tools and guidelines for reusing some of the results or knowledge.

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