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Transfer of Experiences; How to become a Learning Organization

A Case study at Metso Power AB Gothenburg

Master of Science Thesis in the Master Degree Programme Quality and Operations Management

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FOREWORD

This report represents the Master of Science Thesis in the Master Degree Programme Quality and Operations Management, which was realized at Metso Power AB Gothenburg. The Master of Science Thesis has been executed between January and June in 2011 and corresponds to 30 academic points.

There are many persons who have supported us in various ways, and we would like to take this opportunity to thank some of them. First of all we would like to show our appreciation to our supervisor at Chalmers, Doctoral Student Björn Söderberg, who has supported us, given valuable advise and served as a guide during the thesis execution. Thank you also Associate Professor Lars Trygg, the examiner of our final task at Chalmers.

We would like to express our gratitude to the initiator of the Master of Science Thesis, Micael Hangelin employee of Metso Power AB Gothenburg and supervisor within the company, for his help and support during the research. We would also like to thank employees at Metso Power AB Gothenburg, who first of all has contributed to the research through interviews and empirical studies, but also for their warm welcoming and kindness that they have shown us during our time at Metso Power AB Gothenburg.

We would also like to thank Ulf Hansson at Ruag Space AB for his interesting advises concerning approaches enabling continuous improvements to become a natural feature of the organization. Thank you also, Håkan Klein and the participants at Astra Zeneca AB, for inviting us to Södertälje and realizing the workshop. The input generated from the workshop has had a significant meaning for the outcome of the Master of Science Thesis.

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ABSTRACT

The insufficient knowledge management and amount of inter-project learning is a common issue identified in organizations active on today's global market. There is an increasing amount of competitors present on the market, and to sustain and gain market share, organizations rush through project after project leaving no time for reflection and internal improvements. For that reason, this master thesis aims at investigating how a matrix organization, competing on the global market, can utilize experiences generated in projects and integrate this knowledge in the functional units in order to achieve organizational learning and continuous improvements. The research questions that have been guiding the study are as follow;

- *Why is inter-project learning and knowledge integration an issue in today's organizations?*
- *How could a method that facilitates inter-project learning and enables knowledge integration and continuous improvements be designed?*

To answer the questions the organization Metso Power AB Gothenburg was chosen as a case study. At Metso Power AB Gothenburg, the effect of the increased competition and demands for greater returns has evolved as insufficiency of knowledge generalization, dissemination and embodiment through the organization (Bartezzaghi, Corso, & Verganti, 1997). The absence of decent inter-project learning is caused by insufficiency of interaction and communication, inadequate routines for closure of projects, and a corporate culture favoring individual achievements in projects prior to continuous improvements of the organization as a whole.

Theoretical findings, though, suggest that in order to be successful and sustainable in the long-term, previously gained learning's has to be applied. Therefore the organization needs to introduce procedures and use method and tools that facilitate the process of knowledge creation, dissemination and embodiment within members of the organization as well as within organizational elements, reports and databases. Suitable procedures, tools and methods identified are; visual approaches which allow an increased amount of interaction and communicative knowledge integration (Nonaka, 1994), and well established, clearly stated and standardized routines for closure of projects, meetings, and reporting and storing of information and data. In addition, these suggested approaches and procedures, needs to be supported by executives of the organization, communicating its importance through the vision of the company (Davenport & Prusak, 1998).

If the above mentioned improvements are established, Metso Power AB Gothenburg would increase their ability to manage their inter-project learning process and a knowledge-oriented corporate culture could emerge that is characterized by learning and continuous improvements (Davenport & Prusak, 1998).

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1. INTRODUCTION

This chapter will introduce the background of the Master Thesis, as well as a presentation of the purpose and objective. The chapter will further elaborate upon the relevance of the subject, and the problem faced by the case chosen, ending with research questions. Lastly the scope will be narrowed down by presenting delimitations of the thesis.

1.1 Metso Power AB

Metso is a global supplier of technology and services for mining, construction, power generation, automation, recycling and the pulp and paper industries focusing on sustainable solutions.

The subunit Metso Gothenburg, henceforth Metso, is focusing on designing and manufacturing systems for chemical recovery and power generation to the pulp and paper industry and power producers around the world. Their main products are recovery boilers, power boilers, evaporation plants, environmental systems and services. The office in Lindholmen, Gothenburg, is specialized in services capabilities and sustainable energy generation such as chemical recovery systems. They provide redevelopment of existing products in order to enhance their capability and improve efficient use of resources. Hence, their projects are highly independent and non-sequential in their nature.

Metso, who employs approximately 450 people, is organized as a matrix organization, and projects are carried out to enhance and develop new solutions for their customers. During execution of projects, learning´s are established within the project. This knowledge should be preserved and passed on to the next project. Hence, project experiences need to be integrated in each function, so that the knowledge can be used in up-coming projects. However, this transfer of knowledge is unclear, resulting in knowledge loss and inefficient use of resources in the next project.

In order to improve the transfer of knowledge between projects, and create a learning organization, a strategy for how to transfer knowledge needs to be created and made visible to everyone involved.

1.2 Purpose

The purpose of this Master Thesis is to investigate how a matrix organization, mainly focusing on external customer projects, can achieve inter-project learning and continuous improvements in order to enable a learning organization to evolve.

1.3 Objective

The objective is to be able to identify and frame barriers towards knowledge integration and to use these to design a strategy that enables individuals to learn from previous experiences in an efficient and effective manner. The objective is further to develop a holistic method, corresponding to that strategy, which will trigger learning between projects and guide the organization and its functional units towards knowledge integration that will increase and continuously improve functional unit capabilities.

1.4 Problem analysis

As new revolutionary technical solutions have entered the market, the world has become a more competitive arena. Spurred from this globalization of competition, the need of achieving organizational learning and continuous improvements, closely related to organizational learning, has been intensified (Locke & Jain, 1995; Shani, Chandler, Coget, & Lau, 2009). Davenport and Prusak (1998) similarly argue that knowledge may provide a sustainable competitive advantage since it generates increasing returns and continuing benefits. The motive is that competitors eventually will match the quality and price of a market leader's current product or service. Although, by the time that happens, the knowledge-rich, knowledge-managing company will have moved on to a new level of quality, creativity, or efficiency.

The challenge of constantly improve their performance is also recognized at Metso. Traditionally, sharing of experiences at Metso has mainly been focused on senior employees tutoring junior staff facing unexpected challenges. Metso is now facing a generation change, meaning that valuable knowledge and experiences will be lost. Further, Metso is financially sustained by external customer projects. As a consequence customer projects are favored on behalf of internal projects which imply a short-term thinking where reflecting, processing and implementing of acquired experiences from projects is generally not favored. There way of prioritizing differ from what Antoni (2003) suggest, i.e. *"acknowledging the importance of learning from project experiences in product development is the first step towards increased project competence in an organization"*. Metso is a successful organization, the number of ongoing projects is high and there is always a new project waiting to get started, people are hurrying between the projects leaving no room for working with internal improvements. These aggregated factors indicate that the situation is particularly interesting.

Employees are well aware that this is not a sustainable way of operating but there are no pre-set procedures for how to integrate experiences gained in projects throughout the functions. Hence, in order to improve their project performances in the long-term, the challenge that Metso is facing in the nearest future is to manage a sustainable transfer of experiences gained through projects.

Metso has already started their journey, they are well aware of the existing shortcomings and in 2010, they decided to find the root cause of failures in one of the projects that was less successful. These findings have initiated this Master Thesis. The Master Thesis will bring the initial study forward and further investigate and analyze shortcomings hindering the transfer of experiences and continuous improvements. To guide the investigation and to be able to reach our objective the following research questions will be addressed;

- *Why is inter-project learning and knowledge integration an issue in today's organizations?*
- *How could a method that facilitates inter-project learning and enables knowledge integration and continuous improvements be designed?*

1.5 Delimitations

This Master Thesis will not elaborate on how knowledge is created within organizations, rather it will focus on transfer of experiences between individuals within the organization, hence the learning process. Though, since archives and databases are means of capturing and disseminating knowledge that could be applied at later stages, these will be considered.

The thesis focuses on inter-project learning and mainly integration of knowledge in functional units, i.e. dissemination and embodiment of knowledge. However, abstraction and generalization of experiences as well as application of learning's will be briefly touched upon. Through generalization and abstraction Metso may find similarities between projects and recurring pitfalls that they keep falling into. When it comes to application of learning, short recommendations will be provided that may contribute to better utilization of organizational knowledge.

The result of the thesis should not require much additional resources from the organization. The thesis will be limited to larger projects, specified as larger according to Metsos definition of larger projects. Further, the thesis will not deal with how an implementation of the findings will look like.

2. METHOD

This chapter aims at presenting the chosen strategy, steps and methods used when carrying out the study. Hence, it will describe the research process so that it can be replicated by other, thus the reliability of the research is achieved. Further, the chapter will simultaneously describe how reliability and validity of the study has been ensured.

2.1 Research strategy and design

In order to investigate how organizational learning between projects is achieved, and what obstacles there are, a case study of the organization Metso was chosen. A case study entails an in-depth analysis of a single case, and is suitable for a qualitative research (Bryman & Bell, 2007). Hence the intention of the research is to provide an in-depth elucidation of a single case on how organizational learning is achieved or not in an organization. It will provide empirical findings that can be analyzed and used when designing a best practice method for organizational learning between projects. This method could therefore be suggested as an improvement action to the specific case chosen. Since the study is based on a single case, the external validity or generalizability of the research can be questioned. Hence a single case is seldom representative for a whole setting and could not be generalized across cases (Bryman & Bell, 2007). However a higher degree of generalizability can be achieved by providing a thick description of the case at hand (Bryman & Bell, 2007). In doing so, organizations can judge if it is transferable to their organization or not, thus increase the external validity of the research. Since the theory will be related to the empirical study, some degree of analytical generalizability will be achieved.

A qualitative study was chosen, since the emphasis is on the understanding of social settings rather than interpretation of numbers and natural science (Bryman & Bell, 2007). Hence it provides a detailed account of what is going on in the social setting and a description of the context that will affect integration of knowledge in organizations. (Bryman & Bell, 2007).

The study has been realized through an abductive approach, i.e. theory and empirical data has been used in an iterative process to develop theory (Dubois & Gadde, 2002). An abductive approach was chosen since it is particular suitable for a single case study aiming at theory development (Dubois & Gadde, 2002). Having a parallel process of going ”back and forth” between theory and data ensures that the theory and empirical data collection will take the same direction. Further, an abductive approach allows for systematic combining. Systematic combining is an intertwined process where framework, data collection and analysis evolve simultaneously. See figure 1 which present an illustration of systematic combining. Triangulation in systematic combining is different from quantitative triangulation where it is a matter of checking the accuracy of data. We have rather used the systematic combining approach towards triangulation which has contributed to the discovery of new dimensions of the research problem. Systematic combining further implies that we, as researchers, constantly has been going ”back and forth” from one type of research activity to another and between empirical observations and theory. The

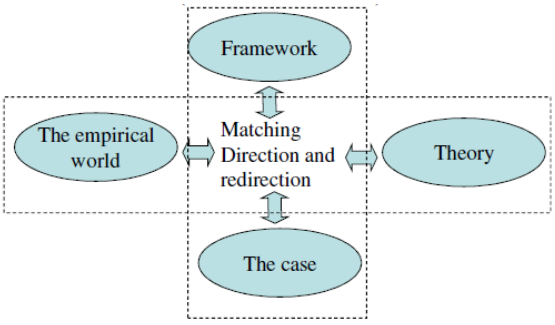

Figure 1: Sytematic combingn (Dubois & Gadde, 2002)

benefit that the strategy brings is, according to Dubois and Gadde (2002) that a greater understanding of both theory and empirical phenomena will arise. Hence, *"theory cannot be understood without empirical observation and vice versa"* and adapting systematic combining confrontation between empirical findings and theory has been a continuous process. Similarly, as Dubois and Gadde (2002) implies, confrontations will occur between the evolving framework and the evolving case through processes of direction and redirection for achieving matching. (Dubois & Gadde, 2002)

2.2 Selecting research area

The first step in our study was to identify and understand our research area. We had a thorough introduction at Metso with introductory meetings with our supervisor at Metso, Quality Manager Mr. Micael Hangelin. Previous project reports as well as an externally performed assessment of the performance of a previous project were reviewed. In addition complementary interviews were conducted with two key personnel in the organization as well as with the consultant who executed the external assessment.

Throughout the initial phase, continuous meetings with our supervisor at Chalmers, Mr. Björn Söderberg, were conducted. Mr. Söderberg provided help and feedback necessary to guide our initial studies when finding out our research area and scope and narrowing it down to a reasonable level. The finalizing phases where realized in a similar way. Regular meetings with Mr. Söderberg and Mr. Hangelin where realized, both separately and all of us together.

2.3 Literature review

An extensive literature review of existing theories is to be performed, in order to broaden our understanding about organizational learning. It will also contribute to an understanding of why the subject is important to study, and the refinement of research questions. By looking at previous thesis as well as getting recommendations from the supervisor, articles and authors that are of interest could be localized. Some key search words such as knowledge management, knowledge transfer, knowledge sharing and organizational learning was formulated and used in databases such as Google Scholar, Emerald, Scopus and other databases at Chalmers library. The literature review will then be used as a basis for analyzing the empirical findings, and development of result. The literature will be reviewed critically, by comparing a comprehensive amount of sources with each other in order to provide a reliable foundation that is based on a comprehensive understanding of the subject. This is supported by Bryman and Bell (1994), who states that a systematic review will provide this foundation. A systematic review is described as "*a replicable, scientific and transparent process, that aims to minimize biases through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer's decisions, procedure and conclusions"* (Bryman & Bell, 2007).

2.4 Empirical studies

The empirical studies at Metso has been realized through a combination of interviews, direct observations at the setting and a study of computer-aided tools applied at Metso.

Interviews with employees of Metso have been the main source of data for this Master Thesis. Complementary data has been collected from internal databases, documents and reports as well as direct observations. Using multiple research methods is supported by Bryman and Bell (2007) who argues that it enhances the potential of capturing complexity and contradictions in the data.

In addition to empirical studies at Metso, benchmarking studies has been conducted at Astra Zeneca AB and Ruag Space AB. The companies chosen are not competitors of Metso which has increased the credibility of their answers. The aim of the benchmarking studies was to compare Astra Zeneca AB´s, Ruag Space AB's, and Metso's procedures for inter-project learning and to use them as sources of inspiration for how to work in the most efficient way with transfer of knowledge.

2.4.1 Preparing and conducting interviews

Empirical data collection from interviews has been conducted in a qualitative manner using semi-structured interview guides with open-ended questions. The approach has allowed us, as interviewers, to ask follow-up questions of interest. It has also enabled the interviewees to elaborate on his/ her ideas which have provided us with an insight of what the interviewee consider as interesting and important (Bryman & Bell, 2007). The interviews have further been carried out face to face. Face to face interviews have enabled the interviewers to make certain basic observations during the interview, e.g. *in what context do the employee operate?* And, *how do the employee react on the questions being asked, e.g. eye movement, breathing?* Observations that are worth noticing are also; feelings, energy level, ease of answering questions etc.[1]

The interviews carried out at Metso have addressed employees representing a diverse range of occupations and organizational positions. For that reason, the interview guide has been slightly different depending on the employee of interest. The interview guide has been prepared in advance, an example of an interview guide could be found in Appendix A. The emphasis when preparing the interview has been to formulate questions that cover the area of interest but from the perspective of the interviewee (Bryman & Bell, 2007). The questions has derived from literature studies, reports on previous experiences at Metso, from information provided by Mr. Hangelin and Metso and from information gained from the initial interviews.

Moreover, ethical considerations have been kept in mind when the interviews was prepared and conducted. Important for us as interviewers, has been that the research shall benefit both the participant and the study; hence our intention has been that the interview shall be characterized by reciprocity and trust. To guarantee this, interviewees have been informed in advance about the purpose of the research and the interview giving them an opportunity to withdraw. There has further been strict confidentiality and anonymity. However, in some cases identification of individual has

[1] Sverker Alänge, Associate Proffesor, Chalmers University of Technology. Lecture at Chalmers 2010.04.23: Interviewing.

been possible and anonymity has not been guaranteed, the interviewee have had a chance to agree with the statement, and approved its publication. The anonymity has further improved the quality of the answers since the interviewee probably has been more confident while exposing their inner believes and thoughts (Bryman & Bell, 2007).

The interviews have been conducted by Marie Andréasson and Michaela Blomén, and the use of two interviewees has minimized the risk of biased interpretation (Bryman & Bell, 2007). 27 interviews have been conducted and complementary meetings have been realized with key personnel within Metso. Of course, a larger sample could have been chosen. However, with the time constraints which the scope of the Master Thesis implies, we believe that the sample is of a reasonable size and has provided us with a comprehensive and fair view of the reality at Metso. Hence, issues discussed at interviews have been of recurring nature which implies that the result can be generalized to the population (Bryman & Bell, 2007). The interviewees have mainly been appointed by Mr. Hangelin, supervisor and initiator of the Master Thesis. Mr. Hangelin has major interests in the research and its results, he also posses great knowledge of the organization and its employees which has been a motive for him to collect relevant interviewees. Though, there might be a risk that the interviewees picked share the same opinion as Mr. Hangelin, which may eventually affect the outcome of the research. However, Mr. Hangelin's knowledge about the organization and employees of different organizational positions has been of great value for us since a good sample has been provided.

2.4.2 Direct observations

As a complement to the interviews, direct observations have been realized within the setting in order to get familiar with the corporate culture at Metso. We have had an opportunity to be located at Metso's office in Gothenburg which has allow us getting acquainted with the settings, interact and socialize with Metso employees and run informal structure observations that has contributed to our understanding of Metso's culture and heritage. As Bryman and Bell (2007) phrase, the social world must be interpreted from the perspective of the people being studied. There is, however, a risk of losing sight and "going native" when getting to comfortable in the setting. To avoid this, and to assure that we kept a professional and objective view, we have spent some working hours out of office working at Chalmers Library. (Bryman & Bell, 2007).

2.4.3 Computer-aided tools and organizational documents

To acquire an understanding of Metso's working procedures, computer-aided tools, databases and previous project reports has been briefly reviewed. This, in combination with interviews and observations, has provided us with valuable background information about Metso and contributed to our understanding of the organizational context and working procedures (Bryman & Bell, 2007).

2.4.4 Benchmarking

As stated above, benchmarking studies has been conducted at Astra Zeneca AB and Ruag Space AB. Through the benchmarking studies theoretical findings has been confirmed. Hence, the result has shown that the methods introduced in theory are applicable and contribute with efficient and structured ways of managing inter-project learning.

The reason why these companies were chosen was that these were recommended by our supervisor at Chalmers, Mr. Söderberg and a line manager at Metso and that they were known for their structured and efficient way of working with knowledge management and continuous improvements. Even though the product of the companies projects differs a lot from what Metso do, their project processes and procedures for transfer of experiences between projects have served as sources of inspiration for the case study at Metso.

The contact with Astra Zeneca AB was established first. To ensure that the company could contribute with valuable information, telephone meetings and a real life meeting were held in prior to the actual benchmarking activity, i.e. a workshop. The members of the workshop were prepared in advanced and received a letter and the research question, see Appendix B. Our intentions were to introduce the research and provide the workshop participators with a mindset corresponding to the one that we sought (Bryman & Bell, 2007).

Nine persons participated at the workshop. Before the workshop the case study at Metso was presented. The presentation served as an additional pointer towards what we wanted them to reflect upon. After that, the agenda, to be found in Appendix C, of the workshop was presented to ensure that there were no confusions. During the workshop we served as moderators, our role was to direct the discussions without getting involved, hence we wanted to ensure that the outcome was not influenced and that a true picture was given. The workshop was a success, spontaneous and valuable discussions were initiated during the workshop and their visual approach to meetings has been a great source of inspiration which have triggered new ideas.

The benchmarking study at Ruag Space AB was not as comprehensive as the one at Astra Zeneca AB. Due to time constraints we were only able to conduct one interview at Ruag Space AB. For that reason, we have not been able to get a comprehensive view of how the population reflects upon the procedures. Though, the interviewee, manager of project leaders at Ruag Space AB, has been an employee for many years and due to his insight of how they work, in projects as well as within the functional units, he were trusted to provide us with a fair view of Ruag Space AB's procedures. The outcome of the benchmarking at Ruag Space AB has mainly been used as inspiration for how organizations most efficiently can work with and frame continuous improvements.

Since the result from the two benchmarking companies differed slightly in content, the information from the two studies complemented each other. For that reason, the structure of the result will not be presented in the same for two companies.

2.4.5 The processing of data

Interviews at Metso

In order to gather the information gained from interviews, notes were taken by both interviewees. This ensured that data wasn't left out and forgotten from the sessions, thus the notes complemented each other sometimes. Further, immediately after the interview, discussions about the result were held to make clarifications and ensures that we interpreted the findings similarly. The discussions sometimes ended with some additional comments and notes, which were done with another color to separate them from the original text. This approach is supported by Bryman and Bell (2007), stating the importance of reading through initial set of transcripts, and further do it as soon as possible.

In order to processing the qualitative data in a structured way, sticky-notes were used. Sticky-note allowed for the result to become visible in a comprehensive and easily overviewed manner. The sticky-note was organized as a map for each interviewee, enabling identification of areas interesting for the study. This way of working is supported by Bryman and Bell (2007), who imply that codifying qualitative data into topics and categories are the starting point for structured qualitative data analysis. The result of each map was then entered into excel, facilitating a comparison between employees maps. By comparing the qualitative data, patterns and similarities could be found. These similarities where codified with different colors, creating areas of problems (Bryman & Bell, 2007). In order to make the result of the comparison easily overviewed, sticky-notes were once again used, this time to create a map for the whole organization.

Having this step by step structure for processing the qualitative data, made us reflect and draw interpretations in an efficient and effective manner.

Benchmarking

The two benchmarking studies were conducted in different ways, which is why the processing of data differs. At Astra Zeneca AB, a workshop was held, while an interview was held at Ruag Space AB. Since an interview was held at Ruag Space AB, notes was taken and discussed directly afterwards, where additional comments were added in another color, to ensure that we interpreted the findings similarly (Bryman & Bell, 2007). The result was written down as soon as possible, to ensure that information was not lost (Bryman & Bell, 2007). Since a workshop was held at Astra Zeneca AB, the outcome was a map over areas of interest. Hence when discussing the result additional notes, taken during the session, were added on the map with another color. Thus clarification could be made and valuable information was not lost. Once again the result was written down as soon as possible, so that nothing was forgotten.

3. THEORETICAL FRAMEWORK

The theoretical framework will start out presenting inter-project learning in theory, and how it relates to organizational learning and continuous improvements. It will further elaborate upon how inter-project learning can be achieved in practice.

3.1 Organizational knowledge and continuous improvements

This first part of the theoretical framework will thoroughly review the concepts of organizational knowledge and how it contributes to the creation of continuous improvements.

3.1.1 The concept of knowledge

In order to understand how knowledge can be integrated in the organization, knowledge needs to be defined. Davenport and Prusak (1998) state that knowledge is neither data nor information, but could be related to both. Data is discrete facts about events that can be found in records and transactions. Information on the other hand is data that makes a difference i.e. it informs the receiver and impacts his judgment and behavior. Information could for example be the content of a conversation or it could be found in a book. Knowledge are created when information is interpreted by individuals and given a context and anchored in beliefs and commitments of individuals (Nonaka, Toyama, & Konno, 2000). Similarly, Davenport and Prusak (1998) states that information becomes knowledge when humans must do the work, thus relate the information to other situations as well how it affects decisions and actions in that context. Further, individuals obtain knowledge from other individuals or groups of knower's, or sometimes in organizational routines. In conclusion knowledge derives from information, as information derives from data, see figure 2.

Figure 2: Knowledge derives from information as information derives from data.

Knowledge can be divided into two types; explicit knowledge and tacit knowledge. Explicit knowledge is described as knowledge that can be formalized and easily expressed in the form of data, specifications or manuals. Hence, explicit knowledge is easily shared and transmitted to others. Tacit knowledge is highly personal, thus it is hard to formalize. It could be subjective insight, rooted actions, or values and beliefs that are hard to communicate to others. (Nonaka, Toyama, & Konno, 2000).

3.1.2 Organizational knowledge creation

In the previous paragraph the concept of knowledge was presented. As Nonaka et al. (2000) phrased, knowledge is created when information is interpreted by individuals. The statement indicates that knowledge is a personal possession and not an organizational. In earlier publications Nonaka et al. (1996) has elaborated on the statement, saying that knowledge is created only by individuals and that an organization is incapable of creating knowledge without individuals. Nonaka's et al. (1996) description of knowledge creation is similar to the one presented by Grant (1996), i.e. that knowledge resides within the individual and the organizations role is rather knowledge application then creation. Organizational knowledge is, however, of great importance for the future success and competitiveness of the company on the ever accelerating market (Locke & Jain, 1995). And to achieve organizational knowledge creation, Nonaka et al. (1996) mean that it must be identified as a process that organizationally amplifies individual knowledge and integrate it in the organization as part of their knowledge system. As previously presented, Nonaka et al. (1996) categorize knowledge into tacit and explicit knowledge. A great advantage that they identified is that Japanese companies has come to realize that knowledge is not just explicit, it is primary tacit, an insight that may explain why Japanese companies outperform many western companies when it comes to improvement work. In Nonaka´s et al. (1996) view, explicit and tacit knowledge are mutually complementary entities. The conversion is a necessary process in which organizational knowledge is achieved through conversion of individual tacit knowledge into organizational explicit knowledge. Hence, due to the nature of tacit knowledge, it may not be disseminated throughout the organization unless it becomes explicit. Nonaka (1994) has developed a model to visualize how interaction between tacit and explicit knowledge can be transformed into new knowledge through four different patterns or modes. The processes involved from, what Nonaka (1994) refers to as a spiral model, figure 3.

The first mode, socialization is a process where an individual, the apprentices, acquire tacit knowledge directly from another person, the trainer, through interaction. Socialization can also take place without using language. Externalization and Internalization involves both tacit and explicit knowledge and are examples of the mutual complementary mentioned above. (Nonaka, 1994). Internalization is closely related to "learning by doing" and is a process of embodying explicit knowledge into tacit. Externalization is a process of articulating tacit knowledge into explicit, it is mostly expressed through language using metaphors and/or analogy. Combination is a process where an individual combine, and reconfiguring, information gained through e.g. meetings, conversations, documents etc. to create new knowledge. Nonaka et al. (1996) further refers to organizational knowledge creation as a continuous process where tacit and explicit knowledge dynamically interact. This interaction is a shift between the different modes forming a 'spiral of knowledge creation'. (Nonaka, Takeuchi, & Umemoto, 1996)

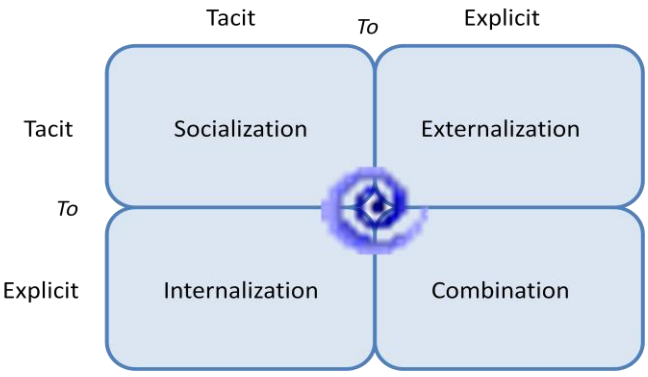

Figure 3: The spiral model of knowledge conversion. (Nonaka, Takeuchi, & Umemoto, 1996)

3.1.3 Inter-project learning and continuous improvements

As Bergman and Klefsjö (2003) states;"*for continuous improvements to become a natural feature of an organization, we need to create a learning organization"*. Learning is an essential process for attaining individual and organizational success (Shani, Chandler, Coget, & Lau, 2009). Therefore, the concept of organizational learning needs to be explained. Learning is defined by Shani et al. (2009) as "*the process whereby new skills, knowledge, ability, and attitudes are created through the transformation of experiences*" whereas organizational learning refers to "*the principles, mechanisms and activities that enable the organization to create, acquire, and transfer knowledge to continuously improve the organization"*. Further, Locke and Jani (1995) explains that organizational learning occurs through shared insights that builds on previous experiences, that will lead to an outcome in the form of knowledge or a skill. To summarize, organizational learning provides great potential to continuously improve the organization. Continuous improvements constitute one out of five cornerstones which are the basis of the well-recognized philosophy Total Quality Management, TQM. The basis of continuous improvements says that it is always possible to get improved quality using fewer resources. (Bergman & Klefsjö, 2003). The close link between organizational knowledge and continuous improvements was also recognized by Bartezzaghi et al. (1997) who argue that managing the process of knowledge creation, dissemination and application is the basis for creating and continuously improving product development capabilities.

A major part of the existing knowledge management literature focuses on cross-functional organizational knowledge. Bartezzaghi et al. (1997), on the other hand, exploits learning in new product development projects by categorizing them into two different levels of learning, i.e. intra-project learning and inter-project learning. These are distinguished depending on where experience is acquired and where experience is applied. Intra-project learning occurs within a single project where both acquisition and use of experience occurs. Intra-project learning is the process of reducing uncertainty within the project by applying continuous learning through what Deming refers to as Plan-Do-Check-Act-cycle (PDCA-cycle) (Bartezzaghi, Corso, & Verganti, 1997). The PDCA-cycle constitutes the symbol of continuous improvements (Bergman & Klefsjö, 2003). The cycle indicates the importance of basing all change on facts, to monitor and evaluate the result of the change and to standardize the operating procedure if the change is considered good enough, i.e. to learn (Alänge, 1994). The PDCA-cycle and the role of learning and standardizations in the quest toward continuous improvements are illustrated in figure 4.

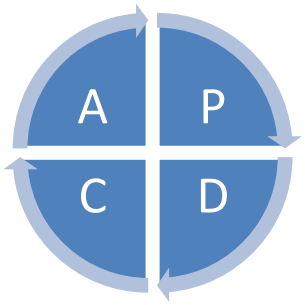

Figure 4: The PDCA-cycle as a symbol for continuous improvement.

Inter-project learning, on the other hand, is the learning mechanism which takes place when experiences acquired is transferred to different projects over a period of time. Intra-project learning is often context specific, the feedback generated is often temporary and partial with the consequence that inter-project learning cannot make use of it. Hence, inter-project learning is about generalizing the knowledge so it may be used in subsequent innovations. Inter-project learning could therefore be seen as a means of enhancing project performance in the long-term. Focusing on inter-project learning implies a balance between the urgency for immediate results with the need to create re-useable knowledge in upcoming projects. Due to this potential trade-off Bartezzaghi et al.

(1997) argue that inter-project-learning should be considered as an organizational objective to guarantee that the long-term perspective is not lost. (Bartezzaghi, Corso, & Verganti, 1997)

The nature of inter-project learning appears to be far more complex than intra-project learning, it requires an organizational ability to constantly and simultaneously learn and unlearn which further require a high degree of awareness. The capability to interpret and understand the causal relationship between phenomena is a great challenge at both individual and organizational level which indicates that interpretative models and tools are of great importance for supporting of inter-project learning. (Bartezzaghi, Corso, & Verganti, 1997)

3.2 Learning in the organizational context

In this part the organizational context in which learning occur will be treated. It will start out with a description of potential organizational designs and structures. In this section the importance of information processing capabilities will be touched upon. The sub-chapter will be finalized with a presentation of the role of the corporate culture and a narrow presentation of cultural aspects that may hinder inter-project learning will be given.

3.2.1 The matrix organization and its information processing capabilities

The three most recognized structures are functional organization, project organization and the matrix organization. A functional organization is appropriate to use when a high degree of specialization is needed, such as developing new technologies (Maylor, 2010; Galbraith, 1971). However the organization is relatively slow as a process, since tasks are performed sequentially, thus becomes time consuming. In the project organization, development of knowledge occurs in project and hence the organization must continuously build their knowledge from experiences which is often more complicated then knowledge creation in the functional organization (Kotnour, 2000). Though, it has the ability to achieve a high-speed process, since it facilitates coordination among specialist, enabling parallel work (Maylor, 2010). A matrix organization is a combination of them both, developed in order to benefit from both the functional structure and the project structure. It consists of functional departments having the role of providing resources to project teams (Maylor, 2010). Moreover, by organizing as a matrix the amount of cross-functional integration will increase which will further imply better conditions for system thinking but also an increased focus on the product and shorter lead times (Wheelwright & Clark, 1992). Hence, with a matrix organization, both technical performance and parallel work is achieved, however specialization will decrease in comparison to the functional structure.

According to Tushman and Nadler (1978), the amount of task interdependencies that exist between different units indicates a need for effective coordination and joint problem solving, which is a source of work-related uncertainty. According to Tushman and Nadler (1978), organizations and its units are facing a great deal of uncertainty from both external and internal sources. As uncertainty increases, information processing requirements increases and hence the organization needs to develop information processing capabilities that are capable of dealing with those uncertainties.

3.2.2 The corporate culture and aspects that may hinder sharing of experiences

Since knowledge and information gained through previous projects are rarely used, literature has been critical to the way projects are monitored and evaluated (Biggs, 2003). Biggs (2003) argues that it is clear that organizations are hunted by the same recurring problems year after year. The following consequence is that organizations do not learn from their mistakes, and lessons are not learned. How can that be? In order to understand why, Biggs (2003) argues that you need to examine the culture within the organization.

Further, to become a learning organization we need to realize that there may be cultural aspects that will hamper the process of learning. By being aware of those cultural aspects, enabling mechanisms may be created that will help us overcome them (Bartezzaghi, Corso, & Verganti, 1997).

The most obvious circumstance to consider is that an organization is made up of people who are working in a social context (Biggs, 2003). Davenport and Prusak (1998) further argues that those people's values and beliefs will influence how they think and act, and hence their personal values and beliefs will have a powerful impact on the corporate culture. By realizing that, one can easily recognize that the corporate culture is a product of personal attributes and social relations between individuals (Biggs, 2003). Moreover, one of the most important qualifications that are considered to lead to success in projects has been identified as a knowledge-oriented corporate culture (Davenport & Prusak, 1998). A knowledge oriented culture is characterized by;

- A positive attitude towards knowledge and knowledge sharing.
- An open climate that encourages knowledge sharing and learning.
- Executives support and credit the handling.

However, many organizations seem to lack this openness. One reason could be that employees possessing knowledge critical to their unique value fear to share their knowledge with others since it might threaten their future positions in the organization. Another reason could be that organizations rather encourage creativity and the development of new ideas, than using already created knowledge and experiences. To overcome this, to stop inventing new untried concepts, and to foster a knowledge oriented culture, Davenport and Prusak (1998) mean that aspects such as trust, management support, and allocation of resources would help. To further enable the rise of a knowledge-sharing culture, Davenport and Prusak (1998) suggest that organizations should establish an incentive and reward system. (Davenport & Prusak, 1998)

Similarly to Davenport and Prusak (1998), Alänge (1994) has studied the importance of a culture of continuous learning. Alänge (1994) argues that a corporate culture favoring knowledge-sharing will make people reflect and objectively view the company. To accomplish this corporate culture Alänge (1994) suggest that the company shall compare where it wishes to be, i.e. their vision, with where they actually are. Though, according to Bartezzaghi et al (1997) a common barrier towards inter-project learning is that companies lack a strategic vision for improvements. Chawla and Renesch (1995) further elaborates on the importance of a vision stating that one principle barrier towards organizational learning, is to treat business- and learning processes as separated entities. Similarly, Kotnour (2000) states that the opportunity for learning is an inherent part of the project management process, thus the project management process parallels the learning process. Viewing learning as a separate activity makes people less eager to complete their learning process, for example producing formal lessons learned, it is not as prioritized as it should be due to time constraints (Kotnour, 2000). Hence, there is a need for integrating the learning process with the business process and the project management process.

Further cultural aspects, identified by Bartezzaghi et al. (2007), are that;

- Learning's are established in a context and hence might be inapplicable in other situations. Thus, it´s hard to identify problems that is applicable to more than one specific context, and it might be hard to recognize problems that are systematically present in every project. Thus learning's from previous projects are not established when the next project starts.

- There is a space and time disjunction between past experiences and future application Hence experiences from one project must be preserved in such way so that it is easy to pick up in the next project, thus not get lost on the way.

- There is a ”not-invented-here”, i.e. NIH, syndrome. The NIH syndrome is the unwillingness to use past experiences and knowledge gained by others. It may be due to the fact that information is not easily accessible and instead of using existing knowledge it is easier to invent the wheel over and over again, rather than making use of already existing knowledge.

Not making use of previous experiences could also be related to what Chawla and Renesch (1995) refers to as the “non-listening” work environment. In the ”non-listening” work environment efficient communication and the interchange of ideas which are necessary to promote organizational learning is blocked. Hence, you are not encouraged to share and interchange experiences that might be applicable in other projects.

3.3 Achieving inter-project learning

This part will introduce the elements required to create the conditions of a learning organization followed by a suggested process of inter-project learning.

3.3.1 The process of creating inter-project learning

Even though Bartezzaghi et al. (1997) describes inter-project learning as far more complex than intra-project learning, it somewhat occurs through similar cycles of PDCA. However, inter-project learning has a slightly different framing. Inter-project learning starts out with the initial three steps, PDC, which are project-specific steps that are carried out within the project. Decisions are made and solutions are implemented. At the end of the project, however, feedback is generated that will further initiate the inter-project learning. The feedback is based on an analysis of variances between initial plans and final results. However, since projects often are long-lasting and wide-spread the process of collecting feedback is in general neither implicit nor spontaneous. Hence, explicit organizational processes are required to guarantee qualitative feedback. The A-phase is where the true inter-project learning starts. Bartezzaghi et al. (1997) further divide the final phase into four definite steps, i.e. *abstraction and generalization; embodiment of learning; dissemination of learning;* and *application of learning*, see figure 5.

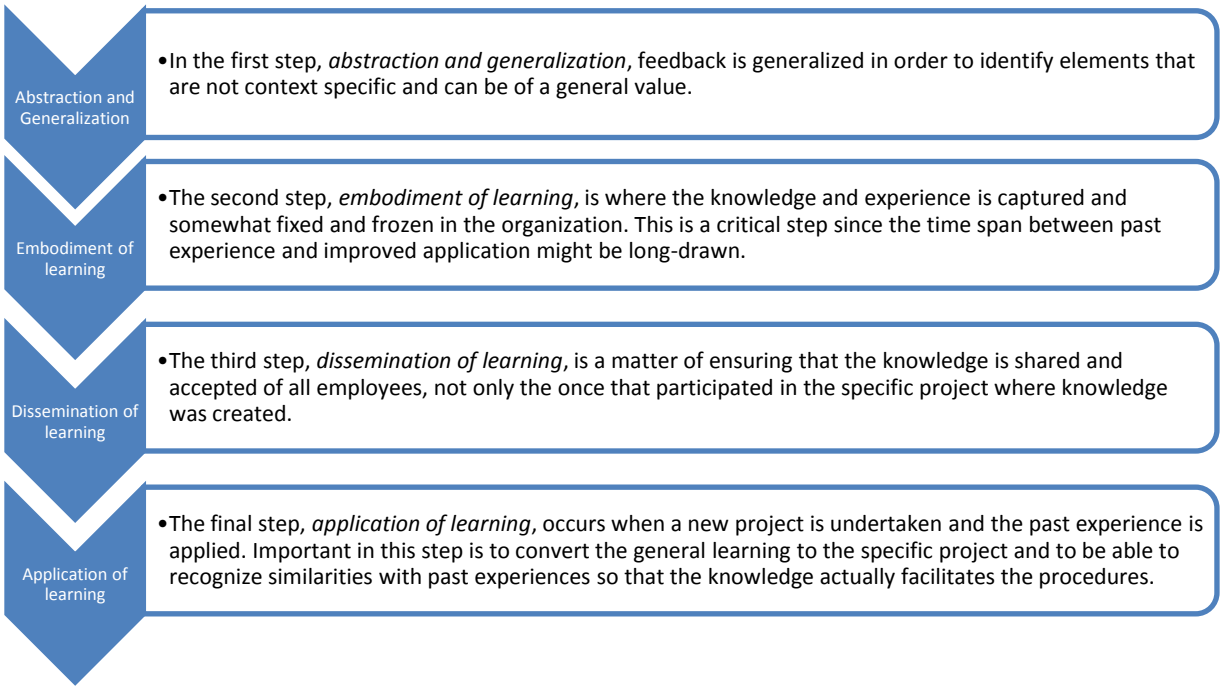

Figure 5: Batezzaghi's et al. (1997) four step process for achieving inter-project learning.

3.3.2 Abstraction and Generalization

The feedback generated continuously throughout the project is generally quite context specific and therefore both temporary and partial. Bartezzaghi et al. (1997), explains that since experiences are context specific, they need to be generalized in order to enable transfer of knowledge between projects. Hence, the feedback is mostly used to foster intra-project learning and providing corrective actions in the ongoing project. To achieve inter-project learning, Bartezzaghi et al. (1997), advocates analysis of variances during project termination to provide the necessary feedback that could, if well

managed, improve the organizational knowledge within the company. However, for analysis of the project in the termination phase to actually be realized, articulated organizational mechanisms needs to be in place (Bartezzaghi, Corso, & Verganti, 1997).

Griffin and Somermeyer (2007) has developed a method for capturing and sharing knowledge that is applicable to more than one context. The method is referred to as *After Action Review*, henceforth AAR, and the focus of the evaluation is to collect actionable knowledge that can be immediately applied in the next project. To maximize the outcome, AAR's should be conducted on a regular basis e.g. after completion of a major activity within the project. Thereby, the AAR becomes an ongoing continuous improvement activity that allows capturing of knowledge during project execution and before the teams disbands. Because of this contingency hence, AAR's are considered to be an effective mechanism for capturing and leveraging lessons learned that is applicable to more than one context. (Griffin & Somermeyer, 2007).

Griffin and Somermeyer (2007) further state that AAR's could be means to find systematical errors. Hence, if themes are surfaced at multiple AAR's it implies that there is a process weakness or a best practice to standardize. (Griffin & Somermeyer, 2007). Like Griffin and Somermeyer (2007), Bartezzaghi et al. (1997) has come to realize the importance of recognizing patterns and similarities between projects, hence *"patterns and similarities are contingent: they do not apply to the overall project portfolio, but only within single classes of problems"* (Bartezzaghi, Corso, & Verganti, 1997). Bartezzaghi's et al. (1997) approach is to adopt schemes for classification of projects. The scheme consists of several dimensions. If each dimension is further divided into different classes that define a framework where similar patterns of cause- and effect relationships may occur, Bartezzaghi et al. (1997) mean that the company will be able to improve their capability to identify similarities between projects and to exploit inter-project learning. (Bartezzaghi, Corso, & Verganti, 1997).

3.3.3 Embodiment and Dissemination of learning

As stated by Bartezzaghi et al. (1997), embodiment and dissemination of inter-project learning are time consuming activities that may imply delays in the project execution. The statement indicates the importance of generalizing data through evaluating and analyzing of project results in the termination of the project. (Bartezzaghi, Corso, & Verganti, 1997)

As was stated above, embodiment of learning constitutes the process of capturing relevant knowledge, store it and preferably develop it until it will be passed to future projects. Making the knowledge available in the organization is a complex process that requires knowledge to be "embodied" in elements that allow improvements to be captured and disseminated. (Bartezzaghi, Corso, & Verganti, 1997). Bartezzaghi et al. (1997) refer to these elements as "vehicles" that allow both capturing and dissemination of valuable information. Bartezzaghi et al. (1997), divide their vehicles into three categories where the choice is dependent on what kind of purpose the vehicle serve. These categories are people, reports and data bases, and organizational and technological elements. (Bartezzaghi, Corso, & Verganti, 1997).

People

The importance of people as knowledge carriers was recognized already in the introductory chapter concerning organizational knowledge creation (Nonaka, Takeuchi, & Umemoto, 1996). Similarly to Nonaka et al. (1996), Bartezzaghi et al. (1997) mean that knowledge and experiences may get

transferred if effective managed. The effective management of people that Bartezzaghi et al. (1997) refers to is to use pre-project team members in the new project so that they may provide the new team with their previous experiences. This method is somewhat limited in comparison to what Nonaka et al. (1996) suggest, that individual tacit and explicit knowledge shall be converted into organizational explicit knowledge (Nonaka, Takeuchi, & Umemoto, 1996).

Reports and databases

With Nonaka's et al. (2000) definition of explicit knowledge in mind, i.e. "*knowledge that can be formalized and easily expressed in the form of data, specifications or manuals*", organizational explicit knowledge may be interpreted as what Bartezzaghi et al. (1997) term as the vehicle *reports and data-bases*. However, reports and databases are widely criticized as a vehicle to capture and disseminate knowledge. As was mentioned in the chapter about culture, Biggs (2003) argue that information gained from previous projects is rarely used. Bartezzaghi et al. (1997) has similarly found that the effectiveness of reports and databases is only marginal since they are seldom used and analyzed. In most cases, reports and data-bases constitutes a high amount of unstructured information, further the information is to project specific, it is not generalizable and has not been put out of context (Bartezzaghi, Corso, & Verganti, 1997).

Organizational and technological elements

Since projects involve a great variety of people from different groups and since the process is so complex with issues that cut across different departments, functions and organizations, Clark and Wheelwright (1993) has declared that organizational learning requires careful systematic efforts. In accordance to Clark and Wheelwright's (1993) statement about the complexity of the development process, Bartezzaghi et al. (1997) argue that the most efficient way to transfer knowledge between projects is to embody the knowledge into concrete and tangible representations. Clark and Wheelwright (1993) identify five concrete organizational elements that allow knowledge to be captured and disseminated to future projects. These are *procedures, tools and methods, processes, structure, and principles*.

- The focus area of *procedures* may be applicable when the process must work more effectively, e.g. through establishment of new criteria or by eliminating procedures in the development process.
- *Tools and Methods* is an important area of focus when the opportunity for improvement requires new capability. Since development entails a great variety of different processes, these tools and methods further needs to be customized to fit process specific requirements and circumstances.
- The third area of focus, *processes*, is closely related to tools and methods since new working procedures may indicate a change of activity sequences and hence processes must be carefully designed for the development to be efficient.
- The focus area *structure* refers to the basic structure of the organization including the formal organization, psychical localization of responsibilities and geographical localization of activities. According to Clark and Wheelwright (1993), these structural elements will influence the nature of interaction across functions, the quality of decision making, and the intensity of completeness of communication, these may further require usage of methods and tools that facilitates the intended procedures.

- The last focus area, the *principles*, include concepts, ideas and values and provide fundamental guidelines for the organization in their decision making and development activities.

All five areas are means that provide the organization with a way to ”remember” what it learns from development projects. The importance of those areas could be identified both as a mean for managers to introduce new capability and improve development performances but also as ”vehicles” to capture and store what the organization learns about development over time (Clark & Wheelwright, 1993).

3.3.4 Application of learning

As was articulated earlier it is of great importance to recognize similarities with past experiences so that the knowledge actually facilitates the procedures. The final step, *application of learning*, occurs when a new project is undertaken and the past experience is applied. Important in this step is to convert the general learning to the specific project and to be able to recognize similarities with past experiences so that the knowledge actually facilitates the procedures. (Bartezzaghi, Corso, & Verganti, 1997). An example of activities are given by Griffin and Somermeyer (2007), who argues that teams benefit from engaging in learning activities before, during and after a project. To be put in correlation with application of learning, are the activities that should be executed when starting new projects. Griffin and Somermeyer (2007) suggests that questions such as; *”Who has done this type of before?”*, *”What can we learn from those previous experiences?”* and *”Are there opportunities for technology reuse?”* should be considered during the start up phase.

3.4 Means for creating opportunities for inter-project learning

This chapter will elaborate upon how organizations can achieve higher information processing capabilities and create opportunities for inter project learning.

First the lean approach and its visual methods will be introduced as a mean to achieve higher information processing capabilities. Second the importance of having face to face communication to increase knowledge sharing will be outlined. Third, a method for how to achieve better face to face communication will be presented, built upon the lean approach.

3.4.1 Visualization – a lean approach

The lean philosophy, and its visual methods, has mainly been associated with manufacturing, however Lean initiatives' has recently moved from being only a shop floor approach and moved towards white collar offices, and thus product development (Liker & Morgan, 2006). According to Liker and Morgan (2006), applying lean throughout the whole organization, and not only at the shop floor, will increase its effectiveness, and thus create an organization that continuously improves. Bicheno (2004) agrees, stating that visual management is most efficiently applied when it is extended beyond the shop floor, and also used in offices i.e. visualization can be used for designing forms, office layouts or present information. In doing so, countless of hours can be saved since time spent on searching and clarifying will decline (Bicheno, 2004).

Moreover, according to Söderberg and Alfredsson (2011), visual planning can be used as a mean to achieve higher information processing capabilities. Visualization methods are widely adopted in the lean philosophy, and it has proven to facilitate a richer information sharing and increased face-to-face communication as well as a better coordination of tasks. Thus it has the potential to facilitate experience exchange and knowledge integration that will minimize uncertainty faced by subunits (Söderberg & Alfredsson, 2011).

3.4.2 The importance of face to face communication

In today's world, computer based communication is given a more central role. New technology, i.e. computers and the Internet has brought great opportunities when it comes to both storage of data and quick communication through intranets, emails and various software (Liker, 2004). A common belief is that groups acting in this virtual world are more effective than groups who meet face to face. However, researchers have found face to face groups being more efficient and less time consuming than groups using computer-mediated communication (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002). The efficiency could in some ways be explained by Becker-Beck's et al. (2005) stating that direct communication enables more detailed conversations, i.e. people receive direct feedback from their conversation partner which allow them to check whether they are being understood or not, and hence direct communication enables information to be more efficiently disseminated (Becker-Beck, Wintermantel, & Borg, 2005).

In accordance to Baltes' et al. (2002) finding's, Liker (2004), in his study of the world class car manufacturer Toyota, noticed that they resist the proceeding IT-centric trend. According to Liker (2004), Toyota believes that working in a virtual world "may take you away from where the real work is being performed". Not to say that Toyota completely avoids IT solutions, hence as stated above it

has brought great opportunities. However, simply using IT to cut costs may cause unintended consequences such as an increased amount of hidden problems that occur, a decrease of efficiency, and even worse, it may change or even damage the corporate culture. Therefore, Toyota rather strives towards adopting the approach that will provide the best opportunities of having visual control. The benefits identified when a visual approach is adopted are as followed; increased productivity, reduced numbers of defects and mistakes, help meeting deadlines, facilitated communication, improved safety, lower costs, and generally more control over the project environment is given (Liker, 2004). The benefit of improved communication could further be identified within Becker-Beck et al. (2005) investigation which indicates that face to face groups performed better and provided products with higher quality than computer-mediating groups did. Though, in contrast Liker (2004) and Baltes et al. (2002), Becker-Beck et.al (2005) did not find any differences between the modalities regarding group work and satisfaction among the group members.

A further fear of Toyota´s is that a virtual approach may damage the hands-on team work, hence a more visual approach, like the Obeya which Toyota adopts, not only fosters communication and information gathering and sharing, but also enables team integration. (Liker, 2004). The statement is strengthened by Baltes et al. (2002) who mean that teams operating in a computer based environment are not as satisfied as members of face to face groups.

3.4.3 The Obeya room

As stated above, a visual approach will enhance the face to face communication that enables information to be more efficiently disseminated (Becker-Beck, Wintermantel, & Borg, 2005). Obeya is a visual method in the form of a ”big room” used for the purpose of knowledge dissemination. In the Obeya room many visual management tools can be found, i.e. visual boards that improves communication and decision making between chief engineers and the functional managers. The board’s represents e.g. trend charts, schedules, problems and countermeasures and other information valuable for evaluating the status of the project across the functional units (Liker & Morgan, 2006).

Another example of a visual tool that can be used in the Obeya room is given by Bicheno (2004), who suggests that visual boards are useful when working with improvements. Improvement boards allow employees to easily point out and attach problems and suggestions for improvement on a visual board. To facilitate the execution of improvements, these problems and suggestions needs to be prioritized in a structured way on the board e.g. by using pareto charts (Bicheno, 2004). The problems and suggestions can then be monitored by displaying the stages in which the problems and suggestions currently are in i.e. suggested, investigated, being implemented, or solved. (Bicheno, 2004). In this way the organization can work towards continuous improvements and organizational learning.

Liker and Morgan (2006) suggests that daily meetings in the Obeya room should be conducted, since it provide a focus on integration of parts in the development process and thus provides opportunities for discussion and knowledge sharing between participants (Liker & Morgan, 2006). Regular meetings in the Obeya room may further speed the information gathering which allows knowledge to be shared between employees in an efficient and effective manner (Liker J. , 2004).

As stated, visual management allows for communication and knowledge sharing that could not have been achieved with electronical aids, since only one person uses that kind the information (Liker J. , 2004). Looking at a computer screen is typically done by one person in isolation, thus discussions and knowledge sharing aren´t developed. The benefit of gathering a range of boards in a room is hence that performance can be reviewed by anyone at any time. Thereby deviations from targets are immediately visible in the Obeya, thus improvement opportunities can be found (Liker J. , 2004).

3.4.4 Designing the tool to achieve world class operations

If visualization is to be used for transfer of knowledge in an effective manner, the boards are to be designed in a manner that fulfills the needs of the organization. Burkhard (2005) has stated four perspectives that need to be considered when designing those visual tools. The perspectives are based on four key questions;

1. *What´s the goal of using a visualization method?* I.e. its function. It could be to coordinate individuals in their communication process, give attention to subjects, motivate and activate participants, elaborate upon knowledge in teams, or create new insights about the work. (Burkhard, 2005).
2. *What type of knowledge needs to be visualized?* I.e. what type of knowledge that needs to be transferred in order to fulfill the visualization tool's function. Hence, know what information is needed in the tool, know how things are done, know why things occur, know where information can be found, and know who possesses the knowledge. (Burkhard, 2005).
3. *Who is being addressed?* I.e. the target group and its context, thus the recipients. It could be an individual, a team, an organization or a network. The recipients are affected by their cultural and educational background, and hence needs to be considered. (Burkhard, 2005).
4. *What is the best method to visualize this indicator?* I.e. which type of visualization aid that is most appropriate for presenting the information i.e. sketches, diagrams, maps, images, objects, interactive visualization and stories. Some presentations may be more suitable than others, when it comes to present different information. (Burkhard, 2005).

Having thought of these four aspects will increase the likelihood that the implementation of visualization tools will be successful.

4. EMPIRICAL FINDINGS

This chapter will provide the reader with the findings from the empirical study at Metso. The chapter is divided into three main categories, i.e. The matrix organization Metso Power Gothenburg AB and the processes used when executing activities, Routines for dissemination and embodiment of knowledge and Application of learning.

4.1 The matrix organization Metso Power Gothenburg AB

The following sub chapter will provide basic information about working procedures valuable to understand the situation that Metso employees are faced with, which will be presented later in the following sub chapters of the empirical findings.

Metso is organized as a matrix organization, where the main center of attention is to execute external customer projects in cross-functional teams. Besides the external customer projects, they are having internal improvement projects as well. However, a general opinion that has been identified during the empirical study is that these are not seen as equally important as the customer projects. The priority is motivated by the fact that customer projects are the ones generating revenue for the company. Though, the empirical study has shown that employees believe that internal improvement projects are given too little attention. The general comment is that; ”*external customer projects are given all attention. If we are to improve, internal improvement projects also need to be prioritized”*. Top management has stated that continuous improvement are embedded within the vision and objectives of the company, however it is unclear of whether the message has reached the whole organization and its employees. Hence, employees claim that there is a lack of resources allocated for improvements and that the heavy workload forces them to be reactive and to focus on the ongoing customer projects.

4.1.1 The functional units and the OnePower Process

As was stated above, Metso is organized as a matrix organization consisting of functional units, i.e. departments. The departments are further broken down into groups, with different responsibilities to enable some specialization within the unit. Employees within the groups are allocated to different projects, and employees often participate in several projects in parallel. To carry out their tasks, each functional unit and group have their own routines and methods for working. However, when tasks are to be executed, the standardized process of Metso’s is to be followed, i.e. the management system OnePower. OnePower represents standardized activities in the process of conducting a specific task, e.g. designing a pressure part. Hence, OnePower is not based on functional activities, and is rather process based, i.e. it states the flow of activities in a process.
Depending on whom you are talking to, the empirical study has shown that processes within OnePower are differently exploited. Statements such as *”OnePower process is unnatural to apply, hence I cannot work in accordance to that process*” have been expressed by one of the group members. And group mangers have stated that ”*the process in OnePower doesn´t contain everything. I would like to extend the base, so that it is easily applied by everyone, including new employees*”, and ”*OnePower is a great tool for gathering instructions, however, the process isn’t finished yet, and continuous updates are needed*”. To summarize, the shared view of OnePower indicates that the tool needs to be developed and exploited to a larger extent.

4.1.2 Projects and the Project Execution Model - PEM

Metso's Project Execution Model, PEM, is the stated structure which every project is to follow. PEM is a global tool that provides tollgates for projects execution, thus serve as a roadmap for projects. The tollgates are further reached by following the above presented OnePower process.
By the use of tollgates PEM also facilitates a close monitoring and control of how well projects are performing. Before moving on to the next phase, the project needs to pass checklists. The result of the monitoring is coded as green, yellow or red, which indicates the status of the project. Green indicates that the project are working in accordance with the plan, yellow is a warning that issues may turn into problems if not handled properly, and red indicates major problems, thus management attention is needed.

The PEM model further constitutes a feedback element, i.e. by reviewing the projects in the beginning of each phase, opportunities for internal and external improvements can be found. Internal feedback is feedback useful for the project, while external feedback is feedback that is directed to the functional units. Therefore, external feedback is gathered in a "PEM report" and addressed to key personnel in the organization who are responsible for the dissemination and implementation in the functional units.

There is one person responsible of PEM and its application, thus the empirical study has shown that everyone is not using PEM to its fullest extent. There are disagreements of whether PEM is useful or not, for detecting problem and sharing experiences that could be of significant value for projects. However, the responsible person of PEM, as well as top-management, claims that PEM is an excellent tool for experience transfer and detection of problems that is of a general character. A line manager has stated that '*PEM is a huge source for detecting system-wide problems. However, the PEM reports needs to be reviewed and emphasized to a greater extent. Only once I have received a report from PEM*'. A project leader has stated that "*PEM hasn´t been penetrated throughout the organization, hence the feedback system in PEM aren´t working, and generally PEM is not used as it is supposed to. People don´t know how nor why to use it*". He further claims that "*there needs to be a clarification of how to use the tool and who is responsible of it*". There seems to be an agreement that the model is good, however it is not applied properly. To summarize the study has indicated that PEM is not a well known and implemented tool among employees, thus some resistant can be found against the tool.

Project execution

As was stated earlier, projects are to be executed in cross-functional teams. However, the general opinion among top-management and line managers is that there is a culture favoring individual performance, not considering the next person in the chain, causing a lack of system-thinking. It has been stated that "*we do not work cross-functional enough, causing lack of system thinking*". A common symptom, which has been recognized throughout the whole organization, is that it is often delays in time-plan, and faults aren't detected early enough. To resolve the shortcomings and to facilitate a good cooperation and experience exchange, line managers has expressed that there is a need for a better communication between departments.

The individual focused culture can be recognized within the functional units as well. The study has shown that some groups would like to work more jointly in order to foster a natural communicative exchange. For example, one person expressed that; "*I am almost always working alone in projects,*

and hence I cannot share my ideas with anyone. It would have been nice to work in pairs, in order to learn from each other and exchange experiences and ideas". Another group however, is working very jointly and the manager of that group and stated that he was very pleased with how knowledge was disseminated within the group.

4.1.3 Initiation and processing of improvements at Metso

In order to reach continuous improvements, Metso has recently developed a new tool that will operate in accordance to Demming's PDCA-cycle. Metso's intention with the tool is to apply a standardized routine for how to deal with deviations and improvement opportunities. According to the initiators, this will serve as a good base for transfer of experiences and will hopefully result in a reinforced improvement work. The tool developed is a combination of a project based tool, Tasman, and an organizational improvement tool, Improve. As was stated, the merging tool was recently developed and is hence not yet in place.

Tasman was initially, and is still mainly, a communication tool for projects that gathers e.g. all email conversation that concerns the project. However, in order to get a more efficient and clarified way of dealing with deviations and change order requests, Tasman has been extended. From now, problems, mistakes and changes that occur in the project should be reported in Tasman as well. Project specific issues shall be adjusted immediately to ensure that project execution is not delayed. However, as can be seen in figure 6 issues are then handed over to Improve. In improve, improvement opportunities initiated both inside and outside of projects are identified and realized on a long term basis.

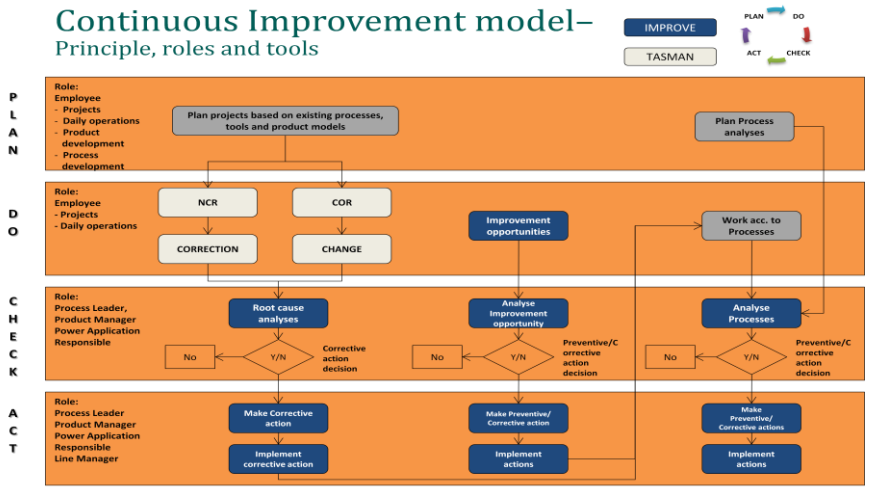

Figure 6: The Continuous Improvement model and the realtion between Tasman and Improve.

4.2 Routines for dissemination and embodiment of knowledge

In this section, findings from the empirical study that concerns the generation, dissemination and integration of knowledge will be presented. The chapter will then be ended with a brief description of relevant routines for application of learning's.

4.2.1 Closure of projects and knowledge generation

When it comes to closure of projects, a range of shortcomings has been identified. A majority of functional managers, group managers, and employees claim that projects are not always correctly finalized and people rush into the next project leaving no room for reflection and improvements. Hence "*I think it is of great importance to ensure that projects are properly finalized, that an opportunity is given to pay attention to available experiences and ensure that experiences gained through the project are shared at the end* ". The reason given is lack of long term thinking, and that there are not enough resources provided to have a proper closure of the project. And thus, "*there will always be a new project waiting to get started, at the mean time, valuable knowledge and* experiences might get lost".

After a project is finalized a project report, containing valuable lessons learned, is supposed to be written by the project leader. The project leader do not have the possibility to be everywhere in the project, hence the project leader's ability to write the lessons learned report is dependent on the project members ability and will to continuously share their experiences. Moreover, even though project leaders represented in the sample of investigation claim that they write project reports, the line manager of projects as well as employees at different levels and from different functional units mean that this is not always the case. Some employees, at group level, argue that they have never seen a project report and were not even aware of their existence. Group managers and functional unit managers, however, know that project reports are written in some cases. Though, the reports are seldom addressed to them and it is hence not possible to disseminate the experiences gathered to the employees. As stated by a line manager; "*group- and line managers do not get access to project reports. I suggest that each manager should gain access, thus it would enable me as a manager to recognize opportunities for improvements*". The line manager of projects is well aware of the shortcomings. He, however, is convinced that lesson learned documenting would be facilitated if there was a standardized and user-friendly template that clearly addressed the issues. Thereby, project leaders would most probably be more motivated to write the report, the receiver would know what to do with the content and hence, the result would most likely be much better than it is today.

In addition to the project report, a closure meeting which review the performance of the project and the project report is supposed to be accomplished. According to Metso employees, these are seldom executed. For example, one of the interviewees at group level that has been a Metso employee for five years has only been invited to three closure meetings during his/her employment.

Additional documentation

Except from the project report, information that might be valuable to others is documented in e.g. construction reports, internal project diaries and inspection reports. The construction report, written by the construction and completion department, henceforth C&C, responsible of building and putting

the boiler into service, is an internal document which embodies information from site. This information may be of great importance for the designers who constructs the product, but the information seldom reaches them.

The reason why construction reports are not accessible is that they are saved in a folder, representing the site concerned, on C&C's internal hard disk. Unfortunately, other departments do not have access to this hard disk. However, the construction report is also handed over to the project leader who, in turn, is supposed to put it in the lessons learned documentation. And hence, since project reports are not always written, knowledge will not get disseminated. C&C's reporting in form of deviation reports are of course also an important source of information. However, a majority of Metso employees argue that there are not enough deviation reports written by C&C, the effect is that failures occur over and over again. One employee states;"*As a designer you do not always get the opportunity to see the design during assembly. Since deviations are not reported, I do not have a clue if problems have occurred at site, thus I do not know what to improve*". C&C department, on the other hand, mean that the reason that they do not report deviations is that their feedback is never taken care of, and hence there is no meaning of reporting. Other explanations given are that there are often technical problems, i.e. no internet connection on site, but it is also a matter of prioritization, they simply cannot keep up with the tight schedule when the boiler is supposed to be put into service. Managers of C&C, among others, claim that an attitude change is needed, there is a vicious circle that has to be tackled, see figure 7. One great example of this attitude change that is required can be found at the engineering department where one designer has, on her own initiative, started to contact the montage engineer to get direct feedback on her work. This kind of behavior as actually proved to be really efficient;"*since I have started to contact them, they know that I am interested in their experiences. Nowadays we have close contact and share experiences*". Hence they have established a relationship based on mutual trust where they cooperate in order to reach success.

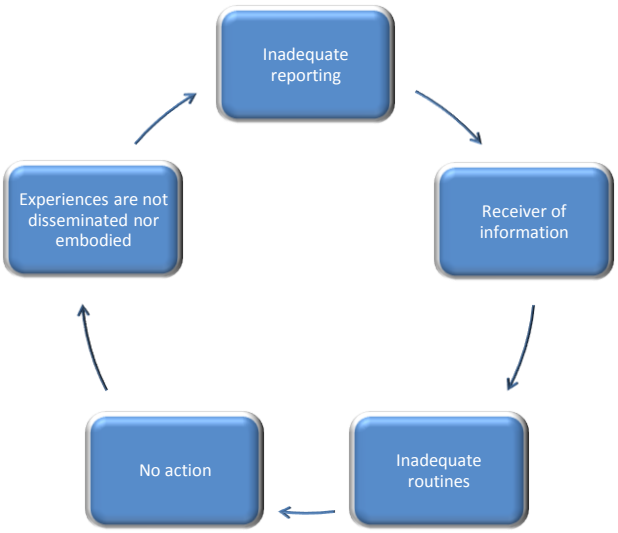

Figure 7: The vicious circle of insufficient reporting and inter-project learning.

Moreover, the internal project diary, mentioned above, is not a recognized way of documenting at Metso. Though, in one project recently executed, a diary was continuously written within a group.

According to people concerned, this was not only an excellent opportunity to reflect about their own achievements, thus when the project was finalized valuable information from this diary was handed over to the project leader who could thereby write a more comprehensive project report. Thus, as stated by one of the employees; ”*If you are to remember which issues you solved and which actions you been taking during project execution, you need to write it down right away, otherwise you will forget about it*”.

Inspection reports are another document generated at Metso, these are saved both internally, for upcoming inspections, but also handed over to the customer. Even though inspections are not included in the traditional cross functional service projects, they are external projects given by the inspection group within the service unit. Unlike the case of project lessons learned reports and construction reports, the inspection group has established a standardized template for writing the inspection report and pre-set routines for dealing with the outcome. Hence, ”*It must be easy to write reports and information provided needs to be short and easy interpreted, otherwise people don´t do it*”. The improved strategy has just started. However, the idea is to summarize each inspection report by appointing key-learning’s from the inspection. When the group meets they get to share their experiences gained, they present all key-learning’s from previous projects and evaluate the inspections performed. The outcome of this group meeting is a further evaluation of the key-learning’s that summarizes all the recent projects. These final key-learning’s are then addressed to the appropriate receiver in the organization.

The routine, that the inspection group has developed, where projects are summarized, is actually something that has been requested by a majority of Metso employees. According to the interviewees, neither PEM-gate reports nor project lessons learned reports are summarized. Interviewees believe that an evaluation of several reports at a time would enable Metso to detect patterns and trace recurring failures.

4.2.2 Computer based tools and archives

A general issue identified at Metso is their way of organizing data and reports. Interviewees confirm that there are too many different databases, that there is no structure within them and that new databases, programs and tools are released without sufficient introduction. The effect that has emerged is that people do not know where to put the information, and since there are no standardized structure nor directives for how to use the databases, people do their best to organize the information which means that information gets organized in completely different ways. Due to the above mentioned shortcomings, people has a hard time finding the information needed, and using databases would require a lot of resources that they for now do not posses, hence it is easier to ”reinvent the wheel”.

Archiving of relevant documents, reports and instructions

When a project is finalized all valuable information and documentation, that may be relevant to future projects, is transferred from the Tasman to the database ProArc. ProArc also embed archives where groups may save their documentation. As was mentioned above, though, ProArc has been criticized for being too complex. During interviews it has been emphasized that there is no common way of organizing your internal documentation. Pressure parts, plant engineering and special products archives information in accordance to the product it belongs to, i.e. product home folders. Engineering Support and Inspection archives their inspection reports internally in accordance to the

machines id-number, C&C has different folder for each site and sales coordinates their documentation to the relevant boiler. As was mentioned above, C&C archives their information on their own database and this is also the case for Engineering Support and Inspection, which makes the information unreachable for other departments and groups. Though, a significant difference is that Engineering Support and Inspection address issues to the group responsible. To make the search for information even more complicated, interviewees' claim that it is not possible to search through multiple folders within ProArc, hence there is no communication between the different bases that the groups utilizes.

The efficiency of the approach applied, where information is archived in product homes, has been widely debated. Product homes have been used for about 10-15 years. While product homes that belong to plant engineering and special products are updated on a regular basis, the manager of pressure parts argues that the quality of their product homes varies. Some product homes are well structured and up to date while others are not updated as often. However, the manager of pressure parts puts a great value on continuous improvements and internal project, meaning that they should be equally prioritized as customer projects, hence, "*if we do not work with internal improvements we will not be successful in the long term*". Therefore, the manager allocates resources and encourages people within the pressure parts group to work with their product homes. An illustrative example of how she pays attention to improvement work is the statement; "*at each formal meeting, time is devoted to the product homes, thereby the product home owner is able to share information about changes and corrections that have been realized within the product homes, and in addition feedback from ongoing projects are given to product home owners"*. The approach is applied due to the manager's believe that an interest among employees will arouse when people work with their product homes.

Even though, pressure parts employees agree with their manager's statement that they are encouraged to work with their product homes. They argue that still there are not enough resources provided. Their conception is that the equation does not hold, even though some internal projects may be as important as customer order projects, there are too many external projects in parallel. Hence, there is no time to devote.

An additional shortcoming, identified by pressure parts employees, is that there is no standardized way of working with the product homes. The absence of directives is revealed through the diversity of content in the product homes and in the diverse structure of the different folders. From this perspective, a great difference between the product homes belonging to special products and the ones that belong to pressure parts can be identified. They are not quite there yet, but the special products group strives towards a standardized tree structure that will organize their archives in a common way. This is something that is sought also at the pressure part department. According to pressure parts employees, some employees within the group do not know how nor why product homes should be used in their every day work, hence they do not understand the potential of the database. Another factor that may influence the incentive to work with the product home is the fact that designers, there among the interviewees, do not utilize the product homes when they design products. People simply do not see the purpose of keeping them up to date. The situation at special products differs. A possible explanation given by their manager is that they are owners of the products to which they are responsible.

However, some employees at pressure parts recognize the value of the archives, claiming that it is of great importance that new information gets in to the system. To ensure that you do not forget what to put in, one of the interviewees suggests that; ”*it would have been good if we could create some sort of queue for updates that are to be done in the design manuals, like a temporary folder that could be used, e.g. a binder that constitutes the ”on hold*””. Another interviewee would rather like to scrap the product homes and start archiving information in accordance to the site or boiler that is concerned. He argues that ”*it would be beneficial since it would be much easier to find historical documents that may be relevant”*. However, a pre-requisite is that it is possible to obtain experience related to the same area. The argument is strengthened by one of the group manager at sales who mean that also the technology department, owners of products that the product homes represent, should consider organizing their information in accordance to the boiler.

A mutual shortcoming of the different departments’ and groups’ databases is that there is no room for experiences that do not concern instructions and drawings, i.e. ”tips and tricks”. At pressure parts ”tips and tricks” are disseminated at the group meetings, however, they are not embodied in documents and reports. The approach is criticized by one of the employees saying; ”*Even though tips and tricks are shared at meetings, there is no natural base where you can store them. So, you simply have to hope that you remember it until you need to practice it*”. The need of a natural base for ”tips and tricks”, is even more obvious at C&C, since the groups do not gather as often as other departments, and hence ”tips and tricks” are seldom disseminated. At sales, though, there is a system where experiences may get archived, the problem is that it is not fully utilized. However, there is no place where experiences and information that concern the customer relationship may get logged.

4.2.3 Sharing of experiences between people

The most common way of storing knowledge at Metso is within people. Metso has many employees that have been working there for decades and thus posses a valuable body of knowledge and great experiences. These employees are to leave the organization within the nearest future, and hence this is considered as a weak link within Metso. However, of course there are great experiences stored within younger coworkers as well. It has, for example, been pointed out by several of the employees, that chief engineers are the ones that everyone asks for advice, if questions or hesitations occur. Only having a few persons with such an expertise is an untenable situation and how to solve this problem has been an unsolved standing item for everyone at Metso. Since a lot of information is stored within people, there is a need for coordination of knowledge. Today, group managers serve as accommodators that advice and direct people to the right competencies. However, everyone seems to have the same opinion; ”*knowledge and experiences needs to be captured and stored in a more persistent way*”.

Informal procedures for sharing of experiences

Knowledge and experiences are also shared spontaneously between employees when bumping into each other in the corridor. However, informal meetings, are considered to be a good way of disseminating knowledge among employees at Metso. One of the line manager even expressed that informal meetings are just as important as formal meetings, and he states that ”*I encourage my group members to visit responsible person and ask for information rather than sending e-mails, since it promotes a better dialog*”. This view is shared by a group member who states that ”*in order to get*

a system perspective, you need to search for the right information and directly ask responsible person for information and feedback". They believe that informal meetings and continuous dialog is the key to success.

Surprisingly, not much experience exchange occurs at coffee breaks. This can be explained by a statement from one of the employees; "*we need to have our coffee breaks and talk about what has happened during weekends and evenings, in order to perform the rest of the time*". This view is shared throughout the whole organization.

Formal procedures for sharing of experiences

What has been noticed as a general shortcoming is that there seems to be a lack of standardized routines for how formal meetings should be accomplished. For example; everyone in the functional units, including line managers, think it is important to focus on improvements and knowledge sharing. Hence, they have expressed their desire to have continuous improvement as a standardized item on the agenda.

Meetings are utilized for delegating tasks and corrective actions that are to be done within the group or unit. It could, for example, be corrections of the OnePower process, or changes of instructions in the product homes, see example from the pressure parts group under *4.2.2 Computer based tools and archives.* After meetings, protocols are most often written. These contain information of what has been discussed during the meeting. During interviews it has been identified that it is unclear how the meeting protocols are conducted and disseminated within the functional units and groups. Often they are written and stored in such way that employees that couldn´t participate can read them afterwards, which is appreciated. However, people has expressed their disappointment with the lack of routines for monitoring of the preceding meeting protocol, hence, decisions and actions are not always evaluated at the next meetings.

In general monitoring of action taken, or rather the lack of decent monitoring, has further been a recurring item of discussion during the interviews. Depending on which manager that is responsible, actions are differently monitored. One group manager states that "*when I delegate tasks, I expect them to be done without monitoring*". Another group manager states that "*I do not monitor very much at all*". Although, a line manager states that "*I use an action list to monitor delegated tasks. It is very important to monitor if anything are to be done. It clarifies that I am paying attention to the result*". The line manger further states that "*I do not personally monitor, I trust group mangers when they states that actions has been taken*". Hence, monitoring is a contentious question at Metso. During interviews, suggestions for how to utilize monitoring on meetings have been pointed out. It has been stated by both line managers and group managers that preferably a few actions should be brought up at meetings in an action list that could be delegated and further monitored at the next meeting. Another suggestion, that has been expressed, is that every individual initiating a corrective action should monitor its progress themselves. Otherwise there might be forgotten, and hence no improvements are reached.

The frequency of the meetings varies depending on which functional units and group that is asked.

- Project leaders do not have any meetings within their function at all, one of the project leaders in the sample see this as a great shortcoming within their unit. Earlier though, brainstorming sessions were held between project leaders to exchange experiences and help each other to solve problems currently existing. The sessions were very appreciated among project leaders, and, according to the project leader, it would increase experience exchange.
- Due to the fact that members of C&C are spread over the world they have a hard time to gather everyone at the same time, and hence C&C has a very low frequency of meetings. Approximately, meetings are held once a year at C&C, although everyone still cannot participate. A group manager at C&C has stated that "*not enough meetings are held to capture individual experiences gained at site*". How to solve this is considered difficult at Metso. There is a suggestion for using video conferencing, but there seems to be some disagreements about its applicability within the unit. As someone stated "*it would still be hard to gather everyone due to time differences"*.
- Engineering and their groups are having meetings very frequently, weekly or every second week. How they are utilized depends on the group leader, thus everyone have their one agenda. One of the groups, Plant Engineering, also has had brainstorming sessions for making use of experiences captured within individuals. Plant engineering has also operated presentations where employees present their findings from projects that might be applicable for others within the functional unit. The group manager seemed very pleased with the result of those sessions. However, this is not a general approach among the groups.

4.3 Application of learning

In Application of learning a short description of relevant procedures, and shortcomings, in the initial phase of the project will be presented. Even though application of learning is not the focus of the case study it will be briefly touched upon since application of learning is substantial for the intra-project learning process which further constitutes the base for inter-project learning.

It has been recognized that start-up meetings are held, when starting new projects. However there are no routines for going through previous projects that possesses valuable information, applicable for the up-coming project. An example of this is expressed by a group member who states that "*we are having start-up meetings, however we are not going back and check on past experiences, thus the same problems are repeated project after project*". He further suggests that "*reports from previous projects should be overviewed in the start-up phase*".

5. BENCHMARKING AT ASTRA ZENECA AB

This section will bring a description of the procedures adopted at Astra Zeneca AB in order foster inter-project learning. It will start out with a short introduction of the sample represented and the project approach that they have adopted. Later on their routines for closure of projects will be described, the section will then be complete with a description of their methods for dissemination and embodiment of knowledge throughout the organization.

5.1 The organization

Astra Zeneca AB, henceforth Astra, is a biopharmaceutical company that provides medicine to a global market. The group participating at the workshop, though, belonged to a supporting function, i.e. R&D Information that develops it-solutions. The group represented consisted of people with different competencies of expertise and, depending on their competencies, they belonged to different units within R&D Information. Thus, the R&D Information at Astra is organized as a matrix organization. However, employees are always occupied in projects, and seldom spend time in their functional units. The projects are executed in cross-functional teams and Astra claims that they try to have the same people in similar projects. Hence, the necessary introducing phase, i.e. the ”honey moon”, which is necessary in all project constellations, gets more efficient since people are used to work together. The approach further minimizes the risk of confusions and trouble in the beginning caused by lack of understanding and knowledge, but also shortens the development cycle significantly, since knowledge is already established.

To facilitate a learning organization that adapts to environmental changes, Astra has adapted the concept of Lean in combination with an agile approach. An Agile approach allows the work in projects to be broken down into small packages, so called ”sprints”, thus small loops of developments can be done and tested before moving on to the next sequence of work. A benefit recognized with the iterative way of working which the Agile approach entails enables Astra to continuously develop and make their standardized project process more efficient. The Lean concept has been adapted to facilitate a great deal of effort in the beginning of the development process in order to do it right the first time. They have also implemented a ”Lean room” from the Lean philosophy, where all projects are easily overviewed and visualized. According to Astra the Lean room allows information to be disseminated in a comprehensive and easily understood manner. The combination of has proven to be advantageous since the firm believe that an Agile approach provides a system thinking that is important in order to reach the objectives and adapt to changing circumstances, while the Lean concept makes the process stable thus avoid large changes late in the chain, it also makes the work visible and improves everyone’s involvement.

5.2 The Lean room

The ”Lean room” is a tool for visualizing projects and its status in comprehensive way. It’s a room that permits information and experiences to be disseminated and shared between project members, as well as between functional members. Having a ”Lean room” devoted for meetings makes meetings focused, and discussions are often spontaneously developed and new ideas and experienced are shared around a problem or a project. It creates an environment of ”openness” and a willingness to share knowledge and experiences.

In the lean room there are boards that present and visualize the agile project process, as well as responsibilities and activities. The project boards further states which activities that are waiting to be done, in progress, to be tested, are tested or which activities that are completed. It also states current problems in projects that need to be resolved.

5.3 Closure of projects

What symbolizes Astra's experience and knowledge transfer between projects is their best in class performance in lessons learned documentation. Astra has a well developed strategy and routine for lessons learned documentation that includes continuous lesson learned activities after each sprint in their Agile project process as well as standardized routines for writing their final project report called OFI, i.e. opportunities for improvements. Beyond lessons learned writings, each project is finalized with a closure meeting which is dedicated to knowledge integration and dissemination. Each closure meeting is given approximately half a day. At this occasion the whole department participates and the project group present key learning's from the project and the OFI report.

The continuous lessons learned activities during projects comes in two variants. The first one is the evaluation that is performed after each sprint. This retrospective activity is a pre-set routine which generates opportunities for improvements in the agile project process which may be utilized within the upcoming sprint. The second activity of continuous lessons learned is, in some cases, realized by the project manager. The project manager continuously document learning's on his/her own initiative in order to capture the learning's until the final project report is written in the end of the project. However, this lessons learned documentation is only dedicated to the project manager him-/herself and is hence not disseminated to the rest of the organization, on the other hand it is used in the final report and hence disseminated by then.

The final project report, OFI, allow project experiences to be embodied within a report. The group represented at the workshop is pleased with their standardized routines for documenting learning's. All project members are involved in the generation and the OFI report has at some occasions been complemented by a workshop. There is a standardized template to be used and the report is always written. However, they do recognize a major insufficiency, the report is archived but it is not available to everyone after the project is finalized, and hence the knowledge is not disseminated outside the project. The group further state that Astra do not take care of and utilize the experiences generated within reports, the reason is that there are no routines for how to disseminate and embody knowledge. Because of inadequate routines for anchoring knowledge, the workshop members have a hard time identifying the flow of information. And, even though both lessons learned are written and disseminated at closure meetings, the employees would appreciate more pre-set routines for anchoring experiences gained.

Astra employees claim that they would like to store and structure the OFI reports and projects in a computer system, like SharePoint or something “Wikipedia-inspired”. They further would appreciate if the report was complemented with appointed key learning’s that could be addressed to the responsible discipline. By summarizing key learning’s Astra employees believe that information would be easier accessible within the report. Employees would further like OFI reports to be summarized in order to visualize systematical errors and patterns, the process would most likely be facilitated if the key learning’s were compiled. In order to ensure that learning’s are disseminated and routines are followed they would also like the activities to be monitored. This could preferentially be achieved if additional bullets, e.g. H*as key learning’s been appointed? Is the knowledge disseminated? Has it been presented?,* were added to the checklist.

5.4 Knowledge integration at Astra

5.4.1 Formal meetings

As mentioned above, ”Obeya” offers good opportunities for having focused and dedicated formal meetings for experience exchange and knowledge dissemination. What is further recognized is that Astra has Continuous Improvements as a standard item on the agenda, which emphasizes the importance of having a long term thinking and always trying to improve the performance.

The Lean room is utilized both within the projects, but also by the functional units in order to keep individuals informed and provide opportunities for experiences exchange within the department. Astra also have regular ”networking presentations” where experienced project leaders or other guests are invited to presents and share their experiences around a topic.

In order to capture project experiences during projects, Astra utilized the regular project status meetings between project leaders. At the meeting each project leader present their project to the other project leader, the effect is that brainstorming and experience sharing is triggered which may facilitate the project execution. The idea of using presentations as mentioned above can be developed and used in the beginning of a project. Hence, to avoid searching for information in the beginning of a project, that could be somewhat time-consuming, Astra suggests that there should be startup meetings at each project. Instead of searching for the information, ”guests” e.g. old project leaders, can be invited to present experiences gained from previous projects that may be applicable in the up-coming ones. It is further suggested that old lessons learned should be overviewed at those meetings, which is not the case of today at Astra.

5.4.2 Informal meetings

Since Astra are organized in quite small groups, communication and knowledge dissemination is quite efficient. At the moment a lot of experiences are shared informal and quite ad hoc, around the coffee table or in the corridors when bumping into someone. It is stated that there is a good communication between individuals and an openness and willingness to share experiences, however sometimes it is more of a fortune if you bump into the right person. To further disseminate knowledge and increase individual capabilities and broadening their skills, Astra has, in some functions, adopted an approach where they have utilized job-rotation.

People also searches for the right information and the right people in order to gain knowledge and experiences from previously performed projects. To facilitate this search for information, Astra suggests that there should be some kind of ”knowledge network” in place, where you can find the right people and competencies. In the ”knowledge network” people have to state their interest and knowledge area. Letting people fill in their profile themselves will improve the likelihood that they are committed to the subject, and hence have the ability to help others.

5.4.3 Databases

To further improve knowledge sharing Astra has developed a community, a Wiki on the intranet that is supposed to store knowledge. However, it is hard to find right information, thus the site is not updated regularly. To improve the tool, Astra are currently working on developing an engagement network, where people are dedicated to be responsible for a specific area within the community.

However, a general problem recognized at Astra is that systems aren´t long lasting. Hence experiences get lost when new systems are introduced and people have a hard time figuring out where information is supposed to be stored. As a consequence, they suffer from having too many different sources of information, hence it is hard to search for relevant information.

6. BENCHMARKING AT RUAG SPACE AB

Ruag Space AB, henceforth Ruag, is a company developing and producing products for space applications. Ruag has adopted a structured way of working with continuous improvements and transfer of knowledge which will be presented in this section. The text will start out with a short presentation of the organization and necessary pre-requisites for understanding their way of working with continuous improvement and experience transfer between projects which will be described in the rest of the section.

6.1 The organization

Ruag is organized in a traditional matrix organization, where their main development projects are customer financed and influenced, thus customer projects are highly prioritized compared to internal improvement projects. Project leaders are building their teams based on individuals from different functional units. Hence, line managers are responsible of allocating resources to the projects. The organization is broken down into division, department and further into sections. Individuals within each section have somewhat different competencies, and hence they are allocated to different types of projects. Further, even though the organizations intention is that individuals should participate in one project at the time, they may be allocated to more than one project in parallel.
Ruag has adopted a ”Lean approach” towards continuous improvement and experience transfer between projects. Which can be seen in their use of improvement boards as well as visual planning, both will be described further down.

6.2 Generation, dissemination and embodiment of knowledge

6.2.1 The project process and transfer of experience

Ruag are running their projects in accordance with a local project process, thus their process is adaptable and flexible. Their project process is reviewed and continuously updated every quartile, in order to keep it accurate and usable for the employees. The projects consists of three phases; a start-up phase, an execution-phase, and a closure-phase.

To capture earlier experiences from previous projects and apply learning’s in the up-coming project, Ruag has adopted a standardized start-up template with a check list that ensures that old experiences have been overviewed and utilized. Their working procedure is to identify projects that are of interest to the up-coming project, and hence overview lessons learned from those specific projects. This is a well implemented procedure that is used by everyone at Ruag.

Traditionally, lessons learned reports was written at the closure of projects at Ruag. However, one has come to realize that it is not an efficient way of working. Today Ruag has changed their procedure, Ruag believes that improvements and experiences should be captured continuously during projects, and not only as a lessons learned document at the end. They argue that improvement opportunities and experiences found in the beginning of projects are lost if they aren’t continuously gathered. For the purpose of gathering continuous lessons learned, ”blue sticky-notes” are utilized. Suggestions at these may be initiated by anyone at Ruag. Moreover, to facilitate the

reporting procedure, ”blue sticky-notes” are in a standardized format. The sticky-note should contain ideas and suggestions for improvements. These notes are put on a sectional improvement board, the process of integrating them will be described further down in subchapter; *Continuous improvements and knowledge integration - Improvement Boards at Ruag.*

In the closure phase, continuously generated lessons learned are gathered into a final lessons learned list. To ensure that this final lesson learned is published and accessible for everyone, another checklist is used at the final tollgate. This is also a well implemented routine that, according to the interviewee, everyone at Ruag utilizes.

6.2.2 Visual Planning at Ruag

At Ruag Visual Planning, VP, is used both within projects and at a sectional level. VP is mostly used for planning, e.g. to visualize allocation and deliverables. However, VP is also of great importance of knowledge dissemination, hence VP serves as a forum that triggers communication and experience sharing.

VP meetings are realized every morning. Meetings are short and efficient, maximum 15 minutes are dedicated, and hence it is important that each member of the meeting is prepared by putting their current status on the board prior to the meeting.

6.2.3 Continuous improvements and knowledge integration - Improvement Boards at Ruag

At each section improvement boards are placed, an example is given in figure 8A. Improvement boards are used by the members of the section as a tool to achieve continuous improvements. The group gathers at weekly meetings that are driven by a person, normally not the section manager, appointed responsible of the improvement board. In addition, the department for operations improvements serves as a guide of the improvement work but also monitors the actions generated. Operations improvement is also responsible of the synchronization of boards, meaning that they are responsible of addressing suggestions to the appropriate sections if there are any hesitations.

The board is designed to suit the section concerned but some standard categories are developed, these are; inbox, waiting-list, prioritized and accomplishments. The inbox represents ideas and suggestions generated internally within the section alternatively improvement suggestions initiated by the continuous lessons learned generation, described above. The suggestions are defined and put on the board. In order to prioritize between the ideas and to evaluate the value of the suggestion, a matrix called pick chart is used, see figure 8B. When suggestions are prioritized they are put in the ”under consideration” category forming a list of actions to be implemented. Actions are delegated and a person responsible of the realization is appointed. When actions are realized they are put as accomplishments.

According to the interviewee, the approach is successful since it triggers continuous improvements.

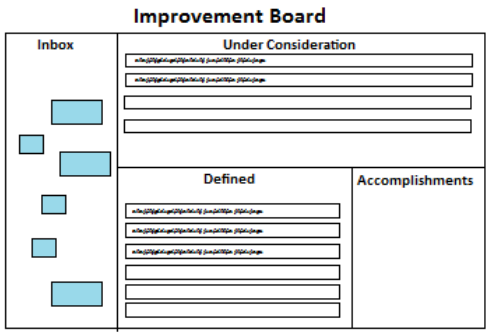

Figure 8A: An example of how the improvement board may be designed.

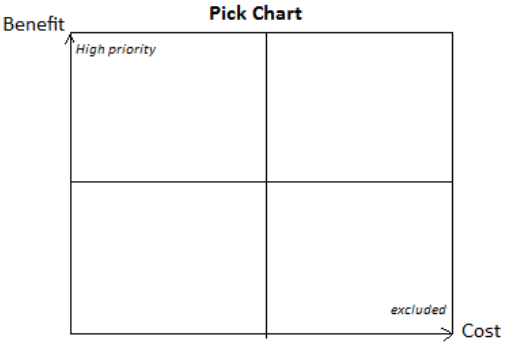

Figure 8B: The Pick Chart which is utilized for prioritizations.

As he put it, ”*people are eager to get their action on the accomplishment list and hence, these days there are not that many suggestions waiting to be taken under consideration*”. The interviewee further argues that the board meetings provoke communication that benefits experience exchange.

At the project department, though, the improvement board is software based, however the inbox for suggestions of improvements is still visual. The interviewee means that even though it is not as available as the common visible improvement board, it is still working fine. Every employee has access to the virtual board and it is monitored once a week at the department meetings.

6.2.4 Dissemination and Embodiment of Knowledge within Databases

Ruag has developed a Wikipedia inspired database, referred to as ”besserwisser”, which is used as an open source for experiences. This base is usable for everyone at Ruag in order to store and disseminate knowledge that might be applicable for others. However, it has just started and is under construction. The interviewee believes that responses have been very positive and that there are many individuals that are utilizing the source for experience exchange.

Each department’s standardized working process and their instructions are, on the other hand, stored and updated in the management system. This process is, similarly to the project process, continuously reviewed quarterly at an organizational level. Thereby Ruag ensures that routines and procedures are up to date and that the process is efficient.

7. ANALYSIS

Through a thorough evaluation and comparison between the empirical study and relevant theoretical findings, the analysis aims at simultaneously answering the research questions that was stated in the introducing chapter, i.e.; "Why is inter-project learning and knowledge integration an issue in today's organizations?" and "How could a method that facilitates inter-project learning and enables knowledge integration and continuous improvements be designed?". Therefore the structure of this chapter differs from previous chapters and is rather divided into issues affecting inter-project learning.

7.1 Organizational obstacles towards knowledge integration

This section will describe the organizational pre-requisites that may serve as obstacles towards knowledge integration. The chapter will start out with elaborating upon the complicated priority of short- vs. long-term gains, and its implications for knowledge dissemination. Secondly, it will explore how system thinking or rather the lack of system thinking, affects the knowledge sharing in the organization and how it can be improved.

7.1.1 The balance between internal- and external projects

In literature it has been recognized that projects are hunted by the same recurring problems year after year, and hence lessons are not learned (Biggs, 2003). According to Bergman and Klefsjö (2003), organizations need to create a learning organization if continuous improvement is to become a natural feature of an organization. Hence, managing the process of knowledge creation, dissemination and application is the basis for creating and continuously improving organizational capabilities (Bartezzaghi, Corso, & Verganti, 1997). The challenge of constantly improving the organization has also been recognized at Metso, where the process of knowledge transfer between projects appears to be insufficient and mistakes are sometimes repeated project after project.

The difficulty with creating a learning organization, focusing on continuous improvement, can be related to the fact that there is a balance between urgency for immediate result and to create reusable knowledge in upcoming projects (Bartezzaghi, Corso, & Verganti, 1997). Hence, there is a trade-off between short and long term gains that needs to be considered. This difficulty is also acknowledged at Metso, where external customer projects are favored on the behalf of internal improvement projects, since they are generating revenue to the company. Hence, people are constantly hurrying into new projects, and no room is left for internal improvements. This implies a short-term thinking, where improvements are insufficiently prioritized. Bartezzaghi et al. (1997) argue that inter-project learning should be considered as an organizational objective to guarantee that the long-term perspective is not lost. This has also been recognized by the employees, who have expressed a desire to give internal improvement projects a higher priority, in order to achieve long-term gains i.e. "*if we do not work with internal improvements we will not be successful in the long term*". Hence, they have stated that there is a lack of resources allocated for improvements forcing them to be reactive, focusing on customer projects, rather than having long-term thinking.

However, top management has stated that continuous improvement is embedded within the vision and objectives of the company. Arguably there is a divergence, within the company, of whether continuous improvements are given enough attention. Theory has acknowledge the importance of having a clear vision for improvements and an aligned business- and learning process, hence viewing business- and learning process as a separate entities, makes people less eager to complete their learning process e.g. producing lessons learned (Chawla & Renesch, 1995; Kotnour, Organizational Learning Practices in the Project Management Environment, 2000). Bartezzaghi et al. (1997) further states that the lack of a strategic vision for improvement is a commonly faced barrier towards inter-project learning in organizations of today. Since observation at Metso has shown that projects aren´t getting proper closures and that lesson learned aren´t always disseminated, it indicates that Metso are facing this barrier towards inter-project learning. Accordingly, there is a lack of clear vision for improvements in the organization. Hence, even though top management states that continuous improvement is embedded in the objectives of the company, it is not visible enough to the organization and its employees. Consequently there is a need for making continuous improvement visible on a daily basis, if the organization is to view learning as a matter of consequence.

Making continuous improvement visible could be put in correlation to the knowledge-oriented culture where executives support and credit learning, where there is a positive attitude towards knowledge sharing and an open climate encouraging experience exchange and learning is established (Davenport & Prusak, 1998). At Metso, the journey towards a knowledge-oriented culture has started. The empirical findings at Metso have shown that not enough time is spent on continuous improvement, however they wishes to increase the amount. The question is how to make continuous improvement and organizational learning embedded in the daily work at Metso. By elaborating upon what organizational learning refers to;”*the principles, mechanisms and activities that enable the organization to create, acquire, and transfer knowledge to continuously improve the organization”* the question can be addressed (Shani, Chandler, Coget, & Lau, 2009). Top management must make the continuous improvement work visible throughout the whole organization by the use of right principles, mechanisms and activities. An approach that has been widely adopted towards information and knowledge sharing in organization today is the ”lean approach”, which constitutes tools and techniques that facilitates those principles, mechanisms and activities (Liker & Morgan, 2006). Especially visualization has proven to facilitate continuous improvement and organizational learning, by the use of improvement boards (Bicheno, 2004). The approach has also been adopted by the two benchmarking companies Astra and Ruag, who states that visualization, e.g. lean rooms or visual improvement boards, allows information to be easily disseminated. The result of using visualization at Ruag and Astra has been excellent, and internal improvements are given a higher priority than before. Ruag is faced with the same problem as Metso i.e. customer projects are highly prioritized compared to internal improvement projects. However, by using visualization boards for improvement, the employees nowadays are aware of how important improvement work is and thus are eager to get their action on the ”accomplishment list”. A decline in improvement suggestions has been acknowledged, due to the fact that the process is constantly improved and actions are taken. Hence the organization has learned from their mistakes. Similarly, Astra states that nowadays continuous improvement is a standard item on the agenda, which emphasizes the importance of having a long term thinking and always trying to improve the performance. They imply that visualization triggers communication and experience exchange and thus has great potential for contributing to the creation of a learning organization. Having visual boards for improvement work

makes continuous improvement highly visible throughout the whole organization. It will increase coworker's awareness of how important continuous improvement is, and that it is acknowledged and credited by top management. Thus internal improvement will get a higher priority.

To summarize, visualization has the potential to increase the priority of internal improvement project, by facilitating the right principles, mechanisms and activities that contributes to organizational learning. Visualization makes improvement work visible throughout the whole organization, thus continuous improvement will no longer only be embedded in the vision and objectives of the firm. Instead the learning process will be aligned with the business process, and thus be visible on a daily basis. As a result, a knowledge-oriented culture may emerge.

7.1.2 The importance of system thinking

Theory has emphasized the importance of effective coordination and joint problem solving when working in matrix organizations, since there are task interdependencies between units, causing uncertainty of work task (Tushman & Nadler, 1978). As stated by Clark and Wheelwright (1993), there are structural elements influencing nature of interactions across functions and the intensity of completeness of communication, which may require usage of methods and tools that facilitates the cooperation. Similarly Tushman and Nadler (1978) states that there is a need for right information processing capabilities, in order to handle the uncertainty of work task. If the cooperation and information processing capabilities are well managed, cross-functional integration implies better conditions for system thinking (Wheelwright & Clark, 1992). However, there seems to be a lack of system thinking at Metso. According to the empirical findings, there is a lack of cooperation between departments, hence it has been stated;"*we do not work cross-functional enough, causing lack of system thinking*". Projects are delayed because of individuals who do not consider the next person in chain, thus an individual culture has established. Especially in big projects, individuals find it hard to see the whole chain of activities, causing lack of cooperation and communication between employees. The individual culture has also been recognized at the functional units, where it has been stated that there is a need for working more jointly in order to exchange ideas and knowledge. Put in relation to theory, there is a need for a better communication between individuals and departments. Individuals' needs to be aware of what others are doing and who are the next person in the chain, if they are to exchange knowledge and learn from each other. Therefore there is a need for an effective coordination and a joint problem solving to overcome the lack of system thinking, and work towards knowledge sharing and integration.

In addition to their insufficient cross-functional integration, cooperation and communication, the absence of system thinking can be identified within Metso's inadequate routines for finalizing projects, for capturing experiences, and in their computer aided approach towards continuous improvements. The lack of communication, closure of projects and storage of information will be elaborated upon in the subsequent chapters. Though, this chapter will elaborate upon usage of computer-mediated models and tools for their working procedures in projects and its effect on cross-functional team integration and system thinking.

Initially, as empirical findings indicate, systems, models and tools, e.g. PEM, OnePower as well as Improve and Tasman has not been properly introduced within the organization. Since Metso has adopted Demming´s approach towards continuous improvements, management's way of introducing new systems can be questioned. Demming's approach states that all changes should be based on fact

(Alänge, 1994) and further, introduction of new systems must be preceded by an examination of the corporate culture within which it will operate (Biggs, 2003). Management's way of implementing new tools and systems in order to cut costs thus indicates that they do not understand the implications that it may bring to the whole organization.

Both PEM and OnePower are used as computer aided elements, stating activities that are to be done within projects. Since they are providing the flow of activities, they have great potential to provide system thinking to the organization and its employees. The consequences of only relying on computer-mediated tools are immediately acknowledged at Metso. Findings such as;"*OnePower is unnatural to apply*", and "*PEM aren´t used as supposed to, people don´t know how nor why to use it"* strengthen the statement of computer aided approaches as unsatisfactory. The conclusion is that if OnePower and PEM are not utilized to its fullest extent, it may affect employees understanding for the whole chain of activities. Hence, applying computer aided elements does not encourage face to face communication and consequently do not foster system thinking among employees (Becker-Beck, Wintermantel, & Borg, 2005). As theory has shown, IT solutions has brought great opportunities, however simply using IT may cause unplanned consequences, such as hidden problems and a damaged corporate culture (Liker J. , 2004). Hence a knowledge-oriented culture may not evolve. To avoid this phenomenon, causing lack of system thinking, there is a need for making Metso's working procedures more visualized. Not only relaying on computer-mediated environments will induce better team-integration, thus better system thinking.

As mentioned, a virtual approach may damage the hands-on team work. Instead theory suggests a more visual approach, like the Obeya, not only fosters communication and information gathering and sharing, but also enables team integration (Liker, 2004). The statement is strengthened by Baltes et al. (2002) who mean that teams operating in a computer based environment are not as satisfied as members of face to face groups. Liker and Morgan (2006) suggests that daily meetings in the Obeya room should be conducted, since it provide a focus on integration of parts in the development process and thus provides opportunities for discussion and knowledge sharing between participants (Liker & Morgan, 2006). The benefits of having visual aids as complement to IT solutions for visualizing activities and deliverables, has also been acknowledged by Astra and Ruag. Astra imply that having boards in a room stating which activities that are waiting to be done, in progress, to be tested, are tested or which activities that are completed, facilitates a close control over projects. Anyone can easily overview and monitor its progress, and hence keep employees up to date. The benefit is also recognized within literature stating that a range of boards in a room allows for performance to be reviewed by anyone at any time (Liker J. , 2004). Astra claims that a lean approach i.e. visualization makes their process stable, thus late changes can be avoided. It increases everyone's involvement, which indicates an increased joint problem solving and coordination resulting in better system thinking. Ruag similarly explains that visualization is a great tool for visualizing allocation and deliverables, and serves as a forum that triggers communication and experience exchange. Thus better involvement can be achieved.

7.2 The problem of making knowledge explicit and accessible

This section will describe the problem of how to make knowledge explicit and accessible within the organization. The chapter will start out by describing how projects may benefit from proper closures. Further the importance of detecting recurrent problems will be addressed and how knowledge can be made accessible by the use of structured computer aided systems and databases. At last the chapter will examine how projects may benefit from looking at previous experiences, when new projects are started.

7.2.1 Continuous documentation and closure of projects

As could be identified in the empirical study Metso has recently applied Improve and Tasman which are operating in accordance to Demming's PDCA cycle. The approach where project specific issues are adjusted immediately and system-wide improvement opportunities are dealt with on a long-term basis is confirmed as successful by Bartezzaghi et al. (1997). As stated, intra-project learning mainly focuses on reducing uncertainty within the project and hence only apply to the three initial stages of the PDCA-cycle, i.e. PDC. Inter-project learning, on the other hand, could be identified as the process within Improve which is seen as a mean of enhancing performance on a long-term, thus finalizes the PDCA-loop. (Bartezzaghi, Corso, & Verganti, 1997).

Improve and Tasman could be categorized as Tools and Methods in Clark and Wheelwright's (1993) organizational elements. Though, to serve in an effective way these must be customized to fit process specific requirements and circumstances (Clark & Wheelwright, 1993). However, the empirical study indicates that significant pre-requisites for completing the cycle is not yet in place. Bergman and Klefsjö (2003) states;"*for continuous improvements to become a natural feature of an organization, we need to create a learning organization"*. Studying the knowledge transfer at Metso, one can see that, due to insufficient closure of projects, lack of deviation reporting and their inability to recognize similarities between projects, Metso is not quite there yet (Shani, Chandler, Coget, & Lau, 2009). And hence, in order to achieve inter-project learning, they need to find a balance between the urgency for immediate results with create re-useable knowledge in upcoming projects (Bartezzaghi, Corso, & Verganti, 1997).

As the problematic balance between internal improvements and customer projects implied, projects are seldom correctly finalized and people rush into the next project leaving no room for reflection and improvements. This behavior indicates that Metso do not fully understand the importance of integrating the learning process with the business process and the project management process (Kotnour, 2000; Chawla & Renesch, 1995). Consequently, as was elaborated on above, this is a matter of management support and resource allocation.

However, people are tired of not being able to make oneself heard, of not getting any response of their project initiated deviations and experiences. Therefore, a general opinion among Metso employees is that projects need to be properly finalized and evaluated. Hence, as recognized Metso needs to start prioritizing internal improvements and thus inter-project learning in order to be successful in the long-term.

7.2.2 Closure meetings

It has been identified that closure meetings of projects are seldom realized. Astra, however, has a well established routine for closure meetings. A half day is dedicated, and the activity enables project experiences to be disseminated and embodied (Bartezzaghi, Corso, & Verganti, 1997) within the people participating, i.e. personnel from the whole department. The importance of having a closure meeting where project members gather is strengthened by Becker-Beck et al. (2005) who suggests that direct communication enables information to be more efficiently disseminated. In accordance to Becker-Beck's et al. (2005) statement Nonaka's et al. (1996) further argues that people are essential knowledge carriers. Astra's approach confirms the findings. According to Astra employees, closure meetings enables both project members as well as other employees to communicate and reflect upon project key learning´s and even though databases are not structured, their inter-project learning process is quite efficient which could be explained by Becker-Beck's et al. (2005) and Nonaka's et al. (1996) reasoning.

7.2.3 Project reports

The project report and the lessons learned presented, could serve as a great initiator of inter-project learning (Bartezzaghi, Corso, & Verganti, 1997). Since projects are seldom reviewed, neither at closure meetings nor as lessons learned activities, the PDCA-cycle is not completed and the experiences are only inherent within the project members. Writing a project report will not only imply an occasion for communication and experience sharing, but also ensure that knowledge becomes explicitly written down as information. That is, data that makes a difference, which informs the receiver and impacts his/her judgment and behavior. (Nonaka, Toyama, & Konno, 2000).

In their writings, both Biggs (2003) and Bartezzaghi et al. (1997), criticizes reports and databases as vehicles for knowledge dissemination and embodiment. They argue that they are seldom utilized and that they are too context specific. Bartezzaghi et al. (1997) further argues that they constitute a high amount of unstructured information, which most likely is the reason why they are not applied. The nature of databases will be elaborated on below. But to start with, information needs to be structured. As was stated by the line manager of project, writing project reports would probably be facilitated if there was a standardized template to fill in. The statement is supported by the manager at Engineering Support and Inspection who utilizes a standardized template when writing inspection reports. Similarly, Astra has a standardized template for writing their project reports, and what is interesting is that both Engineering Support and Inspection and Astra always write lessons learned. In addition to a standardized template, Engineering Support and Inspection will start appointing key learning's in their report. This is an approach that Astra would appreciate in their OFI reports as well since they believe that information then would be easier accessible within the report. Likewise, the manager of projects stated that issues would be easier addressed and hence the receiver would know what to do with the content. So, how come there are project reports not written and why is there no standardized template within the project department? It might be that projects, as stated above, deals with intra-project learning, and hence are to reduce uncertainty within projects (Bartezzaghi, Corso, & Verganti, 1997). However, they are still a part of the organization and their experiences are of great value for the inter-project process.

As Bartezzaghi et al. (1997) argued inter-project learning are time consuming activities that may imply delays in the project execution and hence evaluation and analyze of project results should be

executed in the termination of the project. This is also the case at Metso, i.e. in cases when the project is reviewed. In contrast, Griffin and Somermeyer (2007) argue that activities within the project shall be reviewed at a regular basis. Thereby they create opportunities for continuous improvements that allow dissemination and embodiment of knowledge during project execution. Continuous gathering of lessons learned is not sufficiently executed at Metso and is hence something that is sought for. Interviewees realize that if solutions and corrections during project execution are not documented right away, you may forget them until the final report is written down.

Bartezzaghi et al. (1997) recognize the issue of a long-lasting and wide-spread process of collecting lessons learned, meaning that explicit organizational processes are required to guarantee qualitative information. Such explicit organizational process for continuous collecting was identified at Astra and Ruag.

At Astra, continuous lessons learned activities are included in their project process. Activities are evaluated when completed as suggested by Griffin and Somermeyer (2007). Similarly, Metso's PEM model constitutes an element for continuous review during project execution. However, as was recognized this is not utilized at Metso. Astra, on the other hand, has great success in their continuous evaluation. What distinguish Astra's approach from Metso's is that the project process has a central role. As discussed above Astra utilizes visual boards. At the tollgates people gather and discussions arouse and the performance is reviewed by the entire group. The shortcoming of the virtual PEM model is confirmed by Liker (2004) who suggests that "*looking at a computer screen is typically done by one person in isolation, thus discussions and knowledge sharing aren´t developed*".

An approach identified at Astra as well as Metso, are project diaries. At Astra the project manager continuously documented learning's until the final project report was written at the end of the project. At Metso, on the other hand, the diary was written within the group. The approach implies organizational knowledge creation corresponding to the process of externalization and combination (Nonaka, 1994). To clarify, the positive result is acknowledged by Davenport and Prusak (1998) meaning that knowledge is created when humans do the work. Hence, the approach implies dissemination and embodiment of knowledge within people (Bartezzaghi, Corso, & Verganti, 1997).

Ruag has a slightly different approach to continuous capturing of valuable improvement opportunities. They do write a project report at the end, though, this summarizes the continuous lessons learned gathered throughout the project. Like Metso, Ruag believe that "*improvement opportunities and experiences found in the beginning of projects are lost if they aren't continuously gathered".* But they have also realized the importance of visualization (Liker, 2004). Ruag utilizes improvement boards which serve as a base for initiation of improvement. When an improvement opportunity, i.e. a continuous lesson learned, occur in the project this is reported on a simple sticky-note note and addressed to the responsible section. Bicheno (2004) support the activity meaning that visual boards are useful when working with improvements since these allow employees to easily point out and attach problems and suggestions for improvement on a visual board. The statement corresponds to the situation at Ruag who argues that "*people are eager to get their action on the accomplishment list and hence, these days there are not that many suggestions waiting to be taken under consideration*". In addition Liker (2004) identified benefits such as increased productivity, reduced numbers of defects and mistakes, help meeting deadlines, facilitated communication, improved safety, lower costs, and generally more control over the project environment is given,

when a visual approach is applied. Thus, these are benefits recognized also at Ruag. Bicheno (2004) argued that countless of hours can be saved. This statement corresponds to Bergman and Klefsjö's (2003), "*it is always possible to get improved quality and continuous improvements using fewer resources*".

The continuously gathered improvement opportunities at Ruag could be compared with the deviations generated within Metso. From now on these are supposed to be reported to Tasman. However, as noted, a virtual approach is generally not as efficient as a visual one (Liker, 2004). Reporting of deviations is mostly discussed at the C&C department. Since deviations and feedback reported by C&C has traditionally not been taken care of, a vicious cycle has emerged. The C&C employees' perception of Metso is similar to what Chawla and Renesch (1995) refer to as a "non-listening" work environment. The emerging effect is that people no longer write neither reports nor deviations, hence information is not disseminated throughout the organization which calls for a change of procedure.

7.2.4 The incapability of detecting recurrent issues

Inter-project learning is further affected by the time disjunction between projects. As stated inter-project learning is about generalizing knowledge so it may be used in subsequent innovations (Bartezzaghi, Corso, & Verganti, 1997). Insufficiency of detecting recurrent issues is a persistent issue presented in the empirical findings. A common belief among Metso employees, but also at Astra, is that an evaluation of several reports at a time would enable them to detect systematical errors and patterns. Interviewees state that PEM is an excellent tool for detecting system-wide problems, though, if these are to be detected PEM reports needs to be reviewed and summarized to a greater extent. The same applies for project reports and C&C reports.

Bartezzaghi's et al. (1997) emphasizes that the capability to interpret and understand the causal relationship between phenomena is a great challenge within organizations. They further argue that organizational elements are required to support the complex inter-project learning process. This kinds of elements are recognized at the Engineering Support and Inspection group. Their approach is to summarize key learning's within each inspection report and then present these key learning's when the group meets so that experiences gained from inspections performed may be shared and evaluated. The procedure at Engineering Support and Inspection could be compared to Griffin and Somermeyer's (2007) AARs. As Griffin and Somermeyer (2007) implies, systematical errors are detected when issues are surfaced at multiple reviews.

The AAR's indicates that issues occur within a scope of project's. However, as can be seen at Metso, projects are not executed in sequence and it could be difficult to catch these similarities and patterns of cause- and effect relationships between projects. Bartezzaghi's et al. (1997) approach is rather to classify projects within several dimensions. This approach would most probably be more suitable at Metso when summarizing PEM-, Project-, and C&C reports. Though, given Metso's insufficiency of organizing data and reports that would require substantial organizational efforts.

7.2.5 Structured computer-aided systems and databases

As empirical findings indicate, systems and tools such as PEM and OnePower has not been properly introduced within the organization. Though, as Bartezzaghi's et al. (1997) indicated, this is not an unusual problem, for example Astra faces similar issues. As the empirical studies indicate, employees think that there are too many systems and too many databases that stores information and data. It is understandable why Bartezzaghi's et al. (1997) do not favor reports and databases, hence as Metso confirms, a mass of information is stored in an unstructured way.

Since organizational knowledge is of great importance for the company's future success and competitiveness on the market (Locke & Jain, 1995), the importance of reports and databases could be identified within theory. Thus, an organization cannot create knowledge; knowledge is created when information is interpreted by individuals, and hence when being applied, information needs to be in place (Nonaka, Takeuchi, & Umemoto, 1996; Grant R. , 1996). The amount of databases and archives at Metso indicates that storing of information is seen as valuable. Though, because of insufficient directives, structure and updating of information among databases, people do not utilize them as much as they would like to do. One of the interviewees claim that a queue system for updating could be beneficial, remembering the reasoning above, where continuous lessons learned was discussed, a queue system would imply the corresponding procedure when it comes to updating of archives.

What is further relevant for the storing of data and information, is that archives are not accessible to everyone within the organization. The sought for a mutual database is supported by Tushman and Nadler (1978). Since Metso execute projects within cross-functional teams, coordination and joint problem solving is of great importance, however, as stated by Tushman and Nadler (1978) interdependency between units require substantial information processing capabilities for dealing with uncertainties aroused. Not being able to search through multiple folders and databases, as well as storing of information at internal databases, like C&C do, or not embodying information in e.g. product homes in a structured way, will hence not contribute to control of uncertainties.

An additional shortcoming identified within all groups and departments at Metso, is the lack of a database where ”tips and tricks” relevant to the group may be gathered. These are often shared informally and at meetings, however, there is no natural base where you can store them for future application. Benchmarking at Astra and Ruag has shown that open source databases inspired by Wikipedia are used for the purpose of embodying knowledge. At Astra, the structural issue still seems to be a problem thus is not fully utilized (Bartezzaghi, Corso, & Verganti, 1997). Though, at Ruag the ”besserwisser” system has been successful. The success could be interpreted as a result of a corporate culture favoring knowledge-sharing (Alänge, 1994), hence as Davenport and Prusak (1998) stated, the people within the context affects the corporate culture with their values and believes, and those values and believes influence how they think and act. Thus, Ruag employees have a strong believe in sharing and embodiment of experiences

As Davenport and Prusak (1998) stated; a knowledge oriented culture is characterized by a positive attitude and an open climate towards knowledge sharing, and executives who support and credit the handling. Empirical findings imply that the corporate culture at Metso corresponds to the first and second feature. However, there is a lack of executives support and credit. Sure, Metso employees are encouraged to disseminate and embody their knowledge. Though, as indicated not enough resources

or directives provided. Employees do not know how to act which is clearly not understood by managers. At Ruag monitoring ensures that information is published. Their approach is to utilize checklists. This approach is also sought for at Astra and Metso. However, a line manager at Metso has already adopted monitoring. As stated; it is important to monitor, it is a demonstration saying that I am paying attention to the result and, if monitoring is not applied, nothing gets done. Monitoring could be interpreted as the organizational element *procedures* which Clark and Wheelwright (1993) refer to. Hence, if a knowledge sharing corporate culture is to be established, knowledge sharing has to be supported by executives and they need to set an example and demonstrate its importance.

7.2.6 Application of learning's

The purpose of inter-project learning is to be able to use knowledge gained from previous project in up-coming innovations (Bartezzaghi, Corso, & Verganti, 1997). Though, as been recognized by Clark and Wheelwright (1993), what is critical is to recognize similarities within past projects and apply these past experiences in the new project so that the knowledge actually facilitates the procedures.

Application of learning's is the final destination and, as could be seen in the empirical findings, shortcomings are identified both at Metso and Astra. Bartezzaghi et al. (2007) has listed a couple of potential barriers hindering the utilization of previous project experiences. The barrier of space and time disjunction between past experiences and future application is a well recognized barrier at Metso. Hence, due to the complexity of their service affair, projects are not sequential and you never know when learning's are to be applied the next time. Though, as been elaborated on above, it is important to generalize context specific issues since these may contribute to adjustment of problems that are systematically present in every project (Bartezzaghi, Corso, & Verganti, 1997).

An approach towards effective management of people and utilization of knowledge embodied within those is presented by Bartezzaghi et al. (1997). They suggest that pre-project team members could be allocated to similar projects. A similar approach is applied at Astra who argue that the team gets more efficient and in addition they are well aware of each other's competencies and difficulties. However, due to the non-sequential project occurrence, the approach would most possible not be successful at Metso. Hence, as suggested the method is somewhat limited in comparison to what Nonaka et al. (1996) imply; that individual tacit and explicit knowledge shall be converted into organizational explicit knowledge (Nonaka, Takeuchi, & Umemoto, 1996).

An approach that would have greater potential to succeed is, once again, to establish procedures to ensure that work is completed (Clark & Wheelwright, 1993). At Metso, these procedures correspond to the routines that employees sought for, i.e. to review previous projects when starting new ones. Such a routine is established at Ruag who identifies projects that are of interest to the up-coming project and overview lessons learned from those specific projects in the start-up phase. Similar to what Griffin and Somermeyer (2007) suggests Ruag has adopted a standardized start-up template with a check list to ensure that old experiences have been overviewed and utilized.

As can be recognized in Ruag's approach, well-structured reports and databases are required in order to find relevant information. Though, as Nonaka et al. (2000) indicated, knowledge is not always explicit, and as Japanese companies has come to realize, it is important to pay attention to tacit knowledge and experiences as well (Liker, 2004). Even though, computer's and the Internet bring

great opportunities for storage of data and quick communication through intranets, emails and various software (Liker, 2004), direct communication enables more detailed conversations (Becker-Beck, Wintermantel, & Borg, 2005). Findings from the benchmarking at Astra have shown that direct communication is used as a mean to capturing valuable previous experiences in the initial project phase. Similar to Becker-Beck et al (2005), Astra believe that it is more efficient and less time consuming to adopt presentations where experiences are shared through communication. And hence, as stated social interaction is significant when it comes to organizational knowledge creation (Nonaka, Takeuchi, & Umemoto, 1996)

7.3 Communication as a mean for sharing experiences

This chapter will elaborate upon how meetings may contribute to the knowledge dissemination. First formal meetings will be discussed, followed by how organization could benefit from informal meetings.

7.3.1 Formal meetings

As the empirical findings has revealed, meeting routines are not thoroughly developed and hence formal meetings can be improved to reach better knowledge sharing. As mentioned above there is a need for better communication and cooperation, if the organization are to improve its knowledge exchange and performance. Literature supports this by acknowledging the importance of people as knowledge carriers, thus they need to interact if knowledge are to be exchange (Nonaka, Takeuchi, & Umemoto, 1996; Bartezzaghi, Corso, & Verganti, 1997). Bartezzaghi et al. (1997) argue that knowledge and experiences possessed by people may get transferred if effectively managed. Since individuals obtain knowledge from other individuals or groups of knower's, formal meetings provide opportunities for such effective management of knowledge transfer (Davenport & Prusak, 1998). Further, meetings allows for what Nonaka et al. (1996) refers to the "spiral of knowledge creation". Especially the first mode, socialization can be achieved at meetings i.e. individual acquire tacit knowledge directly from another person through interaction. Meetings can be viewed as, what Bartezzaghi et al. (1997) refers to, a *procedure* that allows for knowledge captured within people to be disseminated. Since the most common way of storing knowledge at Metso is within people, formal meetings should be viewed as an important vehicle for achieving knowledge dissemination at Metso.

Then, how can good meeting routines bee achieved? As stated above, a visual approach will enhance the face to face communication that enables information to be more efficiently disseminated (Becker-Beck, Wintermantel, & Borg, 2005). Theory has acknowledged the Obeya room and visual boards as good methods for the purpose of knowledge dissemination and therefore, the Obeya room may serve as a good forum for meetings. Theory emphasizes the importance designing the boards in a manner that fulfills the need of the organization, if they are to be used for knowledge dissemination in an effective way (Burkhard, 2005). By considering the four perspectives presented by Burkhard (2005), i.e. identifying the boards function, identifying the knowledge needed to fulfill its function, identifying the target group, and lastly which aid that is most appropriate for the purpose, will increase the likelihood of a successful implementation.

Astra has acknowledged its applicability for knowledge dissemination, and utilizes this room for getting focused and dedicated meetings enabling knowledge sharing. Astra states that discussions are often spontaneously developed around a problem, thus a joint problem solving and knowledge sharing can be reached. It has created an environment of "openness" and willingness to share knowledge and experiences. Theory explains that such openness is the key for creating a knowledge-oriented culture, leading to success in projects (Davenport & Prusak, 1998). Ruag, on the other hand, do not utilize lean rooms, however they are using visual boards for planning as well as for improvements when having meetings in the functional units. At Ruag, the boards serve as a forum that triggers communication and experience sharing at meetings, and has proven great result for their improvement work. The implications are clear; Metso may benefit from introducing a more visual approach for their meeting routines. Not only do theory emphasis its applicability for

knowledge dissemination, but the two benchmarking companies confirm its applicability for conducting meetings that facilitates a good knowledge transfer between individuals. Further, a visual approach creates an openness to share knowledge, important for creating a knowledge-oriented culture.

The empirical findings at Metso has further identified that continuous improvement must be recognized as a standard item on the agenda if the organization is to learn from their mistakes. By utilizing standard meeting routines e.g. having continuous improvement as a standard item on meetings, continuous improvement can be reached. There are no standardized routines for how continuous improvements are to be handled i.e. how actions are to be delegated and monitored at meetings. There seems to be a divergence over how actions are handled among line managers and group mangers. Some uses action list, others don't. Some monitors their actions, others don't. However, the general opinion is that a few actions should be brought up at meetings, gathered in an action list that could be delegated and further monitored at the next meeting. Opinions have been raised that if actions are to be completed, monitoring is necessary, since it clarifies that attention is paid to the result and that actions are rewarded. Similarly, theory emphasizes the importance of having a rewards and incentives to enable a knowledge-oriented culture, supporting continuous improvement and organizational learning (Davenport & Prusak, 1998). Hence, monitoring should be designed to facilitate the acknowledgement of good work rather than punishment of unaccomplished actions, if a knowledge sharing corporate culture is to be established at Metso.

The approach of using visual improvement boards has, as mentioned above, has been adopted by Ruag, for the purpose of having continuous improvement as a standard item on the agenda. The improvement boards has proven to be a success, especial at Ruag where the approach has triggered continuous improvement to the extent that not many suggestions are waiting to be taken under consideration anymore. The success can be related to the fact that actions taken are credited and rewarded by the use of "accomplishment lists". The accomplishment lists has proven to create a desire among employees to get their actions on the accomplishment list, thus good work is rewarded and a knowledge-oriented culture has emerged. This indicates that their improvement boards are carefully designed to fulfill the need of the organization. Similarly theory has accredited visual improvement boards, since it allows for actions to be prioritized, delegated and monitored in a structured way so that organization can work towards continuous improvements and organizational learning (Bicheno, 2004).

Another issue identified at Mesto is the frequency of meetings held. Theory suggests that daily meetings should be conducted in e.g. the Obeya room (Liker & Morgan, 2006). Having regular meetings speeds the information gathering, which allows for knowledge to be shared between employees in an efficient and effective manner (Liker J. , 2004). The frequency of meetings at Metso seems to vary a lot depending on which functional units that is asked. For example, project leaders do not have any meetings within their function. Earlier, highly appreciated brainstorming sessions for problem solving and knowledge sharing where held. Employees argue that they miss these occasions, which indicates that more frequent meetings may benefit the unit. Thus, a more joint problem solving and experience exchange can be achieved. The benefits with having regular meetings are recognized by Astra who realize regular project status meetings between project leaders. At the meeting each project leader present their project to the other project leader, the effect is that brainstorming and experience sharing is triggered which may facilitate the project execution. C&C

are faced with a geographical barrier, which is a structural element that minimizes the opportunities of meetings (Clark & Wheelwright, 1993), thus it may be hard to increase the amount of meetings, which indicates that alternative solutions are sought for. Engineering on the other hand, are having very frequent meetings in comparison to the above mentioned departments; weekly or every second week. However, in comparison with theory the frequency of meetings are still not enough. Similarly to theory, Ruag are having daily meetings and think it facilitates a good communication and cooperation, indicating that there are benefits to gain by having daily meetings. Ruag states that maximum 15 minute are given if the meetings are to be efficient, and hence members need to be prepared prior the meeting. According to theory Metso may need to increase their frequency of meetings. The new working procedure indicates a change of activity sequences, and according to Bartezzaghi et al. (1997) the process must be carefully designed if it should be efficient. Hence, the frequency and amount of time spent on meetings needs to suit Metso's working process. Metso may also benefit from introducing the idea of presenting each other's projects at meetings. As stated by Astra, it triggers brainstorming and knowledge sharing which facilitates the execution of work. Regular meetings further allows for coordination of knowledge, since a lot of information is stored within people at Metso.

7.3.2 Informal meetings

Except from the organizational routines already discussed, Davenport and Prusak (1998) wrote that individuals also obtain knowledge from other individuals or groups of knower's. The statement emphasizes the importance of communication as a mean of knowledge integration which has also been discussed by Nonaka et al. (2000) who argued that social interaction enables knowledge to be transferred.

The importance of people as knowledge carriers (Nonaka, Takeuchi, & Umemoto, 1996) is obvious at Metso where experienced employees constitute a significant source of knowledge. Even though the corporate culture favors individualistic achievements, knowledge and experiences are shared spontaneously between individuals and employees value these informal meetings as much as the formal ones. The findings at Metso confirm that there is an open climate and a positive attitude towards knowledge and knowledge sharing, thus employees do not seem to fear that their future positions in the organization becomes threatened when their expertise is shared (Davenport & Prusak, 1998). The open climate is a major benefit at Metso, which is also recognized at Astra. However, as stated by Astra it is more of a fortune if you bump into the right person. Though, the formal meetings, which been elaborated on above, may bring beneficial side effects in terms of increased informal communication and knowledge dissemination. As Liker and Morgan (2006) indicated, visual approaches provide opportunities for discussion and knowledge sharing between participants. The benchmarking studies at Astra and Ruag both confirmed Liker and Morgan's (2006) statement saying that it fosters a willingness to share your knowledge and experience. This willingness could be associated to Liker (2004) suggestion that visual approaches foster team integration and that groups who work in a context where frequent face to face communication is applied are more satisfied then those who don't (Liker J. , 2004; Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002). Moreover, since direct communication enables more detailed conversations, it may foster a corporate culture characterized by mutual understanding and a closer cooperation and relationship between group members (Becker-Beck, Wintermantel, & Borg, 2005; Liker J. , 2004). The beneficial side effect is thus that close relationships evolve which may trigger spontaneous

communication also outside the formal meeting. And, as the empirical findings indicate employees would like to work more jointly in order to foster natural interaction and sharing of experiences.

The need for closer relationships, communication and cooperation at Metso is identified both within groups as well as between groups and departments.

The amount of collaboration between employees differs between groups. In despite from groups who do not meet regularly, e.g. the C&C – and the project department, and groups where employees work alone on their tasks, empirical findings point towards more efficient knowledge dissemination in cases where the group works jointly. One employee emphasize that he/she would appreciate to work in pairs, so that they could share their thoughts, learn from each other and exchange experiences and ideas'. The statement is strengthened by Shani et al. (2009) meaning that new skills, knowledge, ability, and attitudes are created through the transformation of experiences'. An example of successful cooperation could be seen in the application of a project diary. As stated employees were given an opportunity to reflect upon their achievements, but also, knowledge was disseminated between and anchored within those individuals. Implementation of project diaries within the group hence confirm that information becomes knowledge when humans must do the work and that knowledge is created when information is interpreted by individuals (Nonaka, Toyama, & Konno, 2000; Davenport & Prusak, 1998).

As was mentioned earlier in the analysis, people has emphasized that they do not work cross-functional enough which causes a lack of system thinking. Even though managers encourage people to contact each other and establish relationships across functional boarders, empirical findings indicate that there is still a need for better cooperation between departments. Theoretical studies has suggested that direct communication is essential when information is to be efficiently disseminated (Becker-Beck, Wintermantel, & Borg, 2005) and the suggestion is confirmed by the behavior identified within the engineering department where the employee has established a close relationship with the C&C department instead of relying on the computer-mediated information. As been stated the approach has contributed to a mutual understanding of issues and they are nowadays working more informally integrated and broadly direct communication, close cooperation and relationships, hence imply an opportunity to individually and informally monitor progress of action (Becker-Beck, Wintermantel, & Borg, 2005) which has been sought for at Metso.

8. CONCLUSION

The study has elaborated upon inter-project learning and continuous improvements and how it most efficiently can be achieved in a matrix organization. The research has identified obstacles and difficulties commonly faced in today's organizations, which is why inter-project learning and knowledge integration is an issue that many companies are struggling with. During research the incapability of fostering a knowledge-oriented culture was identified. As the theory implied and the case study confirmed, the non- knowledge sharing corporate culture derived from the unbalanced prioritization between external customer projects and internal improvement work. As the research suggested the prioritization is a matter of insufficient management support. Even though executives might think that they do prioritize continuous improvements, employees do not always agree. Hence, as the study has indicated, in order to elucidate the importance of improvement work executives has to communicate a clear vision of what they want to achieve but also allocate appropriate resources which are required to reach their vision. The absence of a knowledge-sharing corporate culture and insufficient management support results in a lack of system- and long-term thinking. The effect of the organizational obstacles becomes substantial in the difficulties which the case organization Metso faces, see figure 9.

Cause	***Effect***
Insufficient closure of projects, i.e. lack of closure meetings and lack of standardized routines for project reports.	Knowledge gets lost, hence knowledge are not captured and learning's are not established
Incapability of detecting recurrent issues	Learning's are not achieved
Unstructured databases	Information storing and searching becomes complicated, hence they are seldom used for knowledge sharing.
Incapability of utilizing previous experiences	Issues reoccur
Lack of meeting routines	Communication and knowledge sharing is not triggered

Figure 9: The cause-effect relationship between inadequate beahvior and difficulties that emerge.

In order to overcome these difficulties and to foster a knowledge-sharing corporate culture, the findings indicate that there is a need for procedures, methods and tools that will facilitate the process of inter-project learning. Suitable elements identified that would increase the possibility of achieving a decent generalization, embodiment and dissemination, and application of knowledge are; visual approaches and standardized routines and procedures. However, as theory implies, and as historical experiences at Metso indicates, there is a need of a proper introduction of new organizational elements. Hence, executives' has to support the introduction and allocate time and resource needed to reach a sustainable solution.

8.1 Fostering intra-project learning to support the process of inter-project learning

As was presented, project execution is rather about intra-project learning then inter-project learning. To guarantee efficient intra-project learning and reducing of uncertainties within the project, it is important to establish procedures which allow learning´s to be utilized. First of all, routines that allows for previous projects to be reviewed in the initial phase of the project needs to be established. It has been suggested that people can be allocated to similar projects. However, as seen in the case study, that is not always appropriate. Thus, suitable routines are rather to review lessons learned reports and, if possible, to invite relevant people to present their previous experiences. To capture experiences during project execution, a visual approach may be suitable. Findings indicate that companies of today are not communicating enough partly due to their virtual approaches. Hence, using computer aided tools and methods for interaction and guidance of work, may damage the hands on team work which is a shortcoming that has also been recognized within the case organization. Therefore, it is important that project leaders meet and share their experiences, preferably in an Obeya room where all projects and their performance can be overviewed. The Obeya room should also be a room where visual planning can be utilized within each project. The project boards could hence serve as a forum where the project group meets and execute short meetings to review progress but also to foster spontaneous discussions and knowledge dissemination.

The intra-project learning's generated is a great source of information which has to be integrated as knowledge within the organization. Therefore, it is important that the organization establishes routines for how to realize a proper closure of projects. The project lessons learned report is a significant source of information. Though, it is important that the structure of the report is standardized. The report should be as short as possible, preferably summarized with key-learning's, it should not be a time consuming activity to fill it in and it should neither be hard to interpret the outcome, hence issues need to be addressed. In addition, to ensure that these are not lost during the long-lasting project process, lessons learned needs to be gathered on a regular basis. This is achieved through collection of continuously written internal project diaries and of continuously reported and addressed deviations. The project should then be finalized with a proper closure meeting. This should preferably involve both project members and relevant key personnel within the organization. At the meeting, project performance shall be reviewed and project key learning's shall be disseminated to the participants. Through realization of these activities, great prerequisites for inter-project learning are achieved. However, the next step is to disseminate and share the knowledge within the rest of the organization.

8.2 Detecting recurrent issues and patterns

The importance of being able to understand causal relationships between phenomena and to detect system-wide issues, research has suggested that organizational elements enabling monitoring and review must be established. AAR's were suggested as an appropriate procedure to find similarities and recurrent issues. The approach is a typical functional task which was recognized within the group Engineering Support and Inspection. Though, it would also be a suitable approach towards PEM reviews.

However, the complexity of inter-project learning and also of Metso's service affair, suggest that ARR's are not always suitable. Hence, instead documents and reports, e.g. project- and construction reports, should be archived in folders which may enable regular review and detecting of recurrent issues. Though, such archive requires an arranged and structured database.

8.3 Structure of Databases

Hence, databases need to be structured in an efficient manner to facilitate its usefulness. Archives and databases need to be accessible to everyone in the organization and hence mutual databases have proven to be beneficial on the behalf of internal archives and databases. Principles, such as directives and guidelines of how to use them need to be clearly stated, if they are to be updated on a regular basis. Further monitoring of updates, is viewed as a procedure that facilitates that actions are taken. Preferably a queue system should be developed so that updates are not forgotten. Further a database for embodying ”tips and tricks” needs to be in place. It has been recognized that open sources may be a beneficial tool for the purpose of embodying knowledge, ”tips and tricks”. However a knowledge-oriented culture favoring knowledge sharing needs to be in place for the open source to work.

8.4 Integration of learning's in the functional units

To take the last step in Demming's PDCA-cycle, and create inter-project learning, functional units must have the right tools and procedures that enable dissemination and sharing of knowledge. First of all the continuous improvement must be embedded in the daily work of the functional units, which will enable a knowledge-oriented culture to emerge. As has been found in the research, visual improvement boards allows for this, by providing the right principles, mechanisms and activities that makes continuous improvements visible in the organization. Introducing visual improvement boards provides routines for how actions are prioritized, delegated and monitored, and hence improvements will be accomplished. The importance of acknowledgement may be achieved through the establishment of an accomplishment list which visualizes their performance and hence can be credited by management. Further visual planning should be used as a procedure that facilitate an awareness of each other's tasks, thus a close relationship between employees may evolve where opportunities for communication and knowledge sharing between employees are encouraged. Thus provide better system thinking within the functional units. However, when introducing the boards, they need to be carefully designed in order to fulfill the need of the specific functional unit.

Visualization in the functional units can be seen as a tool that will increase inter-project learning in an efficient and effective manner. Formal meetings routines shall be established, meetings shall be short and efficient and hence, members must be prepared in advance. As suggested, 15 minutes per

day is appropriate. The approach enables efficient monitoring and dissemination of tasks and activities within the group. And, in addition, mutual understanding will emerge, spontaneous discussion and dissemination of knowledge may evolve and a close relationship between employees may be established, fostering the establishment of a knowledge-oriented corporate culture. Further, the knowledge-oriented corporate culture which evolves is beneficial for creating informal meeting opportunities. Thus, it has great potential to increase the amount communication and knowledge sharing.

If the suggested vehicles are introduced, the organization will improve its inter-project learning process, and hence a learning organization can be achieved.

9. RECOMMENDATIONS

To foster inter-project learning and enable an knowledge-oriented culture to emerge at Metso, the following recommendations are provided;

9.1 Overall recommendations;

- Introduce a visual approach in order to increase the importance of continuous improvement and knowledge sharing, thus it will get a higher priority.
- Set the management system OnePower in relation to the PEM model.
- Databases need to be structured, in order to facilitate its usefulness.
- Consider introducing a mutual database, e.g. sort information common way.
- Internal archives and databases are not acceptable; hence access is necessary if all information is to be available.
- An open source for"tips and tricks" are recommended to embody valuable knowledge across departments.

9.2 Project execution;

- Reviewing of previous projects at start-up meeting to ensure that mistakes are not repeated and that learning's are applied.
- Introduce an Obeya room, i.e. a project room where project meetings can be realized and project performance can be overviewed and monitored.
- Make PEM a visual model and realize frequent meetings by the board to enable project leaders to share their experiences but also to monitor the performance of the projects in process.
- Monitor the realization of project reports and closure meetings at the final PEM tollgate.
- Design a standardized template for lessons learned which is easy to fill in and clearly address issues. Summarize and provide key learning's on the front page in order to enable the reader to easily overview the outcome.
- Establish routines for continuous gathering of lessons learned. Two complementary approaches are suggested
    1. Write internal project diaries within the groups. Thereby knowledge may be embodied and disseminated in more efficiently within the group.
    2. Use a visual approach towards NCR, (non-conformance reporting). I.e. address deviations direct to the responsible group by putting them on their improvement board so that these may be visualized and adjusted by the entire group.
- Realize closure meetings to review the project performance and share project key learning's

9.3 Functional unit activities;

- Introduce visual improvement boards for the purpose of having continuous improvements as a standard item on the agenda - allows for efficient priority, delegation and monitoring of actions.
- Introducing visual planning, to increase the awareness of each other's tasks. It will provide a better system thinking, which will increase the amount of communication and knowledge sharing between participants.
- Principles, such as directives and guidelines for how to use and update your databases are required. Standardize archives such as product homes.
- Realize dedicated meetings within the group.
    - The group should preferably meet every day for maximum 15 minutes by the visual planning board.
    - The group should preferably meet once a week by the visual improvement board.
- There should be a queue system for updates of databases, so that updates are not forgotten.
- AAR should be implemented at each department, so that key learning's can be detected and resolved.

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APPENDIX A: INTERVIEW GUIDE – GROUP LEVEL

Din roll i projektet

- **Vilken roll har du i kundorderprojekten?**

- **Hur ser samarbetet ut mellan projektmedlemmar?**

Mottagning av feedback

- **Vad får du för typ av feedback på ditt arbete?**

- **Vad anser du om kvaliteten på feedbacken?**

- **I vilken form skulle du vilja få feedback?**

- **Hur går du tillväga när du får feedback?**

- **Hur arbetar för att sprida de erfarenheter du får i dina projekt?**

- **Hur skulle man inom avdelningen kunna effektivisera mottagning av information?**

Generering av feedback

- **Hur tycker du generellt att generering av feedback fungerar på Metso?**

- **På vilket sätt bidrar du till att feedback kommer fram till andra avdelningar?**

- **Till vem lämnar du feedback?**

- **Har ni några speciella rutiner och metoder som tillämpas inom avdelningen?**

- **Ger du feedback på dina kollegors arbete?**

- **Ser du några brister med genereringen av feedback?**

- **Uppmuntras du att lämna feedback?**

- **Känner du att du får gehör för den feedback du riktar till avdelningen?**

Integrering av erfarenheter inom avdelningen

- **Hur tycker du generellt att erfarenhetsåterföringen fungerar på Metso?**
- **Hur fungerar samarbetet mellan kollegorna inom gruppen ut?**
- **Vad händer med den kunskap ni får på erfarenhetsmötena?**
- **Vilka generella brister kan du se?**
- **Hur kan man öka systemperspektivet?**
- **På vilket sätt bidrar du till erfarenhetsåterföringen ska fungera i gruppen?**
- **På vilket sätt arbetar ni med erfarenhetsåterföring inom gruppen?**
- **På vilket sätt arbetar ni inom avdelningen för att sprida information som kan vara nyttigt för arbetet?**
- **På vilket sätt sprider grupp- och avdelningschefen information till gruppen?**
- **Är det tillräckligt mycket? Upplever du att informationen når dig?**
- **Är det någon som följer upp att du har förstått och rättat dig efter nya rutiner och direktiv?**
- **Har du några funderingar på hur man skulle kunna arbeta mer effektivt?**

Produktrelaterade erfarenheter och åtgärder

- **Är du produkthemsansvarig?**
- **I vilken utsträckning uppdateras produkthemmen?**
- **Uppmuntras du att uppdatera produkthemmet?**
- **Vilka använder sig av produkthemmen?**

- **Vad kommer in i produkthemmen?**
- **Ser du några brister i användandet av produkthemmen?**
- **Har du några funderingar på hur man skulle kunna arbeta mer effektivt?**

Processrelaterade erfarenheter och åtgärder

- **Upplever du att systematiska fel kommer dig tillkänna?**
- **Hur går man vidare med denna information?**
- **Hur dokumenteras åtgärder?**
- **På vilket sätt arbetar man inom avdelningen för att säkerställa att alla tagit till sig och rättat sig efter processrelaterade åtgärder?**

APPENDIX B: BENCHMARKING ASTRA ZENECA AB - WORKSHOP PREPERATIONS

Workshop 19/4 2011 – Kunskapsöverföring mellan projekt.

Tisdagen den 19e april kommer vi, Marie Andréasson och Michaela Blomén, till er på Astra Zeneca i Södertälje för att titta på hur ni arbetar med kunskapsöverföring mellan projekt.

Vi är två studenter från Chalmers Tekniska Högskola som just nu skriver vårt examensarbete för Metso Power AB i Göteborg. Examensarbetet är en studie angående kunskapsöverföring mellan projekt där syftet är att undersöka hur projektbaserade organisationer använder sig av kunskaper och erfarenheter från ett projekt och integrerar dem i organisationen. Allt för att undvika att gamla misstag återupprepas och att man ”uppfinner hjulet på nytt” i nästa projekt.

Den workshop som vi planerar att genomföra hos er i Södertälje är en del av den benchmarkingstudie som vi gör på Astra Zeneca. Benchmarkingen syftar till att ge oss en inblick om hur ni, på Astra Zeneca, arbetar med kunskapsåterföring. Syftet är vidare att jämföra Astra Zenecas rutiner och metoder med dem vi identifierat hos Metso Power AB, förhoppningen är då att båda parter ska kunna inspireras och ta lärdom av varandras tillvägagångssätt för att skapa en lärande organisation.

Målet med workshopen är att kartlägga er process för kunskapsöverföring, vi vill veta vilka rutiner ni använder för att sprida erfarenheter inom er organisation. På workshopen vill vi ge er en möjlighet till att reflektera över era arbetsmetoder och själva kunna identifiera svagheter, styrkor och potentiella förbättringspunkter.

Vi kommer utgå från frågeställningen:

> *”Vilka aktiviteter tillämpar ni för att sprida de kunskaper och erfarenheter projekten medfört, och vilka rutiner finns för att ta tillvara på dessa i organisationen?”*

Vi ser framemot en trevlig eftermiddag med er, och hoppas att ni kan dela med er av de erfarenheter som ni har!

Med Vänliga Hälsningar

Marie Andréasson och Michaela Blomén

APPENDIX C: BENCHMARKING ASTRA ZENECA AB - WORKSHOP AGENDA

Kunskapsåterföring – Benchmarking för att undersöka hur organisationen Astra Zeneca tar tillvara på och sprider de erfarenheter och kunskaper som genererats inom projekt.

1. **Vilka är vi och varför är vi här?**
    - Presentation av examensarbetet och syftet med benchmarkingen.

2. **Introduktion och presentation av frågeställningen.**
    - *Vilka aktiviteter tillämpar ni för att sprida de kunskaper och erfarenheter projekten medfört, och vilka rutiner finns för att ta tillvara på dessa i organisationen?*

3. **Diskutera frågan fritt två och två i 5 minuter.**

4. **Uppdelning av workshopens medlemmar i två grupper.**

5. **Dokumentation.**
    - Gruppen får 25 klisterlappar lappar till sitt förfogande och dessa fördelas jämnt mellan deltagarna.
    - Deltagarna svarar sedan på frågan genom att enskilt skriva ner en aktivitet/rutin per lapp.
    - Aktiviteten/rutinen ska förklaras med en kort men fullständig mening på 2-3 men inte mer än 4 rader.

6. **Presentation och tydliggörande.**
    - Syftet med steget är att alla ska få en gemensam förståelse för lapparnas innebörd.
    - Gruppen samlas kring lapparna.
    - Läs upp budskapet på en lapp åt gången och låt författaren förklara och tydliggöra innebörden för resten av gruppen.
    - Det är viktigt att man inte kritiserar innebörden eller argumenterar för om det är rätt eller fel. Fokus ska istället ligga på att alla ska förstå innebörden.
    - Om det behövs så har gruppen här möjlighet att komplettera och korrigera budskapet så att alla förstår. Detta görs med en röd penna.

7. **Gruppering.**
    - Arbeta tillsammans för att arrangera lapparna i grupper så att lappar med samma innebörd grupperas tillsammans.
    - Gruppera inte efter ordlikhet och undvik att försöka se logiska samband mellan grupper.

8. Komplettering.

- Gruppen får ytterligare två lappar som kan användas för komplettering om något väsentligt saknas eller har utelämnats.

9. Skapa ett flöde.

- Arbeta gemensamt med att skapa ett flöde av de aktiviteter som tillämpas för att möjliggöra erfarenhetsåterföring.
- Arrangera lapparna på det stora pappret.

10. Identifiera flödets styrkor och svagheter.

- Diskutera inom gruppen hur ni tycker att det fungerar. *Vad är det som är bra och vad är mindra bra? Förankras kunskapen med de rutiner som tillämpas eller skulle man kunna arbeta annorlunda för att gynna spridning och integrering av kunskap?*
- Gruppen får 10 mindre klisterlappar för att dokumentera styrkor och svagheter. klisterlapparna placeras ut i flödet.

11. Presentation och avslutning.

- De två grupperna får 5 minuter var för att presentera det flöde de skapat och de styrkor och svagheter man gemensamt identifierat.
- Workshopen avslutas med diskussion där vi jämför de båda flödena. *Ser de likadana ut? Vad är det som skiljer dem åt och varför skiljer dem sig?*
- Vad tar vi med oss härifrån?

APPENDIX D: BENCHMARKING RUAG SPACE AB – INTERVIEW GUIDE

- **Vad arbetar ni med här på Ruag? Berätta lite om vad ni gör.**
- **Vilken typ av projekt arbetar ni med?**
- **Vad har du för roll inom organisationen?**
- **Kan du berätta lite om hur ni är organiserade inom Ruag?**
- **Hur mycket jobbar ni i projekt respektive linje? (Vilken typ av Matris org?)**
- **Finns det utrymme för linjearbete? –Hur stor del av arbetstiden uppskattar du att man lägger på kunskapsspridning?**
- **Hur ser er projektprocess ut?**
- **Hur är ni organiserade i projekten?**
- **Hur arbetar ni på Ruag Space med erfarenhetsåterföring?**
- **Vilka rutiner har ni? – Rapporter, Presentationer etc.?**
- **Vilka verktyg/metoder jobbar ni med inom linjen för att återföra erfarenheter?**
- **Vi har fått höra att ni arbetar med visuell planering, skulle du vilja berätta lite mer om det?**
- **Vilken betydelse tror du att VP har för kunskapsspridningen inom gruppen?**
- **Hur ofta har ni möten vid VP tavlan?**