AN APPROACH TO COLLECT AND SHARE LESSONS LEARNED IN ORDER TO IMPROVE KNOWLEDGE TRANSFER ACROSS NEW PRODUCT DEVELOPMENT PROJECTS

A case study in a Swedish company

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The authors take full responsibility for opinions, conclusions and findings presented.

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Jönköping, May 2013.

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Benevento Giovanni          Magoula Anastasia
Abstract

This thesis examines the state of reporting Lessons Learned in a Swedish company that operates globally and explores the areas of potential improvements through better classification and reporting of Lessons Learned from previous projects. Particularly, it explores which the most effective ways to capture and document Lessons Learned are as well as how a System that supports efficient storage, sharing and retrieval of Lessons Learned can be specified.

The research is a case study in a Swedish company and is a mixed-model research as it uses both quantitative and qualitative data from primary sources. Indeed, the data collection was done via interviews, questionnaires, a focus group and the study of the company’s documents.

The findings revealed some issues in the Lessons Learned methods used in the company, especially in documentation. Additionally, the need for a Lessons Learned System to manage the knowledge and experience from projects was also identified.

The thesis concludes with explicit answers to the research questions and more specific with the suggestion of certain guidelines for the employees, a new template for reporting Lessons Learned and the specifications of a Lessons Learned System that can support efficient storage, sharing and retrieval of Lessons Learned.

Keywords

Lessons Learned, Lessons Learned System, Knowledge Management, New product development, Project Organizations
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List of abbreviations

LL: Lessons Learned
LLP: Lessons Learned Process
LLS: Lessons Learned System
NPD: New Product Development
PDP: Product Development Process
PMS: Project Management System
Introduction

This thesis will address the topic of Lessons Learned (LL) from New Product Development (NPD) projects and will focus on how these Lessons can become easier to access, capture and retrieve within a large project-based organization.

The introduction aims to acquaint the readers with the company where the study was conducted and the research problem that was detected. Below, the purpose and research questions will be posed, the delimitations of the study will be described and the structure of the thesis will be presented.

The work constitutes the last part of the educational program “Master in Production Systems with specialization in Production Development and Management” at School of Engineering, Jönköping University and is credited for 30 ECTS points.

1.1 Background

1.1.1 Theoretical background

The dynamic and intermittent nature of NPD projects makes the significance of the right use of employee’s knowledge even more vital and contributes highly to how a company manages problem solving, elimination of knowledge losses and eventually reinforces its competitiveness. The amount of information can be tremendous and daunting and this might be the reason why the efforts to handle and disseminate organizational knowledge and experience are usually not completed with triumph (Davenport & Prusak, 1998).

Shankar, Mittal, Rabinowitz, Baveja and Acharia (2013, p. 2049) define knowledge loss in NPD projects as “the loss of knowledge, information and experience among the individuals or departments in an organization”. They argue that a strong Knowledge Management System that facilitates the recognition, establishment, and transmission of experiences in a business unit have become crucial because it is strongly connected to the efficacy and innovation of NPD projects.

Research in several companies has identified the main reasons for knowledge losses in NPD projects during the stages of Knowledge Capture, Knowledge Transmission and Knowledge Processing, as shown at Table1 (Shankar et al., 2013).

Table 1: Main Reasons for Knowledge Losses in NPD (Shankar et al., 2013)

<table>
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<tr>
<th>Knowledge Capture (Quality of recording)</th>
<th>Knowledge Transmission (Future info availability)</th>
<th>Knowledge Processing (Capture +Transmission)</th>
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<td>Lack of communication</td>
<td>Information waiting from another process</td>
<td>Work culture and maturity of the company</td>
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<td>Lack of accurate planning</td>
<td>Poor delivered data</td>
<td>Information rework</td>
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<tr>
<td>Lack of correct content of information</td>
<td>Inefficient way of transfer</td>
<td>Employees’ transfer or departure</td>
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However, the fast development of network technologies has brought a new movement on Knowledge Management towards interactive online repositories that facilitate cooperation and communication within an organization (Davenport & Prusak, 1998). The desired cross-project learning can be achieved through two ways of knowledge transfer (Jeon, 2009):

- **Direct transfers**: The personnel go straight to the following project and this way their acquired knowledge from the previous project is transmitted.
- **Detoured transfers**: The employees get the knowledge they need via several forms such as information repositories, company guidebooks, educational programs, work instructions, and employees cognition.

According to the company sector, culture, resources or knowledge management efficiency the respective transfer is followed. Direct transfers could be the ideal way to pass previous lessons to the future but it is somewhat illusory to achieve it in today’s business reality because of people leaving the company or changing positions. Detoured transfers are the common practices but can easily become “information holes” where vital knowledge can get lost. It is therefore critical for an organization to be capable to manage the detoured transfers efficiently and without losses (Jeon, 2009).

Nevertheless, knowledge and experience transfer can be achieved through reporting properly LL during projects. Nevertheless, one of the challenges with LL is the sensitivity and accuracy needed in order to capture, delineate and structure the individual knowledge and simultaneously take into consideration the fact that reporting at a specific moment can have an impact on the information (Jeon, 2009).

Moreover, a strategy that will assure the future use of a lesson in a positive way is also necessary. As stated by Maya et al. (2005, p. 18) “A Lesson Learned is a lesson forgotten if it is not implemented in a concrete way that reinforces the lesson and/or eliminates the cause, failure or flaw.”

Some problems that prohibit the capture and share of LL were revealed by a survey at USA construction industry in 1999 (Goodrum, Yasin & Hancher, 2004):

- Lack of reliable communication among specialists and other employees;
- Lack of properly configured data that complicates access, retrieval, and updating of lessons;
- Lack of a system that provides clear and explicit categorization;
- Lack of methods to incorporate new systems to pre-existent ones.

Indeed, even when a system that handles LL is used, if it is not structured and built functionally the retrieval process can result extremely complex (Goodrum et al., 2004). Indeed, as underlined regarding a NASA case, it can be tough to re-
retrieve the relevant lessons among the plethora of information (Government Accounting Office (GAO), 2002).

Concluding, the background of this master thesis could be illustrated by the following eloquent- but dense- statement by Sharif, Zakaria, Ching and Fung (2005, p. 45):

*Managing knowledge is not an easy task. It is because knowledge is human-based, dynamic and involves many cultural issues that need to be addressed. However, to gain competitive advantage in the knowledge-based economy, organizations must recognize the need to introduce processes and technology as one of Knowledge Management enablers that aim to convert employee’s knowledge into organizational knowledge. Thus, one of the solutions to managing organizational Lessons Learned is by promoting a Lessons Learned System.*

1.1.2 Company background

The research has been conducted at a company located in south Sweden, producing and operating globally. The company group has a leader position in Europe and is also one of the world leaders in many product categories. The products are sold by dealers and retailers to the end customers – both companies and individuals- in more than 100 countries. With the aim to meet the project requirements, the organization is structured in six broad categories of product groups and three brand portfolios. Every category is different in size, structure, project scope, involved technologies etc., has its own project managers and works autonomously.

As in most global companies, the environment at the company is intense. As a result of today’s business demands, the organization has introduced and follows a continuous improvement plan. The improvement and implementation of a tool that will capture and share knowledge in a sensible and easy way is a fundamental component of this plan.

1.1.3 Problem definition

Regarding the product development procedure, there is a standardized Product Development Process (PDP) that is used in the company as a guidance and support when new products are developed and transferred to manufacturing. One important activity specified in PDP is to collect and store LL, which is done at the end of every project. The latter, are stored electronically in the company’s Project Management System (PMS). However, this information is not easily accessible for other projects and the need for more complete and better structured information has been identified. The company therefore seeks for introducing an appropriate system for collecting, storing and sharing LL in order to support the efficiency and effectiveness of projects.

1.2 Purpose and research questions

The theoretical and company background propose that knowledge losses during NPD projects can be decreased through cross-project learning and effective handling of LL from previous projects. However, there is still the necessity to find
Introduction

and develop methods to structure, administer, and re-use the existing knowledge. Therefore, the purpose of this thesis is to:

Identify the areas of potential improvements and offer suggestions on how to structure and manage the Lessons Learned from previous projects in order to make them accessible and understandable for future use.

The stated purpose of the research can be reflected by the following research questions that the authors aim to answer at the end of this master thesis:

RQ1. “Which is the most effective way to capture and document Lessons Learned from New Product Development projects?”

RQ2. “How can a System that supports efficient storage, sharing and retrieval of Lessons Learned be specified?”

1.3 Delimitations

The investigation of LL practices in project management concerned only the Swedish site of the company and included only the projects belonging in three of the six categories of product groups. However, these delimitations are not considered to be too influential for the results of the research since the knowledge and experience acquired in any site or project can be useful and applicable to other product families as well, under certain conditions.

1.4 Outline

The structure of the master thesis will be articulated as follows:

Chapter two will present in detail the current trends and background literature in the area of Organizational Learning, Knowledge Management, Lessons Learned practices and techniques for their capture, Lessons Learned Systems, their contribution at the transferring and dissemination of the right corporate information among projects, factors that make their implementation successful and Lessons Learned Systems’ design elements and features.

Chapter three describes the methodology of the research and how the authors decided to implement the study. More specific, account is given on the research and inquiry theory and arguments are presented to support the choice of the specific methods and techniques that guarantee the validity and reliability of the research. Besides, the clear course of action during the conduct of the data collection is analyzed.

Chapter four reports accurately the findings of the research and presents the results of all the methods that were used to extract data about the topic.

Chapter five describes the analysis and elaboration of the captured data in order to explore the possible answers to the research questions and to link the gathered information to the theory but also to an applicable suggested system.
Chapter 6 “translates” the results of the analysis into suggestions and recommendations for the company to use new methods and tools to capture, document, store, share and retrieve Lessons Learned.

Chapter 7 discusses the entirety of the study. Here, for the first time the authors express their personal opinion about the topic and the findings. They state clearly the answers that they managed to give to the posed research questions, they summarize the learning outcome and give some suggestions on how the work could be further continued or developed.

The used literature, some search terms and appendices are presented in chapters 7, 8 and 9 respectively.


2 Theoretical background

2.1 Knowledge Management and Organizational Learning

Knowledge is defined by Davenport and Prusak (1998, p. 43) as “information combined with experience, context, interpretation, and reflection”.

To be successful project-oriented organizations must have a good knowledge management strategy aiming at rising learning. Knowledge is about commitment, perspectives, beliefs, intuition and actions. In the business world, project managers have to deal daily with knowledge that in the literature is distinguished between tacit and explicit knowledge (Nonaka, 1994). Tacit knowledge is non-quantifiable knowledge gathered from interactions, practices, informal communication, and it is more personal, subjective, and less tangible thus more problematic to capture, communicate and disseminate in a meaningful and useful form. Explicit knowledge is codified in formats such as standard operating procedures and databases and the main issue with this knowledge is to handle its high volume and to guarantee its significance. Knowledge management should focus mainly on tacit knowledge because it is the one that creates strategic value and represents knowledge source (Nonaka, 1994).

Nonaka (1994) also claimed that two processes are required for facilitating knowledge acquisition and dissemination when learning. These processes are internalization and externalization. Internalization process occurs when people capture explicit knowledge via reports or databases or when capturing tacit knowledge from others through socialization processes in such a way that it results reliable and valid. Externalization process, instead, allows the codification and articulation of tacit knowledge so that it can be created and shared to make easier and understandable the knowledge that is more complex. Learning is affected by the skills and the commitment of managers in realizing the externalization process. This means that tacit knowledge should be converted, structured, and transferred to explicit knowledge in order to be more accessible, easy, and comprehensible by other organizational members (Sternberg, 1999). Moreover, characteristics such as knowledge objectivity, completeness and quality are directly depending on managers’ codification capabilities (Jackson, 2010).

Hitt, Hoskisson, Harrison and Summers (1994) underline that investments in both human development—in terms of employees’ training—and knowledge systems are required for creating a learning culture and preventing knowledge and experience loss.

2.1.1 Knowledge capture

Kotnour (2000) states that knowledge capabilities will increase by capturing, assimilating, spreading, and applying knowledge within the organization. Greer (2008) has also highlighted the importance of capturing and storing relevant knowledge from experience. Knowledge capture often occurs after particular and
critical situations (mostly negative ones) from which companies want to learn (Jackson, 2010).

### 2.1.2 Knowledge sharing

Knowledge sharing is an activity that is carried out with the scope of solving problems and developing new ideas through provision of tasks and collaborative interactions among all members of an organization. It could be conducted both via written and oral communications, through common network by capturing, documenting, and organizing knowledge for others’ usage (Cummings, 2004; Pulakos, Dorsey & Borman, 2003).

Human social networks are perceived as one of the key aspects for enhancing knowledge sharing culture in the literature. Long work experience and employees’ ability to use computers influence positively knowledge sharing (Jarvenpaa & Staples, 2000; Constant, Kiesler & Sproull, 1994). However due to project’s long life-cycle, members are unwilling to share collective information with other teams as project ends resulting in knowledge dissipation. This may be caused by a poor and inefficient use of social networks or by lack of a supportive system (Keegan & Turner, 2001).

The level and quality of knowledge sharing depends mainly on how management supports this activity by building up a positive attitude in their employees, through improving relationships and recognition of their contributions (Lee, Kim & Kim, 2006). Moreover, a culture focused on innovation, fairness in decision-making and open communication is essential to share knowledge (Cabrera, Collins & Salgado, 2006). Taylor and Wright (2004) stated that focus on learning from mishaps to new ideas’ suggestion has a positive influence on sharing knowledge.

Knowledge sharing and transfer result in big challenges for organizations which attempt knowledge sharing experiments using yellow pages (profiling systems), expert exchanges and knowledge fairs so that organizational members will be aware of what others know. Even though organizations use these experiments, another important aspect to consider is accessibility to knowledge. The redesign of existing physical infrastructures or systems, so that knowledge can better circulate between people, needs to be taken into account for facilitating and for reaching an efficient knowledge share and transfer (de Holan & Phillips, 2004).

### 2.1.3 Organizational learning

Fiol and Lyles (1985, p. 811) defined learning as: “The development of insights, knowledge and associations between past actions, the effectiveness of those actions, and future actions”.

Nowadays, organizations are obliged to provide greater value for their customers by using a balance between know-how, innovation, quality and efficiency. Greater value may be achieved not only by improving operations and productivity, but also by building new methods of thinking and spread a learning culture among individuals, groups and communities within organization (Nonaka, 1994).
Several important aspects are considered when determining the drive and focus on increasing learning among the whole organization:

Nonaka (1991) stated that organizational learning intent resides into member's brain. Physical, mental, and emotional elements drive learning amongst members. Chandler (1992) instead, has claimed that learning intent resides into company’s knowledge strategy and into information sharing within the organization which both influences what members focus on and the extent of incorporating new knowledge.

Both executives and academics have identified organizational learning as perhaps the key factor in achieving sustainable competitive advantage. Learning is essential for building capabilities in a project-based organization (Kotnour, 1999). When running a successful project it is important to consider both how activities are administered and how intensive communication is handled (Morelli, Eppinger & Gulati, 1995).

In the literature, organizational learning is considered as a collection of what people learn in the organization and as a memory system for storage. On the one hand, Simon (1991) argued that human beings are able to learn while organizations do not have this capability. Organizations can learn through its members’ learning and by hiring members with new knowledge. Moreover, organizations must develop internal learning which represents the degree of transferring individual or collective knowledge to other groups or members in order to prevent knowledge loss and simultaneously to give the possibility to future members to learn (Nonaka, 1991).

### 2.2 Learning in project-based organizations

Project management maturity within an organization expresses the ability to learn from previous projects (Williams, 2007). Project-based organizations should use LL with the aim to generate important information and prevent future similar problems in next projects (Von Zedtwitz, 2003).

The importance of having a simple, easy, and well-defined Lessons Learned Process (LLP) lies upon management support as well as on members’ involvement and commitment. Most of people involved in projects are aware of the importance of conducting LL at the project close-out, but in practice this occurs rarely (Williams, 2007; Keegan & Turner, 2001; Anbari, Carayannis, & Voetsch, 2008). Different authors (Gulliver, 1987; Roth and Kleiner, 1998; Turner, Keegan, & Crawford, 2000) have proposed a LLP in practice but without analyzing how this knowledge can be added and shared outside the project team or throughout the organization. Most of the times, LLPs are not in place and companies lack of standard methods for capturing useful information for future usage.

An important feature that companies must also take into account is the dissemination of LL culture amongst organizational members with the scope of identifying which are the critical information that must be collected, stored and shared in or-
order to improve the performance of future projects, avoid repeating past mistakes and prevent knowledge loss (Kerzner, 2000).

### 2.2.1 Lessons Learned

In the literature, miscellaneous terms are used for LL such as post-project reviews, post-project appraisals, project post-mortem, debriefing, reuse planning, reflections, corporate feedback cycle, experience factory, knowledge across projects, cross-project learning etc. (Disterer, 2002).

LL is a technique to gather the exclusive and essential information collected by practice. LLP can be considered like a small part within the huge area of corporate knowledge management (Greer, 2008). LL have also been defined as data that has a serious effect on processes, adds authority and applicability to operations and diminishes the repetition of negative cases and emphasizes the positive cases (Gordon, 2008).

A definition given by Secchi, Ciaschi and Spence (1999, p. 57) is:

*A Lesson Learned is a knowledge or understanding gained by experience. The experience may be positive, as in a successful test or mission, or negative, as in a mishap or failure. Successes are also considered sources of Lessons Learned. A lesson must be significant in that it has a real or assumed impact on operations, valid in that it is factually and technically correct, and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result.*

Summing up the previous definition, Andrade et al. (2007) have underlined the three key requirements of LL:

- **Significance**, meaning that they can be useful for other cases as well.
- **Validity**, meaning that they can give reasonable and precise associations between problems and solutions.
- **Applicability**, intending at bringing results to raise the total quality of knowledge transfer.

### 2.2.2 Lessons Learned Capture

Gordon (2008) claims that LL should be captured by both inside company sources - individual experiences, self-assessment or case reports - as well as by outside company sources such as improvement suggestions, or relevant articles and journals on the matter.

The ‘ideal’ method that Greer (2008) suggests for capturing LL is that the project manager gathers the whole team for a last meeting about what was learned and what needs to be ‘filed’ for forthcoming projects and what needs to be avoided as well. An effective LLP starts with lessons’ identification or capture which is an important part of every project and serves several purposes. Most of project man-
Theoretical background

agers identify formal LL only at the project close-out after 3-4 years from the project beginning. This has proven to be inefficient and insufficient because LL capture should occur throughout the project lifecycle so that all information is documented in a timely and accurate manner. LL must have an adequate detail level so that other project managers may have useful knowledge and enough information to not repeat common past mistakes and to assure continuous improvements (Williams, 2007).

However, the results of the above-mentioned meetings are usually forgotten or not carefully filed or kept and thus the information is not easy to retrieve and re-use (Greer, 2008). Many other authors have given more reasons why LL are difficult to capture. Insufficient time and lack of motivation are the main factors from the managers’ side (Pinto, 1999). Furthermore, Garvin (1993) found that capture is difficult when managers feel the pressure to move on to the next project. As a result, learning from past experiences, reflecting on problems and successes, gaining more insights from each project and managing future projects better are inhibited. Williams (2003) has stated, in addition, that management support, initiatives, standard methods and clear guidelines are the main missing factors that are needed for developing a learning culture, especially when capturing LL.

To make LL capture easier, Reich (2007) proposed two interrelated key principles. The first principle concerns knowledge sharing when new project begins. The author claimed that encouraging an active learning culture through a skilled facilitator is fundamental when managers reflect together. In this way, they share previous knowledge in order to deduce what went good and bad in their past project experiences. The second principle argues that lessons should be captured as they occur and not at the project close-out. In this way, the capture of important information will be done at each important middle-gate. Also Anbari et al. (2008), state that regular and frequent capture of what has happened and which decisions were taken will decrease the pressure to report LL at project end and will help to avoid memory efforts and at the same time will assure high level of accuracy.

Furthermore, several authors have proposed different types of processes for gathering information from project teams and make them available for each organizational member who may need them. Roth and Kleiner (1998) suggested a six-stage process which starts with planning, meditative interviews, extraction, writing, authentication and dissemination. Busby (1999) encouraged a process with feedback loops for effective learning, while Schindler and Eppler (2003) recommended the presence of a responsible manager for processes of reviewing a project and transferring LL among project members and between project teams. Sowards (2005) suggested a five-stage process which focused on criteria’s establishment, key people involvement, agenda’s discussion, learning key points reporting and dissemination. Finally, Goodrum et al. (2004) recommended that the outline of the LLP should be: gathering of information, capture and exploration, necessary modifica-
tions and improvements, and communication and maintenance of gained knowledge.

2.2.3 Lessons Learned Documentation

The typical way to handle LL is through documenting. However, in practice it has been proved that these reports are usually imprecise, difficult to find or tough to comprehend. A different auspicious way is the use of standards but the presence of a vast quantity of standards that are not technically consistent or non-applicable is an issue of concern as well (Andrade et al., 2007).

The main reason to document LL, as Carrillo (2005) said, is when project teams separate to work on other projects. If lessons are not reported at the project close-out, individual and also collective knowledge previously acquired will be lost. Indeed, LL documents provide a chance to record that knowledge in order to make it usable and accessible throughout the organization and thus to prevent knowledge loss.

Some issues that should be taken into serious consideration when documenting LL were identified by Gordon (2008) and there was great attention given on the language used. Hence, Gordon suggested that common and informal language should be used and the writer should be careful and shun using terminology, slang and abbreviations.

Greer (2008) argues about the importance of reviewing and documenting good and bad experiences and he adds that the report has to be filled by the project manager or the team leader and then be presented professionally, accurately and reasonably to all the involved parties.

2.3 Lessons Learned Systems

As already stated, Knowledge Management is strongly bonded with LL Management and hence, with Lessons Learned Systems (LLS). Indeed, this statement is reinforced by a study conducted by Davenport and Prusak (1998) where they define LLS as knowledge repository initiatives that store LL.

LLS’ goal is to gather lessons and make them available so that all members of an organization can benefit, for instance, when they come across situations or problems that can be similar with previous events or projects (Webera, Ahab & Becerra-Fernandez, 2001). LLS can be advantageous for individuals or several groups of people like companies, associations and communities, or even whole specific business sectors (Andrade et al., 2007).

Together with the aforementioned classification of Davenport and Prusak (1998), Weber and Aha (2002, p.287) added that “Lessons Learned Systems are Knowledge Management initiatives structured over a repository of Lessons Learned”. Rakoto (2002) defines LLS as a well-built method to utilize and presume upon data deriving from bad and good experiences. It aims at avoiding the same mistakes and requires the
joint contribution of soft (human) and hard (material) resources. Additionally, LLS is a sequence of strategies and actions with the aim to recognize, capture, validate, share and enable the acquisition of past experiences (Meiling, 2010). A more detailed definition is given by Sharif et al. (2005) who describe LLS as a software structure to handle LL. They state that LLS’ foundation is the necessity to maintain corporate information by transforming personal experience into company-wide experience. In this way, even if some people are no longer part of the company, their colleagues can take advantage of the previous LL and handle similar or same situations in the future. The positive result that they recognize about this system is the prevention of what they call “corporate amnesia”.

LLS can be classified according to many features. In line with their content and context, LLS can be classified to the following categories (Bertin, Noyes & Clermont, 2012):

- **Positive:** Acknowledgement of best practices and improvements towards this road.
- **Negative:** Recognition of bad practices and usage to resolve important mistakes.

### 2.3.1 Store and Sharing

When building a LLS, it is important to consider and focus on the special needs and requirements of the specific organization that it is addressed to. Collecting (storing) and distributing (sharing) information have to be done in the proper way and with account given on the diverse implications of the users that will operate the system. Literature suggests that *collection* can be **active** (active scanning of lessons that are spread along the company) or **passive** (users subject the lessons to the system via a user interface). Respectively, *distribution* can also be **active** (lessons are directed to the concerned parties in relation to their user profile) or **passive** (a person has to ask for permission from the system to get access to the lessons that they are concerned of) (Andrade et al., 2007). This categorization of collection and distribution of LL leads to the identification of four different types of *corporate memories* that are shown in Table 2 (Borghoff & Pareschi, 1998; Andrade et al., 2007).

| Table 2: Four different types of corporate memories (Andrade et al., 2007) |
|-----------------------------|-----------------------------|
| **Active distribution**     | **Passive Collection**      |
| Active Collection            | Passive Collection          |
| Pump                        | Publisher                   |
| Sponge                      | Attic                       |

Andrade et al. (2007) suggest some situations where it is more suitable to use each type of corporate memory. Hence, *attic* is better for a “community of interest”, *sponge* is more appropriate for allocation of previous information internally, *publish-
er is also better fitted for internal processes but it is more useful for training and sensitizing people and pump can be more beneficial for groups of organizations as a method to gather or spread knowledge.

Before sharing a lesson, many systems provide a final check and evaluation of the lesson’s utility, quality and value in order to reassure that it will be beneficial. In case of non-conformance to specifications, the lesson is usually reviewed, returned to its writer for editing or discarded (Gordon, 2008).

Another important issue is that lessons should be shared among the right people as to be properly appreciated. An easy way to distribute LL can also be via e-mail. In this way, each professional will be able to get informed about issues on the area of his/ her expertise or interest. This method can be done automatically via a central system but also through personal subscription according to one’s information needs (Gordon, 2008). Furthermore, Mohler (2004) suggests that apart from including LL or Best Practices on the weekly/ monthly internal e-mail newsletter which is a really cheap solution and does not demand the engagement of more employees to manage it, successful dissemination could also be achieved by the creation of a supplementary web site accessible by the employees.

2.3.2 Retrieval: Pull and Push Systems

Theory identifies two major methods to characterize the direction flow between the user of a system and the stored lessons, pull and push (Weber & Aha, 2002):

**Pull:** The user is the one responsible to seek within a source in order to find and get the data that he/she needs. Typical pull-style information captures are libraries and web searches. Classic pull mode for sharing LL is a passive distribution system where users search for LL in an individual repository, stored reports or announcements.

**Push:** The user is not expected to search and extract the necessary data but the data is shared and directed to the potential interested people automatically. Push methods give precious benefits but they also cause some challenges that can restrict their value and effectiveness on LL. These can be:

- Dissemination is detached from organizational procedures,
- Participants may ignore or forget the database to capture LL or they may even not believe in the contribution of LL,
- Participants may be too busy or incapable to capture and understand written LL,
- Participants may not have the aptitude or expertise to apply LL efficiently.

2.3.3 Challenges and Success Factors for Lessons Learned System implementation

The major challenges of LL implementation are:
Theoretical background

- **Sociological and managerial**: Impact of LLS on the participants (comprehension, approval, adjustment, commitment etc.) (Parfouru, 2008).

- **Technical**: Drawbacks of some methods to standardize knowledge (consolidation, configuring etc.) and to treat knowledge (accuracy, update, etc.) (Dechy, Dien & Llory, 2008).

The two major factors that can lead to a successful LLS are:

1. *Repository of data* that will be simply and effortlessly searchable,
2. Fresh, improved *organizational processes* that will guarantee the right usage of this repository.

Therefore, it is implied that companies need to put effort and invest time and money for this goal but it is sure that they will benefit greatly not only in terms of quality of processes but also of financial profit. However, the raw data acquired by previous projects need to be supported by well-structured, complete and clear procedures so that they will be used productively at the beginning of a new project. Thus, the need for *organizational changes* is obvious and vital for the implementation of a useful LLS (Greer, 2008).

According to Jeon (2009), the factors that can have a positive impact on the LL implementation and can ensure a functional and easy-to-use system can be *technological, managerial* or *strategic*. Succinctly:

**Technological Factors**

- Project-oriented system architecture.
- Network all the potential stakeholders.
- Reliability in the storing or diffusion process.
- Simple and convenient interfaces.
- Flexibility of LLS to include variant LL and to further develop and restore.

**Managerial Factors**

- Management of the LLS by a specific group or department (checking, assisting and trouble-shooting etc.).
- Elimination of obstacles for the stakeholders.
- Incorporation to other existing ‘offline’ modules.
- Investment in education and training.

**Strategic Factors**

- Solid top management commitment.
- Substantial investments.
- Lifelong vision to grow into a knowledge-qualified association.
As Weber and Aha (2002) state, close integration of knowledge distribution with the procedures that this knowledge is related to is intensely essential. One of the advantages of this integration is the increased effectiveness of processes because of the direct use of appropriate information. A challenge of the aforementioned integration, that can be converted into an advantage as well, is the necessary flexibility in the configuration of procedures. Moreover, knowledge modeling (standardized format of information) is considered to be critical and mandatory for a successful integration of knowledge with the desired procedures. Thus, it is necessary to provide a flexible design of digital libraries that will make the information-seeking process easier.

2.3.4 Repositories and databases

Using a LLS decreases the possibilities of making the same mistakes but does not promise that mistakes will not be repeated. The methods and techniques used to gather, process and share LL have to be carefully chosen so that they will give a useful outcome. Moreover, not every LLS is suitable for every company so the right system has to be selected according to the organization’s needs. Therefore, the design and architecture of the LLS are very important (Granatosky, 2002).

Greer (2008) suggests that at the launch of a project the project leader should certainly have a meticulous review of the information repository to get knowledge (category of project, management policies, knowhow, equipment and designs etc.) about the previous projects that can be helpful to learn from. Afterwards and during the whole project lifecycle, LLS can be used in combination with other tools and databases when it is considered necessary.

The sector, the size and the organization of a business can influence the impact that a repository has in dissemination of the existing knowledge. However, it is indisputable that different kinds of organizations can enjoy great benefits from such a repository. Indeed, firms operating in highly innovative and edge-technologies sectors, big companies with complex and hierarchical structures, organizations with less automated processes, highly variable or life-depending procedures can all benefit greatly from the proper sharing of knowledge (Weber & Aha, 2002).

Developing a LLS is a genuinely difficult process that encompasses the confrontation of some critical issues. First, the organization needs to ensure that the stakeholders will be engaged and will work under an ambiance of cooperation and give-and-take attitude (Davenport & Prusak, 2000). Secondly, the participants should have the opportunity to swap tacit knowledge at any time and at any place (Wiig, 1993) and finally, a functionally structured mechanism has to be designed properly in order to classify, standardize, store, exchange and retrieve the appropriate information clearly (van Heijst, van der Spek & Kruizinga, 1997).

A functional database is characterized by many things, but one is fundamental: traceability. So, the capability of searching fast and easily and locating particularly interesting data and not useless information is the first element that has to be provided. A complete database should also include pull-down menus for each feature and distinct fields to insert word-files so that the writer will be able to describe the les-
sons that he/she learned from the project. Finally, it is indubitable, the database will be unusable if it is not updated (Greer, 2008).

Andrade et al. (2007) have identified more features as key requirements of a LLS than traceability. These requirements are described into detail below:

- **Accessibility:** The existing data has to be easily traced and captured from the database and there should also be the possibility to associate the acquired information.
- **Localizability:** There must be a definite identification of the stakeholders and the information that they need to own.
- **Profiles of interest:** There has to be a channel between the stakeholders and the LL that lay in the area of their interest.
- **Ease of use:** The system has to guarantee that capturing, storing, and retrieving of information will be simple and easy.
- **Source:** The system should provide information about the writer of a LL so that the organization will recognize their contribution and simultaneously any interested person will have the possibility to contact the writer for further clarifications and questions. Nevertheless, this requirement can be difficult to implement because of confidentiality issues that sometimes exist in a company.
- **Verifiability:** Specifications of LL have to be set so that unnecessary data will be avoided.
- **Consistency:** Appropriate tools and processes have to be in place to ensure the consistency and update of the system.
- **Diffusion:** All the recently stored data should be spread to the relevant stakeholders.
- **Reusability:** The LLS should provide some general information and recommendations for use in similar situations in the future.

The high value of a LL database can be ensured by some guidelines, suggested by Davidson (2006, p.7):

1. Provide a LL capturing procedure. (“Peer reviews, after action reviews, quality improvement loops etc.”).
2. Make frequent re-evaluations of the LL to achieve “accuracy, reliability and relevance”.
3. Make sure that the repository of LL is being used correctly and is incorporated properly in the organization’s processes. “Document, training course, checklist etc.” can be very helpful towards this goal.
4. Train people to use the knowledge repository for the right reasons and when a problem is not solved through other ways – “this is not as obvious as it sounds”.
5. Adopt and communicate the necessary mentality in order to create an ambiance of free knowledge sharing.
6. Demonstrate the positive results of sharing LL.
7. Appreciate and recognize the contribution of people to LL.
8. “Do something! It’s easy to capture lessons and expect others to read them, digest them and apply them — but it’s only by doing something with them that they will add value.”

Besides, searching can be simplified by the proper labeling of the database fields according to the most important features. The characterization should be detailed but on the same time as laconic as possible. Of course, this depends highly on the scope and nature of the industry (if it is product or process oriented etc.). Typical categories of labels used are the following (Greer, 2008, p. 51):

- Project name & Number
- Project type (Utility, Capital / Expanse)
- Primary or Secondary Plant or Product Systems or Subsystems
- Raw Material Involved
- Intermediate Products Involved
- Final of End Products Involved
- Primary Capital Equipment Impacted (Equipment Numbers)
- Secondary Capital Equipment Impacted (Instrument/ Control Valve Numbers)
- Material Compatibilities

Accordingly, the existence of clearly defined LL fields will also be helpful for the recording and their storage. Some possible fields can concern mechanical, electrical or structural engineering, instruments and tools, project management issues, major processes and departments involved and more (Greer, 2008).

2.3.5 Use of Lessons Learned Systems linked with other systems

LLS have proven to guarantee increased product quality and efficiency and as a result many organizations have encompassed a LLS as a part of their strategy for continuous improvement (Bertin et al., 2012). For large companies which have many projects running simultaneously it can be useful to connect the database to the company’s computerized management system (Greer, 2008). Additionally, many organizations have also decided to develop Product Lifecycle Management solutions so that they will improve the overall management, communication, cooperation, decision making and problem solving. The combination of LLS and Product Lifecycle Management can offer some benefits for an organization can facilitate and empower the application of the LLS (Bertin et al., 2012).
3 Method and implementation

This chapter describes the methods used to conduct the research and what these methods involve. The research structure of the study is presented and account is given on the course of action that the authors followed in order to obtain valuable data to answer the research questions and fulfill the purpose. Furthermore, all the methods and techniques that were used in this master thesis are supported by important academic references and the necessary explanation and credit is given upon the reasons why these methods were chosen. All these actions ensure that validity and reliability are presented.

3.1 Research philosophy

The philosophy that the authors believe that functions better towards the objectives of their research is interpretivism. In their effort to investigate the roles, needs, pursuits and knowledge of the project managers of the company, the authors were open to understand the requirements and the perspectives of the managers’ demands in terms of information availability in the LLS (Saunders, Lewis & Thornhill, 2009). The purpose of this master thesis is exploratory. As Stebbins (as cited in Given, 2008, p.327) states, exploration suits better for wide and organized data collection used to investigate and comprehend a specific area of study. Moreover, it is more useful when the aim is to discover ‘what is happening’, to look for new perceptions, to ask questions and to assess phenomena with a fresh perspective’ (Robson, 2002). Towards these objectives, the authors tried to gain a close and personal observation of the process of LL reporting in the company in any moral way that seemed to give results. The desired outcome of this –and of every- exploratory research is the establishment of inductively achieved tactics and generalities about the examined phenomena (Stebbins, as cited in Given, 2008, p.327-331).

3.2 Research Approaches

Case study is the method that was chosen for this particular research.

Yin (2002, p. 18) defines case study in two parts:

Part One: An empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident.

Part Two: Copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result, relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result, benefits from the prior development of theoretical propositions to guide data collection and analysis.

The case study was chosen because it is a commonly used method of research in companies and organizational behavior and it can be done by analyzing qualitative or quantitative data, or even combinations of both. The opportunity to study the processes in the special context of the company is valuable for the researchers
Method and implementation

(Aaltio & Heilmann, as cited in Mills, Durepos & Wiebe, 2010, p. 67-78). The authors were based on the existing theoretical background which led to the observation, study, analysis and final assumptions. Finally, the specific case study was extensive due to the fact that there was a focus on mapping common patterns within a given environment with the goal to develop or assess a system that would help the company to handle particular business-related phenomena and compare or integrate them into other systems (Eriksson & Kovalainen, cited by Mills et al., 2010, p. 93-97).

3.3 Empirical data collection

During the data collection and analysis process, literature evinces that there can be different ways of data collection and analysis procedures that can be used solely or in tandem in research project (Saunders et al., 2009).

In the current study, the authors used primary data (interviews, questionnaires, LL reports) to examine the situation of LLP in the company, the needs of the involved parties and the potential of the system-to-be-developed. The study of existing tools and methods to store and handle LL (existing databases and repositories in practice, in literature or in the market) were also some secondary data that were used during the investigation. Moreover, the research is a mixed-model research as it uses both quantitative (questionnaires) and qualitative (interviews, focus group) data from primary (project leaders, LL reports) sources.

This master thesis includes interviews, focus group and questionnaires as data collection techniques in order to thoroughly examine the current state of reporting LL at the company and to identify the possibilities for corrective actions and improvements towards a functional LLS.

3.3.1 Interviews

The authors decided to conduct several interviews with key persons at the company that will be further analyzed below. The interviews were semi-structured as there was a structured sequence of questions but the interviewers were also allowed to manage the questions in a less restricted way when they considered it was necessary (Williamson, 2002). Moreover, the authors took the permission by the interviewees to record all the interviews. This made the procedure faster and much more convenient and allowed the authors to feel free, be more focused to the subject and make really good discussions with the participants. Furthermore, all interviews were transcribed soon after the meetings so that no valuable information could be lost or misinterpreted by the authors (Simons, 2009). Finally, the authors were very careful with sensitive issues and respected the people and their culture, the company and the confidentiality that was required by them (Gray, 2004).
In the current case study, there were 9 interviews conducted in total. After a meeting with the steering committee at the company the 10 most important and representative project leaders were chosen to be interviewed at the beginning. Finally, 7 of them were able to take part in 45-minutes individual interviews with *semi-structured questions*. Indeed, there were some fixed questions that were asked to all the interviewees but the authors asked some unplanned questions as well when they considered it essential or when the discussion led to another, interesting for the research topic. Besides, there were also two more interviews conducted with the persons responsible for the PDP and the company’s Project Management Computerized System. The aim of these two interviews was to get to know more about the processes and systems already used in the company and understand the culture, the means and the norms that influence the product development and reporting and hence, the LL.

These interviews marked the start of the investigation. They helped the authors to comprehend the current situation of the company, the purposes of the involved parties and the needs and expectations that they have by a functional LLS. The analysis of the interviews led to the creation of the questionnaire that was sent to all the 37 project leaders of the company and is presented into detail in the next subchapter. After receiving the answered questionnaires, the authors had short interviews with some (8) of the 37 project leaders to clarify and elucidate some dark spots and ambiguities of answers. The interview questions and structure can be found at Appendix 1, in the last chapter.

### 3.3.2 Questionnaires

Questionnaires with *closed-ended questions* were chosen to be sent to all the project leaders since, this kind of questions is more preferable when authentic responses are required and when there has to be a comparison across groups or a statistical analysis of the results. It was also useful because in a short period the authors could have a large number of answers (DePoy & Gitlin, 2005). The uncertainty that is entailed in this type of questions, regarding the clarification or comprehension of the questions by the respondents, was avoided and resolved by the short meetings that followed with some project leaders when it was considered essential.

There were also a few (2) *open-ended questions* included in the end because it was considered necessary by both the authors and the steering team at the company to get some further information and some personal opinions from the participants that could not be captured by the closed-ended questions. These questions were carefully designed and chosen so that they would contribute to the goals of the research, would not be hard to understand or timely to answer.
3.3.2.1 Questionnaire design

After the first interviews and the reception of some previous LL documents, the authors analyzed the given information and extracted the gist that was the base for starting the questionnaire. They managed to identify and cluster the observed issues into 5 main categories: Reasons for not/bad reporting, LL retrieval, Documentation/Templates of LL, Utility of LLS, and Basic information needed at the beginning. Afterwards, there followed two brainstorming meetings where the authors discussed and reflected upon the data that they had gathered and about the basic information objectives that would lead them to define the current reporting state of the company, the usual practices, the goals and ambitions of the LLS and the main characteristics of LL that would lead them to a useful and understandable classification. Thus, 16 questions were created concerning the previously mentioned areas. Subsequently, 7 more general questions were also included that concerned the areas of stage reports during product development process, participation in reporting and culture towards reporting. The aim was to find out the common practices and shortages that exist and may influence or prohibit the successful implementation of a LLS.

Before sending the questionnaire to the projects leaders, the authors had a meeting with the steering committee at the company to check the questions and take some further feedback. Afterwards, they finalized the questionnaire that consisted of 23 questions including 2 personal questions about name and work area of the respondent. This information was only asked so that follow-up meetings with each one of them would be set and the authors guaranteed to the participants that their anonymity would be kept. The complete answers that were received were 22, which is 59.5\% response rate. The full questionnaire can be found at the Appendix 2 in the last chapter.

3.3.3 Focus group

After a short meeting with the steering group at the company and close to the end of the research, the authors arranged a workshop in the form of a focus group.

There, 4 managers gathered together for one and a half hour and discussed about LL, how they perceive that capture, documentation, storing, retrieval and sharing would be easier and bring better results. Even though there were preset questions for them, finally an open discussion was conducted. More specific, the authors started with a directive approach in order to acquaint the participants with the content and aim of the focus group, to make them feel comfortable and to start up the discussion. Then, they continued with a rather nondirective approach, as they let them interact with each other and express their thoughts and questions openly. The authors had the chance to clarify some issues, understand better what the most appropriate structure of template and system is and through the observation and recording of the discussions they checked the validity of the their ideas, suggestions and their comprehension of the LL issues at the company (Stewart, Shamdasani, & Rook D. W., 2007). The questions and topics of discussion during the workshop can be found in appendix 3, in the last chapter.
3.4 Credibility of the research

Validity and reliability constitute two major issues in every research and can either give credibility and status or raise questions and doubts about the quality and integrity of the study (Williamson, 2002).

3.4.1 Reliability

Reliability states the degree to which the data collection and analysis techniques will return dependable results. It can be evaluated by the dependency of results on the occasion, on the observer and by the transparency of analysis of raw data (Saunders et al., 2009; Easterby-Smith, Golden-Biddle & Locke, 2008). It is more about consistency of outcomes in the case that the research is done again (Williamson, 2002).

Following some of the “guidelines” of Saunders et al. (2009) the authors tried to achieve increased reliability in their study via many ways:

Firstly, a thorough and complete literature research on the topic was conducted so that the findings could be easily compared with the existing theories. What is more, methodology was carefully and meticulously structured so that repetition of the research would not be hampered. Furthermore, by sending to the interviewees an informative e-mail before the interviews the authors intended to give them the time to reminisce the topic, recall the involved documents, give access to the necessary documents for the authors and generally to be prepared for the meetings. Besides, during the interviews and the questionnaire design, much effort and attention were put to ensure precision and completeness of questions and to avoid long, ‘guiding questions’ or theoretical concepts that could be misunderstood or misinterpreted by the interviewees. Incidents of participants not willing to reveal and discuss topics or trying to give ‘acceptable’, partial or ‘politically correct’ answers never came to the authors’ perception (but were not that easy to assess). Moreover, aiming to strengthen the reliability of all the examined and assessed secondary data (documents, reports, etc.) the authors always managed to discover and contact the persons who were responsible for writing and editing in order to acquire additional information. Additionally, all the interviews were audio-recorded and the questionnaire results are still available. This certainly improves reliability because another researcher can use the collected data and check whether the results are trustworthy or not. Last but not least, the fact that the authors have collected data from various sources - ‘triangulation’ - corroborates the research findings and adds reliability to the work.

3.4.2 Validity

Validity concerns the matter of the relationship between a concept and its measurement. It checks if the findings are actually what they seem to be (Saunders et al., 2009, DePoy & Gitlin, 2005) and is more linked to accuracy (Williamson, 2002).

Again, Saunders et al. (2009) recommendations led the authors through their attempt to bring valid results:
It could be stated that validity of the current research was guaranteed through the cautious conduction of the interviews and through the explicit and descriptive use of the data collection techniques. Indeed, during the interviews there were frequently clarifications and explanations given and the topic was discussed from several viewpoints. Additionally, the copies of the interview questions, the questionnaire, the tape recordings of the interviews and the transcripts also strengthen the validity of the study. Finally, even if the response rate of the questionnaires (59.5%) is not considered ideal, the follow-up meetings and the focus group checked the strength and correctness of the authors’ ideas, suggestions and comprehension and hence, made the research much more valid.
4  Empirical Findings

As already stated, the authors extracted the necessary information using interviews, questionnaires, and a workshop in the form of focus group and by studying the company’s LL documents. The purpose of the interviews was to gain a first introduction and background of the state of capturing, documenting and retrieving LL in the company. The questionnaire was designed as a result of the feedback that the authors received from the aforementioned interviews and LL documents with the main goal to gain a profound understanding and end up with a useful and understandable classification of the challenges met in projects. Moreover, the aim of examining the LL documents was to understand the LLP and the templates used when reporting and as a result, to extract useful information about the typical challenges encountered in product development projects. In addition, in the middle of the research, a focus group interview with 4 project leaders was organized with the aim to search deeper and to identify the primary knowledge needs by a LLS.

Finally, the authors attempted to benchmark some other companies and their LL strategies and processes as well as to search for commercial software systems available.

At this point it is important to state that the company has currently no dedicated system to handle the LL from product development projects. The only computerized system that is widely used is the company’s PMS where all the documents of the company are stored and the LL documents likewise.

4.1  Empirical results

Almost all managers identified the importance of LLP and they consider that the main and crucial aim is to organize the LL and to pass them to future product development projects. For these reasons, the empirical results have been structured according to the LLP: Capture, Documentation, Storage, Sharing and Retrieval.

4.1.1  Capture

The PDP consists of several gates (stage gates) at the end of each the project leader has to capture the Lessons Learned after one or several dedicated meetings with the project group. Moreover, at the project close-out (END gate) the project leader has to gather all the lessons during the whole project cycle, write them down and store them in PMS. However, most of the times the Lessons Learned are not captured at each stage gate. Indeed, the questionnaire revealed that 52% of the project leaders document LL at each STAGE GATE. Nevertheless, most of the project leaders consider that at the stage gates there are more important issues than LL to report, like for example cost or time issues. As one interviewee stated: “You have the chance to bring up a problem when you open a gate but it is done only for financial or time reasons…Only cost and quality are checked at every gate…”
There can be different ways to capture LL. Most of the project leaders (75%) do it after one or more reflective meetings with all the involved parties but only at the END GATE. The usual participants are the project group, the team leader, the most representative managers, and representatives from purchasing, laboratories, production etc. or anyone else who has interest in the project. Furthermore, they reckon that it is difficult to capture LL within the very limited duration of meetings (each meeting usually lasts 30 minutes or less). No steering team member is present in reviewing LL, they only receive it at the end. However, the rest of the project leaders capture the LL alone. In addition, 45% of the project leaders claimed that they have encountered difficulties in attracting people’s interest and participation in the LL meetings. More specific, one project leader stated: “If the post-project reviews are called Lessons Learned, there will not be much openness from the participants”.

Another issue that came up during the discussions was that of the company’s culture towards learning and the managers’ willingness to conduct LL. 40% of them feel that the main scope of conducting LL is solely to report to the steering team without receiving any management feedback.

4.1.2 Documentation

The majority of the project leaders (82%) believe that it is important to put effort in reporting and transferring LL and all the interviewees agreed that it would be easier to conduct LL meetings before each gate so that the final LL document will be more accurate, precise, and above all with information that has not been forgotten during the years.

The reasons of non-efficient documenting are because the team feels stressed by the time limits (33%) to move on to the next project or even because they no longer care about the past (10%). Moreover, people tend to forget (38%) what has happened in the entire project life-cycle and perhaps some of them are not working at the company or in the same project anymore (43%). Other reasons are the lack of standardized routines, templates, and communication channels (43%), the lack of interest or involvement from the steering team, the feeling that LL will not be appreciated and above all reused, and finally, the time distance from Start Of Production (SOP) to the END GATE that makes LL seem as a faraway task. Moreover, they underline that it is difficult to have a good structure of LL. Besides, they state that the LL today are very dependent on the person who writes them and most of the times even if they get the LL they have to contact the writer for clarifications as well.

4.1.2.1 Templates

The authors discovered that there are at least two different templates for documenting LL used by the project leaders of the company. The one is a Word file template, which is the established document suggested by the company for report-
Empirical Findings

ing LL at the end gate. The results of the questionnaire showed that the majority of the project leaders consider as very important the provision of direct and accurate information, the clear structure of the template and the presence of learning highlights. The other template is a PowerPoint (ppt) slide that is supposed to be used for LL only at each stage gate because it is not meticulous or detailed. More specific, the questionnaire revealed that 75% believe that the ppt includes unstructured or unorganized information and 67% that it gives no clear directions for improvements. Finally, half of the people said that there is no summary of the project included neither is information about contact persons.

However, the purpose of each template is not clear for all project leaders and as a result, each one of them uses at will whichever template he/she feels comfortable with. Indeed, 48% stated that they use the Word template, 33% the PowerPoint template, 14% stated that they use other ways to report (own notes) and 5% claimed that they do not report at all. Interestingly, there were two managers that did not even know about the existence of the Word template. 32% of the respondents declared that they have faced troubles because of the use of different templates especially when several sites are involved in a project.

4.1.3 Storage, Sharing and Retrieval

Most of the managers (81%) have never tried to retrieve information from the LL documents stored in PMS. The main reasons that were identified are that they are not aware of where to find them (87%), they did not have access to other projects’ LL (40%), or no useful LL were available (5%). The ones that have tried it however, have encountered difficulties (do not know where to search, too time-consuming process, etc.) during the retrieval process and they think that although the idea could be functional in reality it turns out to be confusing (poor storage system, lack of the search function and complicated system structure). Therefore, the retrieval of previous LL is not a common practice in the company because it results hard to find them. Nevertheless, almost everyone (86%) claimed that they ask informally other stakeholders or experts for their experience and problems that they have faced in similar projects and how they solved them. Furthermore, one project leader said that he interviews other leaders to find out best practices and uses this information as LL. Besides, another project leader has used other communication channels like e-mail to get ideas, suggestions or information for his project. Nonetheless, they have doubts about the accuracy of the information that they receive in this way.

A major challenge for all the managers is the lack of accessibility to LL of other projects in the PMS. Indeed, the authors discovered that too limited people are currently allowed to access the LL of a project and the rest should first ask for the project’s manager ‘permission’. The reasons for this lack of accessibility are that there are some sensitive financial information included in the stage reports and also that the system is used globally by all the company’s sites. However, the majority of the project leaders (94%) are very concerned and unsatisfied with this lack of accessibility and as one of them said: “It is not secret…it is valuable information”.

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4.1.4 Summary of findings on Lessons Learned Process

The summary of the above findings are presented in Table 3.

**Table 3: Summary of finding in Lessons Learned**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Identified issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture</td>
<td>1. Not recurring LL capture at the stage gates.</td>
</tr>
<tr>
<td></td>
<td>2. Low participation in meetings.</td>
</tr>
<tr>
<td></td>
<td>3. No top-management support.</td>
</tr>
<tr>
<td>Documentation</td>
<td>1. Time constraints.</td>
</tr>
<tr>
<td></td>
<td>2. Forgetfulness.</td>
</tr>
<tr>
<td></td>
<td>3. Employees no longer at the project/company.</td>
</tr>
<tr>
<td></td>
<td>4. No standardized routines, templates and guidelines.</td>
</tr>
<tr>
<td></td>
<td>5. Dependency on writer’s skills.</td>
</tr>
<tr>
<td>Templates</td>
<td>1. Unclear purpose of each template.</td>
</tr>
<tr>
<td></td>
<td>2. Unstructured information format.</td>
</tr>
<tr>
<td></td>
<td>3. No clear directions for improvements.</td>
</tr>
<tr>
<td></td>
<td>4. No project summary.</td>
</tr>
<tr>
<td></td>
<td>5. No contact person information.</td>
</tr>
<tr>
<td>Storage, Sharing &amp; Retrieval</td>
<td>1. Poor and complex storage system.</td>
</tr>
<tr>
<td></td>
<td>2. Time consuming retrieval process.</td>
</tr>
<tr>
<td></td>
<td>3. Propensity to informal communication (oral, e-mail, etc.).</td>
</tr>
<tr>
<td></td>
<td>4. Lack of search function.</td>
</tr>
<tr>
<td></td>
<td>5. No LLS available.</td>
</tr>
</tbody>
</table>

4.1.5 Critical Information at the Beginning of a New Project

According to the research conducted, the basic information needs at the beginning of a new project should include the following areas:

- **Key departments involved** (R&D, Purchase, Suppliers, Risk management, Manufacturing, Design, Logistics etc.)
- **Project aspects** (Planning, Cost estimating and Scheduling, Communication, Type of project)
- **Product aspects** (Type of product, Product specifications, Materials used, PDP, Components etc.)
- **Best practices, Pitfalls, Similarities among projects.**
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From the above presented areas, the questionnaire results (percentages correspond to 17 completed responses for ‘Broader Information’ and 16 completed responses for the other two categories) showed that the most critical issues that are required to know at the beginning of a new project are the following (Table 4):

Table 4: Critical information at the beginning of a new project

<table>
<thead>
<tr>
<th>Broader information</th>
<th>Pitfalls</th>
<th>94%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best practices</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>Improvements</td>
<td>88%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General project information</th>
<th>R&amp;D issues</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risk Management</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Technical/ Mechanical issues</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Cost estimation</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td>Scheduling</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Resources</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Planning</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>87%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific project information</th>
<th>Similar Projects</th>
<th>94%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact person</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Product Specifications</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Key departments involved</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Similar products</td>
<td>87%</td>
</tr>
</tbody>
</table>

4.1.6 Managers’ desired features of Lessons Learned System

As stated by one of the company’s project leaders, “Lessons Learned System should deliver suggestions for improvements, clear information and directions for implementation of the suggested improvements”.

Furthermore, the desire for clear directions about what should be done, who is responsible to report what and what actions should be taken to fix problems on behalf of the steering team was expressed by the majority of the interviewees. Moreover, the clarity, the good structure, availability, visibility, comprehensibility, traceability and ease of use were common expectations from the project leaders. More specific, the project leaders ranked the several attributes of LLS as presented in Table 5 (percentages correspond to 15 completed responses).

Importance has also been given to the format of information so that it could be short, relevant, reliable and standardized and therefore, not so highly dependent on the person who reports it. What is more, there was also the suggestion of a system that would provide the correct information and would filter what is irrelevant to the user’s search.

However, even if the need for short and “fast” information was underlined, the managers would like to have a system that could give them the opportunity to go in depth on a LL if they think that it is necessary for them to understand better. Therefore, they believe that it would be useful to have a link to a long, detailed
Empirical Findings

document regarding each LL that would provide project background information as well.

Table 5: Managers’ desired features of Lessons Learned System

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>93%</td>
</tr>
<tr>
<td>Visibility</td>
<td>93%</td>
</tr>
<tr>
<td>Good structure</td>
<td>100%</td>
</tr>
<tr>
<td>Ease of use</td>
<td>100%</td>
</tr>
<tr>
<td>Consistency of provided information</td>
<td>87%</td>
</tr>
<tr>
<td>Search function</td>
<td>100%</td>
</tr>
<tr>
<td>Reusability</td>
<td>73%</td>
</tr>
<tr>
<td>Profiles of interest (Possible interested people in the specific LL)</td>
<td>53%</td>
</tr>
<tr>
<td>Localizability (Information about the writer of LL)</td>
<td>53%</td>
</tr>
</tbody>
</table>

Another issue that aroused during the interviews was the “location” of the LLS. Opinions were divided: Some people prefer to have the LLS integrated into the PMS while others, would rather have a separate system because they find this way simpler and more focused on LL. Eventually, some project leaders consider unnecessary to capture detailed technical or mechanical LL due to the fact that these are too specific and should be directed to the related experts.

4.2 Benchmarking

4.2.1 Companies X and Y

The authors carried out an interview with an engineer who had worked in two Swedish companies (Company X and Company Y) with the aim to benchmark other companies’ strategies and practices toward LL.

More specific, the interview revealed that in Company X the policy is to conduct several meetings (weekly meetings with the line managers, departmental meetings every Monday, meetings between only the project managers etc.) where the most important issues and Lessons are captured. After the meetings, they put down the LL in presentation with some bullets with what went good, what went wrong, why, what should be done in the future. Therefore, there is not a LLS at the company. They only have a system for specifications, test reports etc. and there they store LL as well. There is free access provided to all documents without any limitation but there is no financial information included there because the products are mostly customized and created under specific customer order.

Regarding Company Y, there is not a functional way of handling LL as they do not use a LLS either. They are currently discussing about a system that will give the possibility to search for different kinds of information but it is not implemented yet. The interviewee underlined that the company is very good in reporting technical LL but poor in the managerial LL due to the lack of a system. What the company uses now is some standards about technical issues containing components’ details, product categories and the contact persons so that anybody can go and ask in person. They also fill some A3 electronic templates with the project
background information, what went wrong, recommendations and solutions. These A3’s and the standards are stored in a database that is only accessible for R&D but even if the information is available there, it is not at all easy to get exactly the information needed.

### 4.2.2 Internet Research

Academic literature and of Internet sources, the few LLS that exist and are used today were found. Unfortunately, there is a limited amount of LLS that are open to public, probably for confidentiality or copyright reasons.

Most companies that were checked through their web sites, seem that only report and file some documents of LL in a directory but do not have any dedicated, structured LLS and they just have a search engine where someone can type “Lessons Learned” and find all the documents regarding meetings, project reviews, new trends about LL presented in conferences and formal guidelines from certain authorities or organizations (Energy Government Office of Environmental Management, 2013; National Institute of Standards and Technology, 2013; U.S. Department of Energy- Office of Health, Safety and Security, 2013; IBM, 2013).

The great majority of what the authors discovered, concern Systems that are used in the army and similar operations (e.g. NASA, Airforce, Coast Guards, Marine Corps), especially in USA. These LLS were considered as too irrelevant to the current subject and although they were studied by the authors, they will not be presented here (Maya et al., 2005; Weber & Aha, 2002; Webera et al., 2001).

Another System that was also studied concerned Safety LL in a construction company (Gordon, 2008). This one was more focused on immediate reporting of accidents and their dissemination to the involved stakeholders in order to avoid repetition. Although the intentions of this system are common with these of the thesis, the authors also consider that the rationale is rather narrow because there was no detail configuration or description of the system and also because what they seek for is a company-wide System that will incorporate all LL (Best Practices and Pitfalls) linked to Product Development Projects.

The only System that was considered as useful for this specific research is a LLS called RITA. This system is used by the U.S Department of Transportation Research and Innovative Technology Administration for reporting Transportation LL from several joint program initiatives in 12 countries in America, Europe and Asia. The database used for the system includes summaries of the benefits, costs, LL, and deployment status of specific implementations, drawn from written sources such as evaluation studies, research syntheses, handbooks, journal articles, and conference papers. There, the user can narrow the results by filtering the information according to their preferences on some pre-set categories that the user interface provides, like for example country, area, state, goals, initiatives and more (See Figure 1). The results are therefore tailored and too close to what they look for and useful information is easily available to the public. A more thorough description of the whole system exceeds the context of this thesis and therefore it will not be further analysed. However, certain good aspects and features can be used to the current thesis as a basis of design and functions’ ideas. A snapshot of
Empirical Findings

the RITA LLS Interface is shown on Figure 1 below (U.S Department of Transportation Research and Innovative Technology Administration, 2013, Lessons Learned Section).

**Figure 1:** RITA Lessons Learned System Interface (U.S Department of Transportation Research and Innovative Technology Administration, 2013, Lessons Learned Section).
5 Analysis

In this chapter the empirical data collected at the case company are analysed and linked to the theoretical background that was presented in chapter 2. More specific, the analysis follows the stages and structure of the LLP and therefore, the subcategories are: Capture, Documentation (and Templates), Storage, Sharing and Retrieval.

5.1 Lessons Learned Process

5.1.1 Capture

The main issues that were revealed by the research concerned the method and the moment of capture LL. Indeed, the capture is not conducted under standardized routines or consistent methods or dedicated resources in this area. Hence, there are some meetings held at the stage gates but not as an established company procedure. What is more, there is a very small percentage of cases – but still important- where there are no meetings even at the end gate. Williams (2007) and Reich (2007) underline the importance of regular capture of LL during the project life-cycle in order to guarantee high level of information correctness and to avoid misunderstandings and other bad results. On this matter, Schindler and Eppler (2003, p. 227) suggest to conduct “collective interactive evaluation” of lessons at important milestones so that, as Anbari et al. (2008) state, the pressure at project closeout to move on to the next project can decrease and memory struggles can be avoided.

Two other issues that were revealed are the low participation in the LL meetings and the lack of top-management support in capturing LL. Williams (2007), Keegan and Turner, (2001), and Anbari et al., (2008) and Pinto (1999) argue about the significance of members’ involvement and commitment in LL and about how managers’ motivation influences positively the quality of lessons captured. Moreover, as Lee et al. (2006) claim, management support also can build up a positive attitude in their employees thus improving the level and quality of knowledge sharing. Schindler and Eppler (2003, p. 225) also argue that a responsible person should be settled by top management as a “neutral moderator” with the aim to be in charge of the entire LLP. Finally, Williams (2003) also highlights that management support and initiatives, standard methods and clear guidelines are needed aids for developing a learning culture, especially when capturing Lessons.

5.1.2 Documentation

On the topic of documentation, the research showed that this is very much influenced by the time constraints that in some cases result in not reporting lessons at all. Factually, many authors admit that the first cause for misreporting is time pressure that impacts also information’s quality (Pinto, 1999; Garvin, 1993).

Another typical challenge with reporting LL is that it often happens that some responsible managers no longer work at the project or even at the company, and as
a consequence the knowledge could be lost if not documented at the proper time. This is the phenomenon most commonly called “corporate amnesia” (Sharif et al. 2005).

Moreover, it has been accepted by many project leaders that the long-time distance between the issues occurred and their documentation may make them forget or, in the worst case, remember them erroneously. As claimed by Anbari et al. (2008) regular LL documentation (after LL meeting) lowers excessive memory efforts and also assures high accuracy of the Lessons for future use. Furthermore, Carrillo (2005) adds that efficient and frequent reporting will likely prevent knowledge loss.

Finally, it has been revealed that there are no standardized procedures, templates, and guidelines for LL documentation in the case company. Regarding the templates that are used to report LL at the company, the first observation is that there is not a clear and explicit purpose for each one of the available templates. This inevitably leads to misunderstandings and unorganized methods of use (Williams, 2003). The unambiguous significance of standardized methods, guidelines and forms are treated in the literature as the cornerstone of successful LL documentation (Goodrum et al., 2004; Gulliver, 1987; Roth and Kleiner, 1998; Turner et al., 2000; Williams, 2003). Furthermore, right now the quality of information is highly dependent on the person who reports and on his/her writing skills. Gordon (2008) has argued about this topic suggesting the use of simple and standard language, avoiding long descriptive text and focusing on critical and short information instead.

As concerns the content of the templates, the authors found out that there is no structured information format, there are no clear directions for improvements, most of the times there is no project summary and sometimes no information about the contact person/s for a specific Lesson is available. Indeed, Goodrum et al.’s (2004) study has shown that the proper information format will make the access, the retrieval and the updating of Lessons easier and more efficient. Moreover, as Andrade et al. (2006) have talked about, the importance of having accurate and valuable information guarantees the quality of knowledge.

5.1.3 Storage, Sharing and Retrieval

The current system used at the company (PMS) is solely a storage system where LL are located. Managers may only retrieve LL documents (if accessible) and read through the lines in order to get the information needed. Thus the current retrieval process results in a time-consuming procedure and additionally the system does not provide any properties to directly search the needed information.

In turn, managers mostly use oral communication for retrieving previous LL. Keegan and Turner (2001) have implied that functional systems and storage procedure can facilitate LL retrieval. Goodrum et al. (2004) has published a survey about the bad effects of such systems in gathering and sharing information and also about the importance of fast and easy retrieving procedures.
The final stage of LLP is dissemination or sharing of the acquired knowledge. As resulted by the findings, there is currently no available LLS at the company or any strategies to assure that Lessons will be disseminated to the stakeholders. Indeed, Keegan and Turner (2001) confirm that the lack of sharing experiences is directly linked with the lack of supportive LLS. Some other barriers are the long project duration and the poor and inefficient use of social networks. Furthermore, Goodrum et al. (2004) highlights that it is crucial for an organization to have a system that provides clear and unambiguous categorization of LL so that dissemination will be facilitated.

Therefore, dissemination is non-existent since the only substantial way that a Lesson can be spread currently at the company is only by word of mouth. Indeed, a common practice is the use of informal communication (oral, e-mail etc.) between colleagues and among departments. Cummings (2004) and Pulakos et al. (2003) seem to approve this informal sharing of information but still, they imply that both written and oral communication is necessary for knowledge maintenance, share and re-use. Furthermore, Gordon (2008) and Mohler (2004) propose the option to send LL via e-mail or newsletters to the most interested people in order to direct the right information.

Concluding and summarizing, all the findings and the solutions suggested by the literature are gathered and presented on Table 5 below.

**Table 6: Summary of findings coupled with literature suggestions**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Identified issues</th>
<th>Literature Suggestions</th>
</tr>
</thead>
</table>
| Capture    | • No recurrent LL capture at the stage gates.  
• Low participation during meetings.  
• No top-management support. | Capture lessons during project life-cycle will lead to:  
• High information accuracy level.  
• Avoid memory efforts.  
• Reduce pressure to move on to next assignments.  
Managers’ motivation and commitment in LL.  
Employment of a moderator and responsible person.  
Use of standardized methods and guidelines. |
| Documentation (Generally & Templates) | • Time constraints.  
• Forgetfulness.  
• Employees no longer at | Regular LL reporting will lead to:  
• Lower memory efforts.  
• Increased information |
### Analysis

<table>
<thead>
<tr>
<th></th>
<th>the project/company.</th>
<th>accuracy.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- No standardized routines, templates and guidelines.</td>
<td>Use standardized routines, homogeneous template and clear guidelines.</td>
</tr>
<tr>
<td></td>
<td>- Dependency on writer’s skills.</td>
<td>Use simple and standard language:</td>
</tr>
<tr>
<td></td>
<td>- Unclear purpose of each template.</td>
<td>- Avoid long text.</td>
</tr>
<tr>
<td></td>
<td>- Unstructured information format.</td>
<td>- Short, clear information.</td>
</tr>
<tr>
<td></td>
<td>- No clear directions for improvements.</td>
<td><strong>Clear and explicit purpose of template.</strong></td>
</tr>
<tr>
<td></td>
<td>- No project summary.</td>
<td>Report <strong>ONLY</strong> accurate and valuable information.</td>
</tr>
<tr>
<td></td>
<td>- No contact person information.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage, Sharing &amp; Retrieval</th>
<th>- Poor and complex storage system.</th>
<th>Functional system and storage procedure.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Time consuming process.</td>
<td>Fast and easy retrieving procedure.</td>
</tr>
<tr>
<td></td>
<td>- Propensity to informal communication (oral, e-mail etc.).</td>
<td>System with clear and unambiguous LL classification.</td>
</tr>
<tr>
<td></td>
<td>- Lack of search function.</td>
<td>Use of system combined with oral communication.</td>
</tr>
<tr>
<td></td>
<td>- No LLS available.</td>
<td></td>
</tr>
</tbody>
</table>
6 Proposal of Lessons Learned Approach

The study at the company has resulted in certain suggestions that will support the establishment of a learning culture at the company and will facilitate the smooth and effective handling of LL.

These suggestions include the proposal of a new template for the company to capture and document LL, two sets of guidelines (general and template guidelines) for the employees, and design specifications for a LLS that will support the successful knowledge and experience transfer among projects and overall project efficiency. Figure 2 shows the stages of the LLP where the authors’ suggestions will be integrated. Each suggestion will be subsequently presented and described.

Figure 2: Integration of authors' suggestions into LLP.

6.1 General Guidelines

LL implementation requires profound changes in an organization in terms of culture, awareness and change management. Based on the theory presented in chapter 2 (Anbari et al., 2008; Carrillo, 2005; Goodrum et al., 2004; Gulliver, 1987; Reich, 2007; Roth and Kleiner, 1998; Schindler & Eppler, 2003; Turner et al., 2000; Williams, 2003; Williams, 2007) and the analysis’ outcome some guidelines are considered to be an additional aid to the introduction of the primary requirements that will facilitate the LL approach at the company:

- The LLP should be incorporated into the ordinary daily routines and practices. It will not be treated as an extra task.
- LL should be documented by the employees of each department, as long as the defined structure is kept and the guidelines for reporting are followed.
Proposal of Lessons Learned Approach

- LL should be reported at any point in time but it is essential that a meeting will be held at the end of each stage gate of PDP for a short discussion and final validation.
- The project closeout meeting (end gate) should be focused on the identification of top LL and good practices.
- LL can be retrieved at any stage of a project. Even if the real benefit of LL lies at the beginning of the project (pull information) when people need to comprehend what can have positive and what can have negative impact on the processes, the use of LL can be done at any point in time. In this way the advantages that can be obtained during the project will be exploited.
- Access should be free to all employees working in NPD projects, but should only be allowed to other employees, sites or parties after permission by the responsible project leader.
- All information has to be secure/locked, meaning that it will not be possible for someone to modify the content of a Lesson.

6.2 New template

The previously presented analysis revealed the improvement potential of the company in terms of capturing LL, particularly in the area of documentation. Therefore, the authors consider essential as a first stage of improvement the change of the current templates and the introduction of one and unique new template for all stages and departments that will be easier to use, faster to compile and simpler to integrate in a new LLS.

The most appropriate categorization that was identified by the outcomes of the interviews, the questionnaires and the focus group is by each PDP stage and by each involved department simultaneously. Hence, the template will offer clear, specific, and most importantly, time-coupled and place-coupled information. Definitely, by determining an identified issue or best practice in connection with the stage of the process when it happened (time-coupled information) and concurrently in connection with the responsible department that handled it (place-coupled information) the result will be the achievement of accuracy and completeness in the LL content.

Practically, the template is an Excel file where the first worksheet is titled as “Project Info” and the rest are entitled by each department that is formally involved in the PDP (R&D, Quality, Product/Marketing, Manufacturing, Industrial design, Purchasing, Project Team).

The first worksheet “belongs” to the Project Leader who is responsible for filling there the general information of the project, the good practices (successful actions) that were used in the project and the success factors that helped to achieve these good practices. Finally, at the END GATE the Project Leader together with the project team has to decide and report which were the top LL (Pitfalls, Actions taken and Improvements) that are remarkable to be used in other projects as well.
Inside the rest worksheets there are different tables for every different stage of the PDP (Specification stage, Development stage, Industrialization stage, Production stage, Sales stage) where people from the specific department can report the issues that they identify as important to document and pass to the future users. Each table asks the users to enter briefly the issue that occurred, the actions that were taken and the improvements that can follow after this experience. For a better and more accurate specification of each issue, the users are also asked to describe it, specify the other departments that might have been involved, which areas were affected (Quality, Cost, Time or a combination of these three) and finally the author’s name. All tables have the same outline but however they are tailored according to the demands and involvement of each department in each stage (respective sub-phases), as it is defined and expected by the official guidelines of the company’s PDP.

Hence, each worksheet has to be filled by the people who belong to the respective department (Responsible Managers and employees) while the first one (Project Info) lies on the Project Leader’s responsibility. In this way, each Lesson Learned will be reported by the people who are more relevant and closer connected to it, and will also be divided so that the burden of reporting will not be put to one person but it will be a collective operation that will be a part of the PDP and will not be treated as an “extra task”.

An example of a worksheet of the new template belonging to a specific department of the company is presented in appendix 4. Clear and more detailed guidelines for a prudent and correct use and completion of the template are presented in the subchapter below.

6.2.1 Guidelines for the template

In order to give the desired results, the templates should be used in a correct way and as standardized as possible (Goodrum et al., 2004; Andrade et al., 2006). Therefore, the authors suggest that the following guidelines have to be followed:

Generally, all cells have to be filled briefly and useless information, complex language or ambiguous meanings should be avoided. Specific guidelines for the different worksheets are presented below.

Project Info worksheet

- The project’s **general information** cells (name, number, type, project leaders, business area, product family, start date) must be filled at the beginning of the project.
- **Project background information** cell: Must contain a brief description of the project and the history behind it.
- **Top LL** table: At the end gate meeting, the project leader together with the responsible managers has to review and evaluate all the lessons in order to extract and report the most important for future use.
- **Good practice** cell: After the evaluation of the top LL, the good practices for future use should be identified and reported in this cell.
Proposal of Lessons Learned Approach

- **Success factors** cell: Describe briefly which the steps that led to this specific good practice are. State only facts, not personal opinions or advice.

**Departments’ worksheets**

- The project’s **general information** cells (name, number, type, business area, and product family) do NOT need to be filled. The **responsible managers’** cell must be filled with the persons responsible for the department in question.
- **Issue** cell: State clearly in a few words which the problem was. Insert one problem per cell.
- **Description of the issue** cell: Describe completely the causes and the impacts provoked by the specific problem.
- **Actions taken** cell: Describe briefly how you managed to rectify the specific problem.
- **Improvements** cell: Describe briefly how the specific problem can be avoided in the future.
- **Sub-phase** cell: Choose between the available alternatives, in which specific phase of the stage the problem occurred.
- **Q, C, T** cell: Choose between the available alternatives, the areas (Quality, Cost, Time) that were affected more by the specific problem.
- **Other departments involved** cell: Specify whether the problem affects other departments as well.
- **Writer** cell: Enter your name.
- **Importance** cell: Choose among the 3 alternatives to specify the importance of the particular Lesson (1- important, 2- very important, and 3- extremely important).

**6.3 Prospective Lessons Learned System**

**6.3.1 General rational**

The aim is that the proposed System will be a **pull system** so that at the beginning of a new project the users will have the possibility to search within it by setting the criteria they want and will be able to retrieve the most relevant to their preferences information and LL documents (Weber & Aha, 2002). Regarding the content and context of the System, the authors believe that the best and more holistic solution is that it will be both **positive** and **negative**, since it will offer retrieval of good practices and pitfalls respectively (Bertin et al., 2012). Furthermore, the collection of Lessons will be **passive**, as the users will enter the Lessons to the new template and these will be directly stored into the System. The distribution will be **passive** as well because the Lessons will not be directed to them but only available to access through the System. Hence, the corporate memory of the company will belong to the **Attic** category (Borghoff & Pareschi, 1998; Andrade et al., 2007). Great importance has been given to the issue of **labeling** of the System fields according to the most critical elements. The designation of the labels is brief, explicit and to the point (Greer, 2008).
The company has many several projects running on the same time all over the world and therefore it will be more convenient and useful if the System would be integrated to the existing PMS that is used by all employees in all different sites. In this way, the company can improve the administration, communication, collaboration, decision making and problem solving (Greer, 2008; Bertin et al., 2012).

In their effort to find the most functional System for LL, the authors considered all the different aspects and needs involved in Project Management and especially in NPD projects. Therefore, the general rational of the System is defined by the working methods that managers use when starting a new project and the information that they primarily seek for. The main objective of the System is to offer all the necessary categories so that the entirety of the Lessons will be filtered wisely and only the important and relevant Lessons will be displayed and retrieved by the user.

So, the research has shown that the prime information is about Quality, Time and Cost issues that are possible to arise in a project. These three are usually interdependent and therefore it is typical that an issue that happens influences two of them at the same time or even all three in some cases. For example, a specific material or tool that has given high percentage of scrap in the past is probably vulnerable to do it again and this issue is linked of course with Quality but also with Time (if there is rework done) or Cost (if the material or tool is changed) or both of them either. Hence, according to the user’s needs, the System should be able to offer search functions for Quality, Cost and Time and in a lower level for any combination of these three. Afterwards, the previous information can also be “translated” or divided into the departments that were involved and handled the problem so that certain skills and specialization areas will be defined. Subsequently, even lower, the stage of the PDP when the problem occurred, the sub-phases of each stage, the Business Area where the product belongs and the Product Family will also be filters of information (Figure 3). In particular, the last two categories are central for delineating and narrowing lessons that are encountered in previous similar projects.

Figure 3: The "Funnel" architecture of the suggested System.
Finally, all the previously mentioned criteria combined together will give to the user the most relevant to the search results. It is important to say that the system will display the results in hierarchical order according to frequency of issues (rated by the system) and according to importance of Lesson (rated by the Project Leader).

6.3.2 Special attributes

The system should be designed in a way that the following attributes will be ensured (Andrade et al., 2007):

Accessibility: The data should be available to everyone and easily traceable. If there are confidential or sensitive issues included in a Lesson these should be “locked” by the Project Leader and someone should get his/her permission to access them. Also, only the Project Leaders and a few delegated people will have the authority to change an existing Lesson and this can be done after a meeting or a formal decision.

Ease of use: The system will be simple to search and Lessons will be effortlessly captured, stored and retrieved.

Search function: Apart from the categories where the user will be able to filter his/her preferences, there will be a search engine where the user can put a keyword to specify better the search and thus narrow down the results.

Consistency of provided information: The system should be regularly reviewed so that it can be updated and inconsistent or irrelevant information will be removed.

Profiles of interest: There should be a “tag” function in the system, so that someone can inform possible interested people about a Lesson that may concern them.

Source of information: There must be information about who the writer of each Lesson (knowledge owner) is, so that anyone interested in a specific Lesson will be able to contact him/her for further information.

Reusability: The system should be structured in a way that useful information can be easily retrieved for future use.

Maintenance: The system should guarantee the maintenance of useful information as well as the update of the already existing data but should also make sure that Lessons are stored in a standardized and “encoded” manner so that same issues will be presented on the same way. Moreover, the users should be able to rate the credibility, the importance and the usefulness of each Lesson through the template in order to help the maintenance.

6.3.3 Final outline

Under all the foregoing criteria and features that have already been presented and described, the user interface of the system that will satisfy the actuated conditions
and will better serve the knowledge needs of the company’s employees, will be as follows (Figure 4):

![User interface of proposed LLS.](image)

Figure 4: User interface of proposed LLS.

The system gives the opportunity to the user to enter keywords in the search engine and then the option to choose between Good Practices or Pitfalls. When one option is chosen, the correspondent category drop-down menus are available and the user can select among the alternatives. It is not mandatory to select an alternative if it is not considered useful for the search. Finally, when the desired category alternatives are specified, the search can start by pressing the FIND button.

The results of Good Practices’ search will be displayed as a list along with the related improvements and the link to the respective LL document (Figure 5).

![Outline of the Results from Good Practice’s Inquiry.](image)

Figure 5: Outline of the Results from Good Practice’s Inquiry.
The results of Pitfalls’ search will be displayed as a list of issues as shown in Figure 6.

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>DESCRIPTION</th>
<th>ACTIONS TAKEN</th>
<th>IMPROVEMENTS</th>
<th>IMPORTANCE</th>
<th>FREQUENCY</th>
<th>WRITER</th>
<th>LL DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue 1</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>3</td>
<td>7</td>
<td>Mr. White</td>
<td>LL X</td>
</tr>
<tr>
<td>Issue 2</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>2</td>
<td>3</td>
<td>Mrs. Black</td>
<td>LLY</td>
</tr>
</tbody>
</table>

Figure 6: Outline of the Results from Pitfall’s Inquiry

*Issue, Description, Actions taken, and Improvements* are very specific depending on which keywords the user has entered in the search engine. In order to offer more detailed information, the system will also show the *Writer* of the issue, so that the user has the opportunity to contact him/her for better understanding. Moreover, the *Frequency* of the issue (detected automatically by the system) as well as the *Importance* of the issue (previously established by the project leader) are presented. Eventually, the system will also provide the link to the correspondent *LL. document* so that the user can check all the issues and good practices of the project.
7 Discussion and conclusions

In this chapter a discussion of the findings, the analysis and the suggested improvements will be presented and the final answers to the research questions will be given. Besides, the major outcomes and conclusions of the thesis will follow. Finally, ideas for further research and preconditions to generalize the results will also be specified.

7.1 Discussion of findings

The main and paramount aim of the current thesis - as posed in the first chapter - was to identify the areas of potential improvements and offer suggestions on how to structure and manage the LL from previous projects. Indeed, the areas of improvements were identified in Findings and Analysis and the suggestions for structuring and managing the LL were given in Results.

More specifically:

RQ1. Which is the most effective way to capture and document Lessons Learned from New Product Development projects?

The research revealed that LL are not treated as an important task in the company. Indeed, the low number of dedicated meetings and participants to capture LL and the lack of top-management support strengthen this point and lead to inaccurate reporting. Some additional reasons that were identified are time constraints, forgetfulness and employees leaving. Moreover, the use of two different templates results in confusing and inefficient reporting.

Therefore, the introduction of a standard, company-wide template for the documentation of LL has been deemed indispensable to ensure cross-project stability and coherence.

The characteristics of the new template are:

- Common structure for all company’s projects;
- Better organization and structure of Lessons;
- Simultaneous time-coupling and place-coupling of Lessons;
- Ease of use;
- Fast compilation;
- Simple integration to LL.

The use of the new template can:

- Engage all stakeholders during the whole project life-cycle;
- Ensure recurrent LL meetings at important milestones;
- Guarantee periodical documentation;
Discussion and Conclusions

- Offer a standard reporting method;
- Decentralize the responsibility of reporting Lessons;
- Ensure Lessons’ credibility through providing the Knowledge owners’ contact information.

The benefits deriving from the use of the suggested template cannot only influence positively the right and quick knowledge transfer but also reinforce the overall project management maturity of the company.

The overall value and effectiveness of the template can be guaranteed and kept by providing some guidelines for proper and sensible use (Davidson, 2006). These guidelines ensure that there are clear rules and responsibilities and that there is a ‘homogeneous’ procedure followed by all involved people in order to avoid ambiguities and reduce the time spent on education and training.

All the aforementioned solutions have decidedly answered the first research question and have proposed a new template as an effective way to capture and document LL from NPD projects.

RQ2. “How can a System that supports efficient storage, sharing and retrieval of Lessons Learned be specified?”

The company is not currently using any System to handle the LL from projects. The empirical findings and the managers’ needs led the authors to the conception of a System from which the users will pull information at the beginning of each new project. Thus, the main goals of the LLS are to offer a fast and easy retrieval of Lessons as well as the opportunity for the user to go deeper-if considered necessary- into all the aspects of the project that he/she is interested in by consulting the correspondent template. In order to satisfy these two goals the authors carefully set the design specifications and structured the System providing the most significant categories to filter the Lessons. The categories that were identified-and are aligned to the PDP that the company follows- are: Cost/ Quality/ Time, Departments, Stages, Sub-phases, Product Family, and Business Area. These six categories along with the search engine, will give the opportunity to the user of the System to define precisely the criteria of his/her inquiry. The results of the inquiry will be displayed as a list of top-matching Lessons according to importance and frequency. In this way, the retrieval of irrelevant Lessons will be avoided and therefore, the users will get knowledge of the most possible issues that they might encounter in the future. Another feature of the System is the contact person information in case that somebody wants to discuss a Lesson with the Knowledge owner. Finally, the opportunity to “tag” an employee to a Lesson and the expanded accessibility will facilitate LL sharing among possible interested people.

Concluding, the suggested System has the potential to provide:

- Accessibility to Lessons;
- Ease of use;
Discussion and Conclusions

- Consistency of provided information;
- “Tagging” of interested people;
- Contact person information;
- Reusability.

All the above-mentioned specifications will ensure that the use of the suggested System will provide the most beneficial storage, sharing and retrieval of LL.

More specific, the potential benefits that can be earned from the implementation of the suggested System are significant. Therefore, the System may contribute to:

- More efficient learning (individual and organizational);
- Better use of knowledge and experience;
- Storage and retrieval of more Lessons in terms of number and value;
- More effective anticipation of incidents and better preventive actions;
- Faster and more flawless product development procedures;
- Better decision making.

7.2 Conclusions

As already discussed, the main purpose of this thesis was to find ways, methods and recommendations to ameliorate the structure of LL and facilitate their access, management and transfer across NPD projects. This purpose has been met through a combination of actions: the thorough study of the literature regarding the topics of Project Management, Knowledge Management and LL, the meticulous and long lasting data collection procedure, and the analysis of the current state of the company. The exploration and correlation of all these, assisted the authors to detect existing challenges and thereafter to assess the potential for improvement and restructuring in the company’s tools to document LL and in the methods to handle them. These improvements can be achieved by the use of the suggested new template, the following of the new guidelines and by the implementation of a LLS with the proposed design specifications.

Therefore, the main areas where some interventions and modifications were considered necessary are reflected by the following directions:

- Conduct frequent meetings to capture LL;
- Encompass LL to the PDP and do not treat it as an “extra task”;
- Involve all departments and stakeholders, including the steering team;
- Carefully study the suggested guidelines, train and give feedback;
- Use the template at every stage, any time you conceive a Lesson, and according to the guidelines;
- Train to become an “expert user” of the System, in order to make the most of the opportunities that it offers.
To satisfy the above directions and see the positive results, the manpower of the company (top management & all employees) needs to be systematic, persistent, loyal to the plan and patient over time.

7.3 Suggestions for further research

It can be claimed that the LL approach that is proposed in this thesis apart from practical implications for the company has academic as well.

The empirical character of the research and the fact that it is a case study make the results difficult to generalize. In addition to this, the rather small samples also imply that further research and authentication are necessary. Therefore, some future studies could be conducted on how and if the suggested approach could be implemented in other organizations.

Furthermore, the investigation showed that the people involved in NPD projects at the company find it difficult to document and transfer their knowledge which leads them to repeat the same mistakes. Hence, the LL approach of this thesis can be the beginning for a more systematic and focused research on the documentation of LL, the significance of standard procedures and the ways to achieve standardization in methods (guidelines) and tools (template, LLS).

Finally, as the empirical findings indicated that the company’s culture towards LL plays an important role, it would also be interesting to investigate the influence of organizational culture on reporting and sharing LL.


8 Reference List


References


References


9 Appendices

Appendix 1: Interview questions on Lessons Learned.

Personal/Professional information
1. What is your position at the company?
2. In which area do you work?

LL information
1. Post Project Reviews (PPR):
   - According to you, which is the aim of conducting PPRs?
   - When are they held (gates)?
   - Who are the key participants in the review process?
   - Can you describe the agenda and format of the reviews?
   - How are the results of the PPR meetings documented and disseminated?
2. Who is the responsible to decide which lessons will be reported?
   - Is the top management involved?
   - Which criteria are used?
   - Is the project’s story included clearly, accurately and completely at the LL?
3. Are you satisfied with the current LLS? Why?
   - Which are the Pros & Cons?
   - Is information useful or confusing when it is retrieved?
   - Have you ever come across any no longer useful LL (not updated)?
   - Which data are easy to capture, which not?
4. Which are the expectations and needs from a new LL System?
5. If given the authority, which actions would you take in order to make learning and information sharing easier?
6. According to you, which is the critical information that must be retrieved at the beginning of a new project?
Appendix 2: Questionnaire on Lessons Learned.

Abbreviations used: LL (Lessons Learned), LLS (Lessons Learned System)

Personal information
1. Name and Surname
2. Area of working

Stage reports during product development process
3. Do you usually report LL at every STAGE GATE?
   a. Yes.
   b. No.

Participation in reporting
4. You write down the LL report:
   a. After one or more reflective meetings with all the involved parties.
   b. Alone.
5. As a project leader, have you experienced difficulty in attracting people’s interest and participation at the project closeout meeting?
   a. Yes.
   b. No.

Culture towards reporting
6. Do you feel “obliged” or “forced” by the steering team to hand in LL reports at the END GATE?
   a. Yes.
   b. No.
7. On a scale from 1 to 5, how important do you feel it is to put effort in reporting and transferring your LL for future use?

<table>
<thead>
<tr>
<th>Not at all important</th>
<th>Not important</th>
<th>Neither important or unimportant</th>
<th>Somewhat important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Documentation/ Templates of Lessons Learned
8. Which template do you use to report LL at the EACH STAGE GATE?
   a. The word template.
   b. The PowerPoint template.
   c. Other. Specify:__________
   d. I don’t report LL at the stage gates.
9. Which template do you use to report LL at the END GATE?
   a. The word template.
b. The PowerPoint template.

c. Other. Specify:__________

10. If you use the WORD template to report your LL, on a scale from 1 to 5 specify the importance of each of the following aspects:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Not at all important</th>
<th>Not important</th>
<th>Neither important or unimportant</th>
<th>Somewhat important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast compiling of the template</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Provide direct and clear information</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Clear structure of template</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Suggested areas to cover</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Learning highlights</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

11. If you use the PPT template to report your LL, on a scale from 1 to 5 specify how often you come across the following challenges (1- seldom, 5- very often):

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Quite often</th>
<th>Very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>No summary provided</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Unstructured / unorganized information</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>No clear suggestions for improvements</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>No information about contact persons</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

12. Have you ever faced troubles because of the use of different templates?

a. Yes.

b. No.

13. If YES, specify: __________

Reasons for not/bad reporting

14. Which can be the main reasons for non-efficient reporting at the END GATE? You can choose more than one option.

a. I feel pressure to move to the next project.
Appendices

b. I no longer care about the past.
c. I may not remember every detail.
d. Involved people may have changed or left the company.
e. There are no standardized reporting methods.
f. Other….specify:_____________

Lessons Learned retrieval

15. What method do you mostly use to retrieve LL?
   a. Written LL in PMS.
   b. Oral communication with colleagues.
   c. I don’t use LL.

16. Do you usually retrieve previous LL at the beginning of a new project?
   a. Yes.
   b. No.

17. If answered YES at the previous question: Declare your opinion on the following sentences.

<table>
<thead>
<tr>
<th></th>
<th>Useless</th>
<th>Out-of-date</th>
<th>Neither valuable or not</th>
<th>Somewhat valuable</th>
<th>Really valuable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value of information</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Accuracy of information</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Improvement suggestions availability</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Improvement suggestions utility</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Tracking of the needed information</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
### Hints for useful LL for my case

<table>
<thead>
<tr>
<th></th>
<th>Not existing</th>
<th>Very few</th>
<th>Few</th>
<th>Somewhat many</th>
<th>Too many</th>
</tr>
</thead>
</table>

### Possibility to search within LL

<table>
<thead>
<tr>
<th></th>
<th>Not at all possible</th>
<th>Not possible</th>
<th>Somewhat possible</th>
<th>Possible</th>
<th>Very possible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### Time for retrieval process

<table>
<thead>
<tr>
<th></th>
<th>Too time-consuming</th>
<th>Somewhat time-consuming</th>
<th>Neither time-consuming or quick</th>
<th>Somewhat quick</th>
<th>Very quick</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

18. If answered NO at the previous question: Why? You can choose more than one option.

a. I did not know where to find the LL that I needed.
b. I had no access to the LL that I needed.
c. I thought that it would be useless.
d. I find the process too complicated.
e. Other…specify:_______

19. According to you, which are the most important benefits of retrieving LL?

20. On a scale from 1 to 5, how do you feel about the access that you have over other project’s LL?

<table>
<thead>
<tr>
<th></th>
<th>Totally limited</th>
<th>Too limited</th>
<th>Limited</th>
<th>Somewhat free</th>
<th>Totally free</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Basic information needed at the beginning**

21. On a scale from 1 to 5, value the features according to the information that you need to know most at the beginning of a new project:

<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>Not important</th>
<th>Neither important or unimportant</th>
<th>Somewhat important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendices

a. Broader information
   - Successful elements. 1 2 3 4 5
   - Pitfalls. 1 2 3 4 5
   - Similar projects by competitors. 1 2 3 4 5
   - Improvements. 1 2 3 4 5

b. General project information
   - Plant communication. 1 2 3 4 5
   - Product Systems/Subsystems. 1 2 3 4 5
   - Planning. 1 2 3 4 5
   - Scheduling. 1 2 3 4 5
   - Cost estimating. 1 2 3 4 5
   - R&D issues. 1 2 3 4 5
   - Risk management issues. 1 2 3 4 5
   - Purchase / Supplier issues. 1 2 3 4 5
   - Technical/ Mechanical issues. 1 2 3 4 5
   - Resources. 1 2 3 4 5
   - Communication. 1 2 3 4 5

c. Specific project information
   - Similar projects. 1 2 3 4 5
   - Project type (business area). 1 2 3 4 5
   - Similar products. 1 2 3 4 5
   - Product specification. 1 2 3 4 5
   - Components/ Items. 1 2 3 4 5
   - Tools. 1 2 3 4 5
   - Materials used. 1 2 3 4 5
   - Key departments involved in the project. 1 2 3 4 5
   - Contact person for clarifications. 1 2 3 4 5

22. Suggest other important information that you may need at the beginning of a new project and rate its importance:_________
Utility of Lessons Learned System

23. On a scale from 1 to 5 value the desired features of the ideal LLS:

<table>
<thead>
<tr>
<th>Feature</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Localizability (Information about the writer of LL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profiles of interest (Possible interested people in the specific LL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistency of provided information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reusability</td>
<td></td>
<td></td>
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<td>Search ability</td>
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<td>Other/Others. Specify and rate:</td>
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- Accessibility, 1 2 3 4 5
- Visibility, 1 2 3 4 5
- Good structure, 1 2 3 4 5
- Localizability (Information about the writer of LL), 1 2 3 4 5
- Profiles of interest (Possible interested people in the specific LL), 1 2 3 4 5
- Ease of use, 1 2 3 4 5
- Consistency of provided information, 1 2 3 4 5
- Reusability, 1 2 3 4 5
- Search ability, 1 2 3 4 5
- Other/Others. Specify and rate: 1 2 3 4 5
Appendices

Appendix 3: Questions of the Workshop on Lessons Learned.

1. Which are the involved parties (representative departments) in each project?
   a. Are there similarities or differences among products, business categories etc.?

2. How, when and by whom should lessons learned be collected?
   a. How should a template be designed for collection of lessons learned?
   b. Details of information in the lessons learned.

3. How should lessons learned be categorized in the most useful way?
   a. For example, according to the PDP-process/phases, product types, technical areas, risk levels, etc.

4. Suppose that there is a system of Lessons Learned today in the company and you are just about to start a new project.
   a. What information will you first search for?
   b. What is the most suitable way that Lessons Learned should be presented (e.g. best-practices, problems/solutions, etc.)?
Appendix 4: Example of the New Template