Improving uptake of Lessons Learned through a Learning Diary

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Preface

This thesis is the result of my graduation research on the field of Project Management. Knowledge management in projects has been a struggle for many project-based companies. The main challenge here lies within the application of the collected knowledge. The research in this thesis explores if a learning diary can help improve the attitude towards knowledge management, which in turn would improve the use of gathered knowledge according to Zhikun and Fungfai (2009). The research consisted of a test pilot within a project from the company Dura Vermeer. With a subsequent round of interviews with the participants. The main findings are that maintaining a diary on a daily basis requires too much effort for most of the people involved, however low-maintenance the structure may be. From the interviews it became apparent that the participants did start to think collectively on how the company should organize knowledge management on a company-wide level. The contents of the diary also did show that some topics, like time-management, were a much more frequent issue that people dealt with on a daily basis.

The main struggle with the research was the battle with keeping a constant motivation throughout a nation-wide lockdown thanks to the Covid-19 pandemic. Both for myself and the people I was working with.

First and foremost, I would like to thank my mentor Ir. Willem-Peter Huijssoon for the facilitation of my research in the midst of the Covid-19 pandemic I have always had the opportunity to ask for help and advice. I appreciate his knowledge and experience in the field of Project Management. In addition, I would like to thank Martijn Leijten and second mentor Dr. Robert Verburg for their support, advice and patience during the process of this thesis.

Also, I want to thank everyone who contributed to the research with time and effort. The information received from them have contributed significantly to this thesis.

Finally, I would like to thank my parents, my girlfriend and other family members for their unconditional support during my time as a student and throughout my graduation research.

Executive summary

This thesis aims to provide a better understanding of how one can improve the uptake of lessons learned. The core mechanism for this thesis is based around the factor that the attitude towards knowledge sharing in projects is a key factor to actually use the lessons learned in future projects (Zhikun and Fungfai, 2009). In a study done by Williams (2008) over 70% of the respondents believed a learning diary to be valuable practice to promote lessons learned, while only utilized by 20% of the respondents. So far, there has not been any study that examined the use of a learning diary for organizational learning purposes. A learning diary might be used to learn as a community when individuals use their personal diaries as input for the improvement of the organization.

To fully analyze the problem three research questions were formulated. The first research question "RQ1: What is the value of LL?" determines the need for a systematic approach of lessons learned. The second research question "RQ2: What are the barriers that make the implementation of lessons learned so challenging?" examines the barriers that are currently limiting the implementation of such a systematic approach. The third research questions "RQ3: How does a learning diary influence the attitude towards Project Knowledge Management" explores the possibility of using a learning diary to improve the attitude towards lessons learned.

To explore the use of a learning diary in a project setting, a pilot was done at a project called "De Groene Boog". De Groene Boog is a large infrastructure project to extend the A16 highway in the Netherlands. The organization used to review a project only after it was completed. Which could be over a timespan of several years and a different set of people than at the beginning. In the pilot nine people from different departments of the organization were given the task to maintain a learning diary. The exercise with the learning diary was to maintain a daily reflection journal on what went well, what could have been better and what have they learned. The exercise should make the participants take time to think about improvements in the organization. At the end of the pilot, (online) interviews were conducted to assess whether this improved attitude was actually present.

The contents of the diary also did show that some topics, like time-management, were a much more frequent issue that people dealt with on a daily basis. The result of the pilot showed that maintaining a daily learning diary is too large a task for people to maintain. From the interviews it became apparent that the participants did start to think collectively on how the company should organize knowledge management on a company-wide level. However, the exact causal connection for this was not explicitly tested. During the interviews it also became clear that a monthly team reflection would have a smaller impact on the time management of people and have a larger weight to detect the lessons learned.

An exercise like the learning diary could prove to be a low-cost analysis tool to determine the biggest pains for the employees. This does however, require further research in more cases.

Contents

1 Introduction

Project management, according to Phillips (2003) is the practice of leading the work of a team to achieve goals and meet success criteria at a specified time. The primary challenge of project management is to achieve all of the project goals within the given constraints (Phillips, 2003).

Even though a project is defined as "unique", there are frameworks all projects follow. All major Project Management frameworks used around the world (e.g. PRINCE2, PMBoK, IPMA) share the understanding one should include Project Knowledge Management (PKM) practices, like a post project evaluation. This should generate certain lessons learned after each project so that the wheel doesn't have to be invented each time. (Bakker, 2008)

Knowledge management is the process of capturing, sharing, maintaining, and utilizing that knowledge efficiently. Knowledge sharing, in particular, is done when an individual, team, and the organization share the knowledge with other members in the form of various activities (Navimipour et al, 2016).

Williams (2008) performed a study that showed that people in project organizations do believe a learning diary is important for knowledge management. We can see that a Learning diary is perceived to be a valuable practice even though not currently used much. Cooke-Davies (2002) claimed that the ability to learn from past projects for future projects is a key success factor in project management.

If every project-based company is using knowledge management practices, how can they still have the same issues in the following projects? This thesis aims to explore a method to improve the implementation of the lessons learned. A project from Dura Vermeer was used to test the effectiveness of the proposed plan.

1.1 Problem Statement

Project team members usually belong to different departments and are assigned the same project. (Bakker, 2008) In a project team, knowledge sharing is very important because the efficiency of the way projects are done can be improved drastically if implemented correctly. Sharing this knowledge can reduce cost and shorten the runtime.

Research on lessons learned have been around for over 20 years. Collier et al. (1996) has provided an early example for a process supporting the collection of lessons learned). And even though this field has been researched for such a long time, case studies, interviews, and surveys show that organizations still struggle with it (e.g., Carrillo et al. (2013); Wiewiora and Murphy (2015); Williams (2008)). In particular, there is a discrepancy between the goals and the outcomes of lessons learned processes (Carrillo et al., 2013)(Buttler, 2016). Williams (2008) found through a survey of experienced project managers that, for about 65% of respondents, their organizations collected lessons learned for some projects, but only less than 40% of respondents of these organizations actually transferred them to other projects. Less than 25% of respondents transferred the lessons learned to elsewhere in the organization.

1.2 Research Objective

This thesis focusses primarily on the use of knowledge management within the process of project management. The management of lessons learned has a far greater potential than currently utilized. Project managers are aware of the benefits but do not or barely make use of its benefits. (Nicolaisen et al., 2016) (Anbari, 2008)

The main research objective of this thesis is to determine if a learning diary can improve the moral regarding Lessons Learned in an organization. The research from Zhikun and Fungfai (2009) explains the link between an improved attitude and the usage of lessons learned. By using the case of Dura Vermeer to make a practical case that is tailored to their way of working, the pros and cons of such an exercise can be measured. The conceptual model is as depicted in Figure 1.
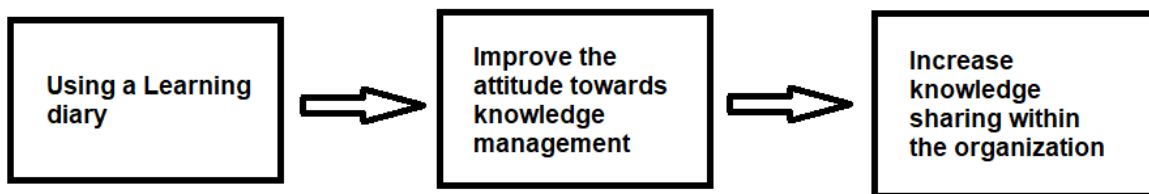

Figure 1: Conceptual model

1.3 Research Questions

This paper aims to investigate how one can organize project knowledge management practices so that the lessons learned from these practices are bound to be used in future projects.

Main Explorative Research Question

How can one improve the usage of lessons learned in future projects?

This will be explored by answering 3 Research Questions.

RQ1: What is the value of LL?

We need to define what lessons learned are and why it is valuable to manage them. We also want to know what methods and models there currently are to manage the lessons learned on projects. This research question will be answered through a literature review. There is a vast amount of research done on the topic of lessons learned and project knowledge management and how it can benefit project learning. Identifying, capturing, storing and using lessons learned is not an easy process for most companies (Carrillo et al. (2013). Which brings us to the second research question.

RQ2: What are the barriers that make the implementation of lessons learned so challenging?

The second research question aims to develop a broader understanding of the barriers and challenges that prevent the lessons learned to be implemented in different projects. For the first and second question, the available literature has been explored to answer these questions. The second research

question is answered through a literature review in combination with interviews with respondents at Dura Vermeer. This research aims to focus on the implementation of lessons learned rather than other parts of the lessons learned process.

In the available literature, a corporate culture that promotes organizational learning is an enabler to Lessons Learned Management (Zhikun and Fungfai, 2009). But how can an organization make the shift towards a more accepting attitude towards Lessons Learned Management?

RQ3: How does a learning diary influence the attitude towards Project Knowledge Management?

The third question is explored through a pilot at Dura Vermeer. The pilot explores whether a learning diary can help improve someone's attitude towards Lessons learned. This pilot is explained in more detail in the Research Method chapter. With this pilot we can determine if maintaining a learning diary can be labeled as a value-adding practices to improve the Project Knowledge Management practices at companies like Dura Vermeer. With the closing interviews we also can also measure if the learning diary might have worked better in a different format for the participants. The length of the exercise and the frequency can be altered to suit the needs of the company. For this research, the length of the pilot consisted from October 2020 till January 2021. The diary in this pilot was filled in once a day and submitted once a week.

2 Lessons Learned

To answer Research question RQ1, the available literature is examined in this chapter to give a deeper explanation into the topic. The articles used in this literature review were acquired by doing a computerized search of scientific literature via Google Scholar, Scopus and the TU Delft library. The following keywords were used: "post project review", "post project evaluation", "Ex-post evaluation", "post project analysis", "post project learning", "post project assessment", "post project management", "post project appraisal", "knowledge management post project", "knowledge management in project management", "knowledge management project management", "Knowledge sharing in project teams", "project management competences", "Lessons Learned Management" "Lessons Learned", "Organizational Learning", organizational knowledge management AND "project management", "Learning diary" AND "project management". The references of the obtained articles were checked and subsequently included if they contained relevant information (snowballing approach).

2.1 What are lessons learned

Project-based organizations collect lessons learned in order to improve the performance of projects. Overall, lessons learned can be identified as knowledge, experiences, learning, behavior, text or an entity in a process.

The purpose of the lessons learned is to repeat successes by using the positive lessons learned, and to avoid repeating negative experiences by using the negative lessons learned. Lessons learned are one of the products that should result from good Project knowledge management (PKM). Project knowledge management is defined as knowledge management practiced in project situations. Project-based organizations tend to put the focus on organizing project teams, they concentrate on effective knowledge sharing within the team and focus on individual knowledge sharing activities. However, they tend to neglect knowledge sharing between project teams (Mueller, 2014). This way the knowledge will not be distributed throughout a company. Lessons learned are one of the products that should result from good project knowledge management

Kasi et al. (2008) considers lessons learned as an entity in a process: „Post mortem evaluation (PME) has long been advocated as a means of improving development practices by learning from IT (information technology) project failures. In theory, PMEs can help individuals and organizations learn what worked and what can be improved upon so that lessons learned in one project can be applied to future projects." From a cognitive perspective, lessons learned can be considered as experiences gained in a project (Liebowitz, 2008; Schindler and Eppler, 2003), knowledge based on such experiences (Gibson et al., 2007; Liebowitz, 2008) or learning gained on a project (Keegan and Turner, 2001). Lastly, lessons learned can be conceptualized as a text or document (e.g., Disterer (2002)).

Lessons learned can be based on positive or negative behavior or experiences (Gibson et al., 2007). Lessons learned based on positive behavior or experiences focuses on behavior that should be encouraged and expanded upon. Lessons learned based on negative behavior or experiences focuses on behavior that should avoided in the future and how one can deal with such negative experiences.

The Project Management Institute (PMI) (2006) defines the lessons learned process as depicted in figure 2. They define the purpose of a lessons learned process as the activities required to successfully capture and use lessons learned.
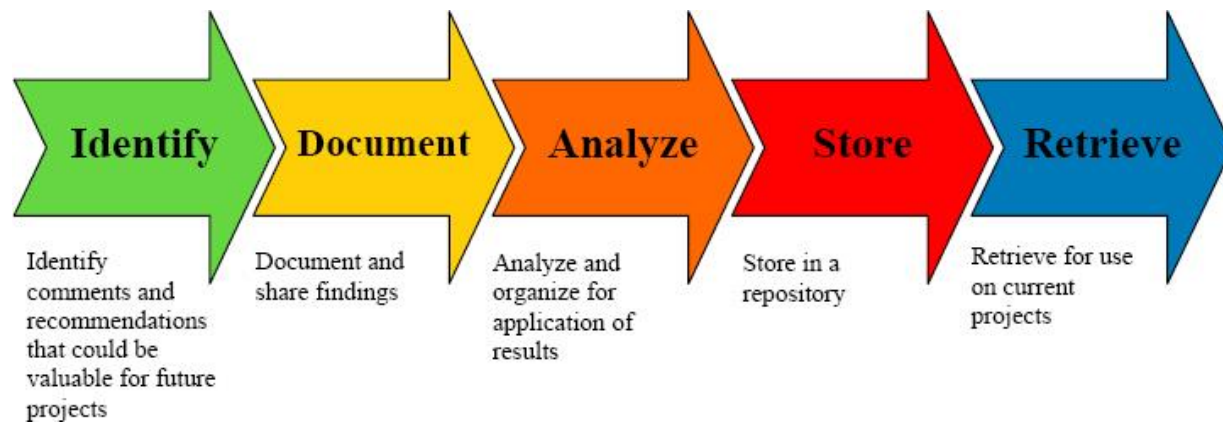

Figure 2: Lessons Learned Process. From: Rowe, S. F. & Sikes, S. (2006). Lessons learned: taking it to the next level. Paper presented at PMI® Global Congress 2006—North America, Seattle, WA. Newtown Square, PA: Project Management Institute.

2.2   What Value/purpose do lessons learned have

On the most general level lessons learned should help to repeat success or avoid failure (Gibson et al. (2007)). Other authors state that lessons learned should be applicable in future projects (Kasi et al., 2008), and provide some benefit (Von Zedtwitz, 2002) or business value (Schindler and Eppler, 2003) in those future projects.

F. Braun and Avital (2007) have investigated the impact of using good project management practices on team members. The results suggest that these practices create a foundation of collaborative relationships and a project team environment that encourages knowledge exchange, individual learning, performance and ultimately job satisfaction.

A lot of reputable sources mention why having an efficient knowledge transfer is important in a project. Love et al. (2005) wrote a book on how a project-based organization can become a learning organization. In their book they state that "The management of knowledge in project-based organizations is becoming prerequisite to sustain a competitive advantage" (Love et al., 2005, p XV). This means that it is of vital importance for a project-based company to learn if they wish to stay ahead of their competition. They also state that "Without the reuse of existing knowledge or the ability to create new knowledge from existing solutions and experiences, project organizations have to create solutions to every problem, which is clearly inefficient" (Love et al., 2005, p. XV). All of the participants in this thesis also claimed that this way of working is very inefficient. Reinventing the wheel every time you run a project is not sustainable in a project-based environment. Project Knowledge Management gives the answer to prevent this reinvention (Ruuska and Vartiainen, 2005, p. 374). Managing your lessons learned can make sure that you learn from your previous projects, which in turn can help prevent similar mistakes (Ayas, 1997, p. 898). Knowledge sharing is not as easy as it is perceived, but "Firms that can successfully share knowledge across individuals and projects may find that ideas and experiences in one project can frequently solve the problems of another" (Boh, 2007, p.2).

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2.3   Lessons Learned Models

The earliest known research to standardize the management of lessons learned is from Collier (1996).

Collier (1996) suggested a phased model to conduct a post project review.

(1) First, one should design a project survey, then conduct this survey to all persons involved in the project. Afterwards, compile and evaluate the results

(2) Then we have to collect objective project information. We can find this by measuring the project to its original and altered metrics. These typically include Cost, Schedule, and Quality, then compare that with the data collected in the survey

(3) Then conduct a debriefing. This should be an organized meeting with clear activities. These activities should at least include the distribution of time and issues and the maintenance of proper documentation.

(4) Only responsible project managers and relevant project staff should be included in the next phase. Activities must include a root-cause analysis of the problems identified, and results must be grouped according to their causal relationship to the problems experienced.

(5) In this phase, the results of the post-project review should be distributed to project teams. The information should include a description of the project, the things that went well and wrong and the lessons learned.

(6) Lastly, one should establish a link between post-project reviews and future projects. All review output is to be documented and sorted according to the lessons learned by project team function and the affected project management process. Senior executives should see the results during regular organizational reviews. Each lesson learned should be assigned to a staff member who is then responsible to further investigate the lesson and implement a solution.

This model proposed by Collier (1996) is an early effort to standardize the process of conducting post project reviews. There currently is no such universal standard. (de Jong et al, 2019) (Paver & Duffield, 2019).

Sepehri (2015) has proposed another method to standardize the management of lessons learned. In his proposition, he sketches a clearly laid out plan (Figure 3) to manage the lessons learned, all the way to implementation. However, the main focus is on the setup and generation of the lessons learned management systems. His system comprises of three stages as can be seen in the figure below.
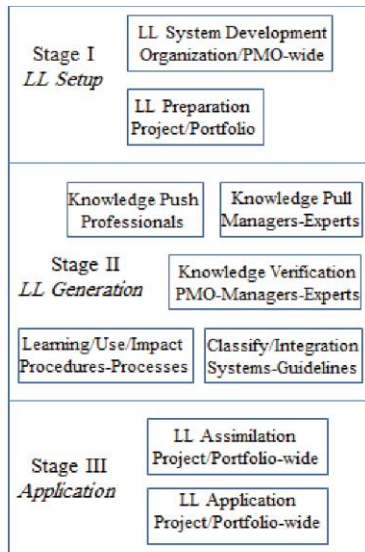
Fig. 1. Overall LL System

Figure 3: Overall LL System. Adapted from: Sepehri, M. (2015, July). Lesson learned knowledge in project management. In 2015 Science and Information Conference (SAI) (pp. 949-953). IEEE.

However, there is criticism among scholars that the lack of implementing the theory in real-life organizations and therefor requires more research into actual case studies to prove the concepts regarding the standardization of project management practices (Chipulu, et al., 2013; Hällgren, et al., 2012). Noboa (2017) also noted this and did a study into the standardization of project management practices in Ecuador. He did a multiple case study into the subject, but his main focus was not on the management of lessons learned.

2.4 Knowledge management practices

Knowledge management practices aim to create a foundation of collaborative relationships and a project team environment that encourages knowledge exchange, individual learning, performance and ultimately job satisfaction (F. Braun and Avital, 2007). Lessons learned are the explicit knowledge that should come from these practices.

One of the most used practices in the field of Project Knowledge Management is the use of a Post Project Review. Especially this field has a lot to gain from a more structured approach in (Pavel & Duffield, 2019). A post project review is a process of capturing the best practices at the end of a project. What went well and what went bad are some of the things that are discussed, noted and stored. Nowadays, the majority of the projects do this type of review at the end of a project, but it is nothing more than a document collecting dust when a new project starts (Brandon, 2019). The knowledge and benefit that can be achieved, if correctly implemented, can be of tremendous value to a company (Pavel & Duffield, 2019).

Nicolaisen et al (2016) conducted an evaluation of Ex-Post Project evaluation schemes in the transport sector. These Ex-Post Project evaluation schemes are another wording for a Post project review. Despite the widespread use post project reviews, there is a significant difference in quality, coverage and comprehensiveness of the review. There is a clear lack of standardized methods of conducting such a review. This means that every company might have a completely different understanding of what a post project review contains. They also mention in the paper that even with all the experience and management, the storage and eventual usage of the data is a widespread problem.

There is a general belief that post project reviews should be implemented (Pavel & Duffield, 2019). However, these types of reviews are not conducted in a consistent manner. In some companies, post project reviews are not even conducted at all (Anbari, 2008)(Brandon, 2019).

Busby (1999) states that there are several reasons to conduct such reviews. People do not always learn from their professional experiences, so the learning process needs to be structured in order to become relevant for people. Also, the knowledge of what happened in a project is usually spread among several people and it is of high importance to avoid repeating the same mistakes. Busby also proposes two different types of structures to conduct a post project review. First, he describes a chronological review in which the lessons learned are sorted according to their phase in the project life cycle. Second, categorical reviews in which all lessons learned are sorted on whether they were positive and negative experiences. Busby (1999) also notes that the execution of such reviews is useful to staff members, project managers and organizations. An extensive analysis of a project's shortcomings is highly recommended. From a review, one can learn what is unique to a completed project and what is more structural to such projects. They can also shine a light on the portfolio of projects on an organizational level. It is important to be as specific as possible about the problems encountered. This will eliminate confusion. People from outside the project should also be included in the post-project reviews as this will help to spread the knowledge captured throughout the organization.

Von Zedtwitz (2002) notes that ''post-project reviews are one opportunity to systematically improve performance in subsequent projects'' (p. 255). However, a survey he conducted reveals that only one out of five R&D projects conducts such a post-project review. He reviews the role of post-project meetings as a tool to improve organizational learning at the group level, categorizes learning obstruction, points out the difficulties of resolving them and proposes a five-level post-project review capability maturity model. This literature is however more subjective towards R&D projects and it is therefore not clear how generalizable it is.

Newell et al. (2006) indicate that capturing the lessons learned by project teams and storing them on a database for others to access is a widely adopted strategy to transfer knowledge from projects, but that such databases are not widely used. They explore ''why cross-project knowledge transfer fails why knowledge captured from one project is typically not used as a 'tool of knowing' by others using data from 13 projects in six organizations'' (p. 167). They conclude that ''the knowledge captured is not deemed useful and/or project teams lack awareness that there is knowledge that could be useful to help them improve their processes'' (p. 167).

Anbari et al. (2008) mention that utilizing the lessons learned from previous projects can enable project managers to manage customer expectations. They will also be able to better predict the probability of scope creep per project. They will gain better insights into acceptable quality standards for the project. Also, project managers will develop a much broader view when conducting stakeholder mapping. This means that they will gain a better understanding of who is involved in a project. Anbari et al. (2008) also propose a model to conduct a post project review. Their model measures the project against two sets of metrics. The first set consists of the traditional project metrics (Project Management Institute, 2004) is whether or not the project was completed on time, within budget, and according to the technical and/or legal specifications of project documents as set by the Project. And the second set consists of meeting the customer's expectations, final quality and how the risks and threats of the project were handled.

The general consensus between all the academics is that the general belief in the usefulness of knowledge management practices is there, but the implementation of the knowledge gained from these reviews has yet to reach maturity. There is no universal standard to engage in these practices. At least not implemented by the majority of organizations. The very nature of a project makes it hard to universalize this.

2.5   Barriers & Challenges

While lessons learned and project knowledge management is highly correlated with project success, this is not considered effective in more than a third of the cases studied by Brandon T.P. (2019). There are several challenges posed to Project Knowledge Management in organizations. Because a project is unique and temporary, it hinders the emergence and development of organizational routines, organizational memory and therefore obstructs organizational learning (Bresnen et al., 2003) (Fong, 2005). Variable working conditions and team compositions will lead to a fragmentation in individual and organizational knowledge (Prencipe and Tell, 2001) (Kasvi et al., 2003). Projects lack "natural" mechanisms for learning. Therefore, the transfer of knowledge from one project to the other is difficult. This shortage of learning mechanism is even more difficult when a project is geographically dispersed

and the project teams are intercultural (Fong 2005) (Boh 2007). Projects usually have a rather short-term orientation with a focus on immediate deliverables. In contrast, knowledge management requires a long-term perspective. Knowledge management is a long-term investment in which the initial investment in knowledge management systems and the return on investment is not immediate. This conflict of perspective can result in an insufficient transfer of knowledge between projects (De Fillippi and Arthur, 1998) (Love et al. 2005).

Several scholars examined the impact that the attitude towards knowledge management has on the usefulness of Lessons Learned Management. Zhikun and Fungfai (2009) have examined the knowledge sharing behavior among architects in a project design team and offered practical guidance to promote knowledge sharing. The results suggested that the attitude towards knowledge sharing is much more important than the willingness of the architects to share their knowledge. The presented results implied that managers should focus more on training architects to have a positive attitude toward knowledge sharing. This should increase the knowledge-sharing between team-members. Their reasoning mostly applies to architects in a project team, but might also be applicable to project teams in general. From this research, they namely suggested to build up a knowledge-sharing culture so that the architects' attitudes toward knowledge sharing become more positive. Thus, creating a more frugal PKM environment. Rowe et al. (2006) also states that capturing lessons learned should be an on-going effort throughout the life of the project. The mindset of continues improvement should be strongly encouraged by the project manager from the start of the project (Rowe et al., 2006).

Choi et al. (2010) have examined the impact of IT and transactive memory systems (TMS) on knowledge sharing, application, and team performance. They found that knowledge sharing has a positive impact on knowledge application, which in turn has a direct impact on team performance. Their results also showed that IT support in organizations has a positive impact on the development of TMS in teams and that both TMS and IT support have a positive impact on knowledge sharing and application. Their research shows that organizations can improve team members' meta-knowledge of who knows what through the careful investment in IT. Finally, their results showed that sharing knowledge alone is not enough. Organizations must ensure that the captured knowledge is in fact applied in projects in order to improve the team performance.

Love et al. (2005) Also mentions some of the challenges that organizations must solve to have an effective transfer of knowledge. Senior managers must create and govern the supportive project environment. Part of that environment is the management of knowledge. The project-based organization needs to think about how it is going to select new knowledge, where they are going to store it, and what it is going to needs to create a fourth step of knowledge management, distribution of knowledge to new projects (Love et al., 2005).

Qi, Wang, and Ma (2010) have examined the impact of several key factors that may affect knowledge sharing within project teams. These results showed that both intrinsic and extrinsically motivated individuals tend to share more knowledge with their team members. Individuals with high altruism are also more likely to share knowledge with others. Moreover, explicit knowledge facilitates knowledge sharing while tacit knowledge creates barriers to knowledge sharing.

Mueller (2015) has investigated the process of knowledge sharing between project teams and used a case study approach. The results indicate that projects create boundaries. Employees and project team leaders mainly use formal mechanisms and they develop informal practices for sharing knowledge between project teams. Furthermore, organizational cultural characteristics in these practices can stimulate the discussion in "knowledge and culture research" regarding the relationship of organizational cultural characteristics and knowledge processes.

Williams (2006) conducted a survey with 522 responses which showed that 32% of the respondents' organizations ''had a specific department responsible for supporting employee learning from projects. The main roles of these departments were to capture learning from projects, to ensure compliance to standards, to transfer learning to future departments, and (less frequently) to audit the lessons-learned process'' (p. 4). Later on, Williams (2008) performed a study to determine the state-of-art of lessons learned management. From his research a number of general conclusions are drawn as to how to create project organizations that are learning organizations. The results of this study, as shown in Figure 4 and Figure 5, show us that the project organizations do know how they can achieve better results in terms of lessons learned. These results also provides a good starting point to test the perceived important practices and whether these actually improve the implementation of lessons learned. A learning diary as can be seen in figure 5 is not widely researched in literature, which does bring an opportunity for the research. Williams (2008) also states that: "*the dissemination of lessons and incorporation of lessons into organizational practice have received less attention in this brief study, and clearly needs further research.*"

Figure 4: People Involved in Lessons Learned. Adapted from: How do organizations learn lessons from projects—And do they?. By Williams, T. (2008). IEEE Transactions on engineering management, 55(2), 248-266.

Which practices should you be doing?

Figure 5: Which practices should you be doing? The figure shows the results of the interviews from Williams' research. Adapted from: How do organizations learn lessons from projects—And do they?. By Williams, T. (2008). IEEE Transactions on engineering management, 55(2), 248-266.

To summarize, the field of Project Knowledge Management still has a way to go to be fully embedded in the field of project management. The available literature does prove that Knowledge Management within projects is of high importance to further the field of project management. There are several challenges that we have to overcome to fully benefit from its possibilities. The main challenge lies in creating a culture that embraces knowledge management. We need to learn from our past successes and failures to keep improving the way of working.

It requires more real-life experimentation to determine what the optimal set-up is. The models that have been proposed in the last 5 years especially have not had enough time yet to study its implications fully. As a lot of projects run longer than that time. Also, most organizations already have their own processes based on their own infrastructure. This makes the data hard to translate to other project-based organizations.

2.6   Learning Diary

Learning diaries are personal records about the experiences that occurred on that they and what they have learned from that experience. Can a learning diary also prove to improve a person's intrinsic motivation to improve the way of working in a project-based organization if one records Lessons Learned in a diary? First, we do a literature study into the use of a learning diary. Then, we take a deeper look if a learning diary is used in project-based organizations.

Could a learning diary also prove to improve a person's intrinsic motivation to improve the way of working in a project-based organization if one records Lessons Learned in a diary?

From the study done by Williams (2008) we can see that a Learning diary is perceived to be a valuable practice even though not currently used much (Figure 5). There is close to none literature studying the use of a learning diary in a project. A simple search query in Google scholar with "Learning diary" AND "project management" only provided 82 results, all since 2017. All of these only studied a learning diary in a different setting. Mainly regarding students. This provides a gap in the knowledge to study in this thesis. SCOPUS gave 6 results that did not apply to a project-based organization. In Williams' study, he

only asked the respondents whether they believe a practice to be useful or not. Maintaining a learning diary could also improve the motivation of the writer (Clipa et al, 2012).

In a study among students, the use of a learning diary did make the students take more ownership of their own learning goals and development (Huisman & Wallenius,2018). However, this study also showed that the level of sustainable learning was linked to the persons engagement. It showed that engagement is a major factor to embrace self-assessment activities.

There has not been any study that examined the use of a learning diary for organizational learning purposes. A learning diary might be used to learn as a community when individuals use their personal diaries as input for the improvement of the organization.

3   Research Method

This chapter explains how the research data was collected and analyzed. A pilot was done within the project "De Groene Boog" to test the effectiveness of a learning diary in a project. The details of the pilot and how it was framed will also be explained.

3.1   Research Strategy

To investigate whether a Learning diary can have a positive influence on the attitude towards Lessons Learned in future projects. A pilot was done within a project from Dura Vermeer and other cooperating companies. The project that was chosen was "De Groene Boog". A multimillion-euro project to extend the A16 highway in the Netherlands. During the Covid-19 pandemic the majority of the people work from home. This also influenced the research method to an online exercise.

While project managers do believe that a learning diary might help them with the project knowledge management (Williams, 2008), there is not any research done that investigates the potential a Learning diary might have in a project setting. Also, the results from Zhikun and Fungfai (2009) suggested that the attitude towards knowledge sharing is much more important than the willingness of the architects to share their knowledge. The goal of the pilot with the learning diary is to improve that attitude by making the participant think about knowledge management on a daily basis. With the findings of Williams (2008) and Zhikun and Fungfai (2009) the expectation is that by being more aware of knowledge management, the attitude towards it will change for the better.

To answer Research Question RQ3, a pilot with a learning diary was run at Dura Vermeer. Via interviews, the perceived usefulness of the pilot was measured. After the pilot, the respondents were asked whether a learning diary helped improve their perception of using lessons learned positively. With the open questions at the end of the interview, the goal is to identify alternatives to the learning diary that the participants would identify. This is also in line with the expectation that the exercise will make the participants think more pro-active about the knowledge management within their company.

3.2   Methodology

Before the pilot, no interviews were held. The decision to not take any interviews was 2-sided. Firstly, the exact structure for the interviews was only conceived during the pilot. Secondly, there was already an open discussion during the explanation meetings of the pilot. The general consensus of those meetings was that all the participants felt that the current situation did not satisfy their need for knowledge sharing. Eight of the nine participants were interviewed a week after the pilot ended.

No control group was used in this research. This choice was made to let the participants themselves reflect on the before and after situation. It was already very hard to get people to commit to this research. Therefore, the sample group could not be too broad.

In this thesis, semi-structured interviews were used as a versatile method to obtain both factual information and insights into intentions, expectations, or perceptions. They were used to collect data for three purposes:

1.   To assess the perceived workload, usage and perception of maintaining a learning diary

2. To measure a change in mindset towards knowledge management
3. To obtain information of possible variations on the learning diary

The interviews were semi-structured to allow more room for follow-up question. This was mainly done to explore the variations on the learning diary as mentioned in the third purpose. The open questions in the interview allowed for more in-depth conversations about possible alterations on the research.

A pilot study was chosen for this research, because of two reasons. First off, the sample size could not be too broad as it requires a lot of commitment from both the organization and the participants itself. Secondly, the possible timeframe to run the pilot was three months due to the time restrictions on a graduation research. In the best-case scenario, this research would run from the beginning till the end of a project to test the research across all stages of a project. These conditions would fit best for a pilot study since a pilot study is defines as a small-sample, quantitative study conducted as a prelude to a larger scale study (Polit & Hungler, 2004). This exploratory pilot study aims to get a better understanding of the use of a learning diary in a project setting, which could guide future studies into the subject (Connelly, 2008).

3.3 Case overview

The research for this thesis was done at a construction company in the Netherlands. Namely, Dura Vermeer. Dura Vermeer has 2 main divisions. The first one is the Construction and Property division and the other is Dura Vermeer Infra. The latter one is involved with large infrastructure projects. Dura Vermeer Infra at the time, was starting to standardize more and more of their processes, so the aim of my research was very interesting to them. For my thesis, I was involved with the Infra division on a project called "De Groene Boog". Internally also known as DGB.

3.3.1 De Groene Boog

De Groene Boog is a combination of the companies Besix, Dura Vermeer, Van Oord, John Laing, Rebel and TBI. They are responsible for the design, construction and pre-financing of the new ring road A16 in Rotterdam North (Figure 6). The proposal of De Groene Boog is energy neutral, innovative and blends in optimally with the environment. De Groene Boog is responsible for the design, construction and pre-financing of the project, plus maintenance over a period of twenty years. Construction is expected to started early 2019. The road will be opened to traffic at the end of 2024. The original project budget is 984 million euros.

Figure 6: A16 Rotterdam, source: https://www.a16rotterdam.nl/projectkaart/default.aspx

3.3.2 COVID-19 implications

This research started in September 2020, which was in the middle of the Covid-19 (Also known as Corona) pandemic. This had implications on the research. The government issued all non-essential workers to work from home. What this meant for my research was that most of the communication had to be done online. This is not the most optimal way to research a process that revolves around the communication of lessons learned. At the end of the thesis, I will explain some of the noticeable implications this had on the research. The main things were that people found that they did not use their time effectively, that the online meetings felt useless. What the work-from-home situation also meant, was that to get information, it was not as easy as walking in the office and talk to that person, but you had to wait for an email of that particular person. This also made the collaboration between colleagues in the company work in a completely different way than before Corona, as everyone started to get used to this new way of communicating. It will impact the replicability of the research since the way people cope with the corona measures change constantly.

3.4 Data Collection Methods

The data that was collected originated from two sources. First the diaries that were filled in and submitted. Secondly, the interviews that were held after the pilot ended. This chapter will explain how the sample of the pilot was selected and how the diary and the interview was framed

3.4.1 Sample

The sample was determined in coordination with Willem Peter Huijssoon. The subjects were chosen to all be from different departments of the project. From each department, the subjects were chosen at random. No distinction was made whether the subject was open for learning. The selection process also did not take into account the willingness of the person to cooperate. The goal was to have as little bias as possible. The sample set consisted of people aged 25 to 60. There was also no selection on gender. Eight out of the 10 people selected were male. This is mainly due to the fact that the project is male dominant. One could classify this method as cluster sampling.

Once the sample was selected, the participants were individually contacted via Microsoft teams. In this meeting I explained them the concept of the research. The task for the participants was to fill in the diary according to the format as can be seen in Appendix 2. They were free to fill it in as they saw fit. This made it possible for them to be creative with their writing. I also explained that the format was not as strict, they could use/write the diary like they wanted to. The format in Appendix 2 can be seen more as a guideline. At the end of every week, I would ask the participants to send me their diaries from the past week. The pilot has run from October 2020 till January 2021. This runtime was also determined due to the time limitation on the thesis. The participants were also encouraged to spread the word of their diaries to colleagues.

The anonymity of the interviewees was promised for each setting. This thesis uses aliases to allow the reader to differentiate between the interviewees. Furthermore, the contents of the learning diaries in the pilot had to be treated confidentially. In order to handle this limitation, the specific contents of the diaries are only described in a very general way when summarized.

Table 1: Pilot Participants

Interviewee	Position	Gender	Age	Participation grade
DV1	Project Lead	M	45-55	3/10
DV2	Project Manager	M	35-45	4/10
DV3	Integral Design Manager	M	45-55	10/10
DV4	Design Manager	M	25-35	10/10
DV5	Department head execution	M	55-65	1/10
DV6	Process Manager	F	45-55	2/10
DV7	Document Controller	F	45-55	0/10
DV8	Safety Manager	M	45-55	0/10
DV9	Technical Manager & Manager Project Control	M	45-55	0/10

It is noteworthy to mention that the middle of the pilot consisted of the winter holidays, which did create a gap in the data since most of the people in the organization did not work during that period of time. This is not an ideal situation unfortunately. Originally, a of total 9 people participated in the pilot. The sample could not be made much larger as the exercise does require a lot of commitment from the participants and it was hard to find more people willing to participate.

DV1 and DV2 did not send anymore diaries after the winter holidays and did not respond to several reminders.

DV5 only send a diary at the beginning of the pilot. The same goes for DV6, but she did send another diary at the very end of the pilot. Both DV5 and DV6 also did not respond to several reminders.

DV7 said that she had the intention of maintaining the diary up till the end. Even in the interviews DV7 said that she really had the intention, but just did not came to it.

An informal interview with DV8 was held to see why he wanted to stop the pilot. He told me that the safety department has an existential role to spread good practices regarding safety throughout the organization. This highly correlates with the management of lessons learned. The only difference is that those lessons learned only revolve around safety. The things he would write in his diary would already be part of his job to act on. Therefor he did not see the added benefit of the exercise.

DV9 was on board with the pilot and agreed to participate in it. However, as soon as the pilot started, he was not reachable on both e-mail and telephone. Due to working from home, a visit by his office was also not possible. The reason he decided not to participate after all remains unknown. DV9 did not participate in the interviews.

The participation grade in Table 1 is calculated as the number of weeks a learning diary was submitted out of the 10 weeks that the pilot ran.

3.4.2 Learning diary format

To investigate whether a Learning diary can have a positive influence on the uptake of Lessons Learned in future projects, a pilot was done within a project from Dura Vermeer and other companies. The project that was chosen was "De groene boog". A multimillion-euro project to create the new A16 highway in the Netherlands. The goal of this practice is to get everyone in the organization thinking about ways to improve the way of working. According to Zhikun and Fungfai (2009), a major obstacle to knowledge management is the corporate culture and how people view knowledge management. The content of the Learning diaries will be analyzed and coded for the use of Dura Vermeer.

The format (as can be seen in Appendix 2) was made as simple as possible by intention. The format is derived from the suggestion by Allan (2017, p. 15). The participants were asked to fill in the diary on a daily basis. The choice to maintain de diary daily, was made to test the shortest sensible interval for a diary. The format is explained to the participants to be used as a simple guideline, rather than a very strict journal. They could also leave certain fields blank if nothing noteworthy happened that day. The

participants were encouraged to fill in the diary as they saw fit. If the diary would consist of too many guidelines, they could hinder their creativity.

What went well?
To describe the positive lessons learned, this column asks the participants to fill in what they thought went well that day. This could be a certain practice that helped them communicate better or that they thought they had spent their time optimally that day.

What could go better?
To describe the negative lessons learned, this column asks the participants to fill in what they thought did not go well that day. The question is purposely stated in this way to promote thinking of problems that can be fixed. If the question would be "what went wrong?", then they would search for negative things, instead of thinking about the solution to that problem

What could be learned?
This column should bring a combination of the positive and the negative experiences that the participants had that day. It could be a practice that went very well that they believe should be used by more people in the organization. It can also be a problem that they experienced, that they want to communicate to more people to prevent this issue from happening in the future.

During the pilot, the contents of the diaries were collected in a single document and analyzed on a weekly basis. A weekly reminder at the end of the week to submit their diary for the past week was sent via email. In the middle of the pilot, I also updated the participants on the current status of the research. The decision to give an update to the participants was made to keep the motivation of the participants. During a discussion with the coordinator, it became known that the motivation to maintain the diary will be higher if it is shown that the diary is being acted upon.

3.4.3 Interviews

To assess the general view against Knowledge Management Practices interviews were held with the relevant stakeholders after the pilot. Based on the research of Zhikun and Fungfai (2009), the understanding that knowledge management is something that needs to be embraced, rather than something that just needs to be done. By measuring the attitude towards the knowledge management practices with the various participants, we should be able to deduct the perceived improvement of the project knowledge management.

On January 31, the pilot ended. The following week, I held the individual interviews with 8 of the 9 participants. The exact structure of those interviews can be seen in Appendix 1. The interviews were done online via Microsoft Teams and recorded. The recorded interviews were transcribed on a later date. The diaries are analyzed by categorizing each topic that came up in the diaries. These topics will be further explained in the results chapter. At the end of the pilot, the number of times certain topics came up were compiled in a matrix. This matrix ranks the cumulative complaints/compliments. This matrix will show which topic and in which layer of the organization the majority of the improvement can be attained. Which in turn can easily be communicated with higher management, to improve the way of working in the project.

Unfortunately, it was not possible to have the interviews face to face due to the corona measures. A face-to-face interview should give more details about their exact experience with the diaries. A study by Krouwel et al. (2019) researched the difference in online and offline interviews and found that "in-person study interviews were marginally superior to video calls in that interviewees said more, although this was on a similar range of topics." (Krouwel et. al., 2019). I did have a technical difficulty during the interviews. As the audio was hard to hear with some participants and the video of the participants did not show to me after a certain time. This did cause me to miss some facial cues during the interviews.

3.4.4 Interview Structure
The exact interview structure can be seen in Appendix 1. The reasoning behind this structure is explained in detail below

The interview is structures in a way to first collect the basic data of the interviewee, such as their role in the project and their responsibilities.
Then a small introduction from the participants on the project. While every participant works on the same project, the question is asked to frame a helicopter from the interviewee. After the framing question. The questions about the project context are focused on the correlation of mistakes made on the current project and the past projects. This question is asked to clarify the need for a more systematic approach to lessons learned. Then the interview zooms in on the reason why these mistakes were made. This question asks the participants to think about the root cause for the previous issues to keep occurring. To finish the question about the project context, the interviewee is asked to reflect on the knowledge management maturity of the organization. This question asks the interviewee to determine how they would rank the project in contrast to other companies in their knowledge. The questions about the project context are asked in a past tense to primarily focus on their view of the project before the pilot.

Then the interview shifts towards the questions about the learning diary. The questions start with an inquiry into how they experienced the past three months working with the learning diary. To further understand how the participants explicitly used the diary, they are asked how the have used the diary. This could be as a personal reference or as input for communication with others. If the interviewee did use the diary in an unexpected way, follow-up questions were asked on the spot. Then the participants were asked if they believe the learning diary to be useful in their organization. If they did not believe the diary to be useful, a question was asked how they would change the format to be useful to them. Especially with this question, follow-up questions were asked to brainstorm about possible alterations and define them as detailed as possible.

As a final section of the interview, the interviewee is asked to reflect on their view on knowledge management as a whole. This section of the interview explores the main outcome of Research question RQ3. The interviewee is asked whether their view has changed, be it positively or negatively. The following question asked whether they believe that they have matured in gathering and spreading lessons learned during the pilot. These two questions ask the respondent to identify the changes from before and after the pilot was conducted. To conclude the interview, the interviewee is asked if they have any other questions or remarks on the pilot. This question can open up any other topics that were

not specifically asked during the interview. The interviewee is also notified that they will get a copy of the results once the research is finalized.

4 Results

The results from the empirical analysis are divided into two parts. First off, the results from the contents of the learning diaries made by the participants. Secondly, the results that followed from the interviews held after the pilot. The results from these two parts are given in this chapter and subsequently interpreted.

4.1 Learning Diaries

Due to confidentiality, the exact contents of the diaries cannot be given in this thesis. However, the interpretation of the content will be discussed in this chapter.

The topics in Table 2 were self-deducted categories. Three weeks into the pilot I analyzed the entire set of diaries and noticed that certain topics would keep coming up. I then tried to define each line in the diary and place them in a category. Instead of trying to fit the content of the diary into the pre-determined categories, the categories were formed around the trend of topics that were discussed in the diary. This would fit the context of the diary better, because of the very open structure of the diary.

Table 2: Learning diary Content analysis

	DV1	DV2	DV3	DV4	DV5	DV6		Cumulative
Time Management	4	7	6	5		6		28
Communication	4	3	7	4	1	1		20
Contract Management	1	1		1				3
Collaboration	1	2	3	2				8
Quality		2		2				4
Self-improvement		1						1
Lack of standards	1		6	2	1			10
Novel idea				1	1			2
Participation grade	3	4	10	10	1	2		

4.1.1 Time Management

The content of the diaries made for a good insight into the most frequent challenges the participants faced during the project. The topic of Time management came up the most in all of the diaries. The results in Table 2 show that the need for an improvement in time management is mentioned more often than other topics. In the content of the diary, it is stated that the time management issue consists of both the time of the writer and the time management of colleagues of the writer. Some writers reflected on their own working day and concluded that they did not spend their time effectively. While this is a common point of self-criticism, the shift to working from home could have influenced the frequency of this complaint. As everyone had to start working from home, people were only starting to figure out how to best manage your own time. This can explain the high number of time management issues in the diaries.

That is probably why we see that the biggest problems that are now being found are related to things such as: meeting online, how to communicate and the cooperation with external parties is found to be difficult. Problems with organizing your own time also appear to occur more often. The lockdown can send this problem in two directions. Either one has more time to do real work, or one spends more time on trivial things. Emailing often turned out to be a lot less efficient than meeting face-to-face. It is therefore good to schedule a meeting more often than to send an email.

4.1.2 Communication

A lot of comments on communication have been made in the diaries. This communication was not only the communication with colleagues, but also with other stakeholders. When discussing the communication with colleagues, the writers mainly reflected that they should have communicated work orders in a different way or sooner with their colleagues. The main points of self-reflection with the stakeholders were that the stakeholders should have been involved earlier on in certain processes. The majority of the topics on communication were about the communication with the stakeholders.

4.1.3 Contract Management

When certain stakeholders did not deliver up to standard, the writers would reflect on this discrepancy. The writers would think about how they could handle that issue in the future. For instance, some of the writers stated that this should be better documented in the contract up front to minimize the risk.

4.1.4 Collaboration

The topic of collaboration has a lot of similarities with the topic of communication. Some of the differences used to distinguish the two were when the diary would talk about certain issues with writer's colleagues or when they would have liked to involve a colleague with a certain expertise in their work.

4.1.5 Quality

The quality of work delivered by others was not always up to standard. This directly impacted the work of the writer. One writer also reflected that he was not happy with some of the work he delivered that day, but vowed in the diary to fix that the next day.

4.1.6 Self-improvement

This topic gave rise, because DV2 mentioned in his diary that he would like to participate in more of the financial reviews to gain more insight into the topic. This meant that he wanted to learn more about a subject.

4.1.7 Lack of standards

The topic "Lack of Standards" was given when the participants noted and/or complained that there was nor given guideline for a certain process. No given guideline for a certain process. The writers noticed that this sometimes causes certain processes to have different outcomes. Ideally, they would like to see a clearer instruction given with certain processes to make the results more uniform.

There were a lot of good ideas written in the diaries. Whenever someone noticed that a process lacked a certain standard, the participants would explain how they would like to see the process standardized.

This could mean that the reflection made them take ownership of the problem and come up with a concrete solution. This did not only occur when a lack of standards was noticed. With every diary entry that "could be improved" the writers also wrote a possible solution in the "What could be learned" column. The entries in this category probably came up, because at a certain point in time, the participants felt this "itch" that they noticed something was missing in their work process.

4.1.8   Novel Idea

When a writer would come up with a solution that is not directly linked to one of the aforementioned categories, it would be categorized under a novel idea. For instance, one novel idea that was written in the diary was the suggestion to have a scientist on site to test the ground samples the moment they come up. This would reduce the time needed for testing since there would be no need for the sample to travel from the site to the laboratory.

4.1.9   Analysis

From the contents of the diary, I noticed that the entries are mainly based on the project itself and not so much based on lessons learned for the organization Dura Vermeer. This is in line with the findings of Huisman & Wallenius (2018). This does not make every entry suitable to be applied to the organization. This would require another step of deeper interpretation of the data in some cases.

The results from the learning diaries did show that certain topics were more frequent and apparent than others. The wording of every diary may be different, but the underlying problems were in some way similar. This made it possible to categorize them. The topics of time management and communication are the most common, they are also the topics that are the most likely to happen on a daily basis. When someone notices that a certain process misses a standard, they only reflect on it when there is a clear problem. This makes the diary matrix in Table 2 more likely to report on day-to-day problems. The problems that arose around the topic of "Lack of standards" are something different. The entries in that category all state a clear lack of standardization in their workflow. These entries can all be acted upon by the organization and improve their way of working directly. Therefor, the entries in the category "Lack of standards" do not revolve around the day-to-day issues, but on a more overall missing process.

The exercise of maintaining a learning diary and summarizing the results in a matrix like Table 2 on page 22 can be used by the company to tackle the most stressed problems. This allows a company to utilize their resources more effectively. The learning diary did make a clarification of the most apparent day to day issues at hand. The organization could use the resulting ranking to better focus their improvement effort. For instance, in this research the issue of poor personal time management was noted as the most apparent issue. With this observation, the organization could determine to provide time management courses for their employees. This course of action would allow the company to help their employees in a personalized manner with the most optimal personal improvement. If an organization is to use a learning diary this way, the learning diary might even be seen as a low-cost analysis tool. Given that the employees do not take too much time to fill in the diary.

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4.2 Interviews

As with the contents of the learning diaries, the transcripts of the interviews cannot be given for the sake of confidentiality.

The practice of using a learning diary did not make the participants have an improved attitude towards knowledge management. The pilot itself and the following interviews did make them think about the current knowledge management processes and how they would like to see them improved. The expected change in behavior depends on the person and the department.

4.2.1 Low participation grade

Most of the participants showed a low motivation to maintain the learning diary, as can be seen in table 1. The people that did have a high participation grade told in the interviews that they were already keen to improve the project knowledge management before the exercise. A big factor for the low motivation for them was that it did not help them immediately. People want to see that their input has value, otherwise they will not do the exercise. The participants also had to dedicate a portion of their time to the learning diary. This did make the practice look like something challenging to them. The participants found it difficult to really sit down at the end of the day to reflect on the lessons learned from that day. People will need an intrinsic motivation to reflect upon their own work. Also, most of the participants did not deliver anymore diaries after the winter holidays. The major drawback from working from home is that one cannot simply meet with the person to clarify the situation. You are reliant on the willingness of the other person to respond when working online. The weekly reminders and personal invites to discuss the lack of content did not get any reply. Only with the interviews after the pilot, the response was that they simply were too busy after the holidays and forgot to maintain the diaries.

This type of complaint was up with the question how they would like to see the format changed. Almost all of them said that they would decrease the frequency of the diary. Most of them saw a real potential in having a monthly reflection meeting with their team.
While the diary is a very personal reflection. Most of the participants saw more potential in having a reflection based on their own team. The suggestion that most of them made was that a daily personal diary could function as an input for a monthly reflection meeting on a team-level. However, the daily diary should not be made mandatory. The interviews were interesting, because they sparked an open debate about how to implement better knowledge management in the organization.

It did become apparent during the interviews that the willingness to learn highly depends on both the individual and the department they work in. For instance, the safety department has an existential role to spread good practices regarding safety throughout the organization. This practice can already be seen as a certain type of lessons learned sharing. For the safety department, this only means that the lessons learned only revolve around safety topics. The Process management team also mentioned during the interviews that they already did sporadically hold an internal reflection meeting on how to improve their own current processes. This shows us that some departments are already more focused on lessons learned than other departments. The department that the participant worked in had a high influence on their perceived usefulness of the learning diary.

4.2.2 Project context

Every participant stated the same thing. They saw that a lot of mistakes from previous projects were also made in current projects. Some of the participants had an explanation for this. Namely that every project that Dura Vermeer does is a collaboration between different parties. When a group of different parties starts a project, it is decided up front which systems will be used in the project. This way the project has a document system from company A, planning software from company B and a customized design tool from company C. This makes it very hard for an organization to generalize lessons learned that revolve around the use of these systems. Other participants stated that Dura Vermeer was not yet mature enough with their lessons learned, because having a single post project review at the end of a project is very ineffective. A lot of the project members would have switched roles throughout the project and it is almost impossible to remember certain important details that occurred several years ago, since that is the typical runtime of their projects. Everyone did say that Dura Vermeer could benefit from having a more systematic approach to their own lessons learned process.

4.2.3 Learning diary reflection

The participants that did fill in the diary regularly were overall positive about the Learning Diary. All of the participants reflected that the pilot is a very time-consuming task that they had to remind themselves of every day. Only DV3 and DV4 had used an approach that worked for them to maintain the diary. DV3 just set a reminder in his calendar at the end of every day and filled in the diary accordingly. DV4 actually did not maintain the diary on a daily basis, but did reflect on the entire week every Friday. This allowed him to keep the workload to a minimum and, as he stated, allowed him to have a better overview of the events of that week. All the other participants said that they simply could not find the time to fill in the diary. When they would be one day behind on the diary, they would tend to also forget it the subsequent days.

While DV7 did not send any diaries, she did like the concept of the learning dairy and acknowledged it's value, but did not had the time to sit down and reflect upon her day. This tells us that the workload of maintaining the learning diary on a daily basis was too much for most of the participants. It would be better to reduce the workload. This tells us that a daily diary might be too much to ask of the participants and that maybe a weekly interval might work better.

The participants very rarely used the learning diary with a different purpose than intended. None of the participants used the diary as a personal backlog of their work. Only DV4 did use the diary to make action points for himself to focus on the following week.

The most interesting part of the interviews was the brainstorm session on how a different format of the learning diary might work in the organization. From the interviews with the participants, it became clear that a process is needed to ensure implementation of lessons learned in a project. During the interviews several ideas for a monthly reflection meeting were conceived. Most of the participants mentioned that this meeting should consist of two parts. First, the meeting should cover both the positive and the negative topics that were present during the past month. A simple database to store and retrieve this information should be present at the company level. Secondly, the topics that arose last month should be the topics that you will work on for the next month. This way, people should improve their recurrent

struggles on a monthly basis. This format was formulated by combining the suggestions from the interviews. It is also optional to maintain the learning diary for the personal learning goals. This learning diary can then also be used as input for the monthly reflection meetings.

Most of the participants also came to the conclusion that a way to manage the lessons learned should be facilitated by the mother organization to begin with. If this would be in place, the employees would have more incentive to keep the management of lessons learned up to date. This is in line with the study by Love et al. (2005) where he states that senior managers must create and govern the supportive project environment.

4.2.4 Attitude towards Lessons Learned

When the participants had to reflect on the pilot and if the pilot changed their view on knowledge management as a whole, all of the participants stated that it did not change for them. Most of the participants would reason that they would be thinking about lessons learned themselves even before the pilot. They did not start to think about it more during the pilot. Actually, all of the participants would state that they were already thinking about ways to improve their own way of working and sharing that knowledge where possible. Because the participants already view themselves as a mature knowledge agent, it is hard to incite improvement in their self-reflection. It is hard to measure the learning maturity of individuals. There are a lot of sources and methods to measure the organizational maturity on knowledge management, but none to measure the individual maturity.

When asked if the learning diary should be carried out throughout the organization, they did not see the value in that, except if it were in the aforementioned monthly or weekly format.

5   Reflection

The previous chapter analyzed the collected lessons learned, obtained from the learning diaries, and the results from the interviews that were held with the participants after the pilot. This chapter draws on those findings in order to obtain a more nuanced understanding of how the pilot with the learning diary shapes the project knowledge management and lessons learned in the organization.

5.1   Project Knowledge management

In the available literature it quickly became known that how organizations organize project knowledge management has not yet reached full maturity. There is no systematic universal way to organize it into the projects. While managing lessons learned and project knowledge management is highly correlated with project success, this is not considered effective in more than a third of the cases studied by Brandon T.P. (2019). As a project is defined as unique and temporary, this hinders the emergence and development of organizational memory and therefore obstructs organizational learning (Bresnen et al., 2003) (Fong, 2005). The participants in the pilot also mentioned that due to the difference between projects it is hard to universalize the project knowledge management systems. Such that it is applicable to other projects by Dura Vermeer. The differences in each of the diaries could also be explained by the variable working conditions in a project. These variable working conditions and team compositions will lead to a fragmentation in individual and organizational knowledge (Prencipe and Tell, 2001) (Kasvi et al., 2003).

Projects usually have a rather short-term orientation with a focus on immediate deliverables. In contrast, knowledge management requires a long-term perspective. Knowledge management is a long-term investment in which the initial investment in knowledge management systems and the return on investment is not immediate. This conflict of perspective can result in an insufficient transfer of knowledge between projects (De Fillippi and Arthur, 1998) (Love et al. 2005).

When asked if the participants had ideas to improve the current project knowledge management structure, they all pitched their ideas that were tailored to their employer. Another major obstacle that was present in both the literature and in the pilot was the challenge to translate the lessons learned from one project to the other. While there is a framework that every company follows when going though a project, there are major differences that limit the transferability.

5.2   Lessons Learned

The practice of maintaining a learning diary is a form of continuous self-reflection. Capturing lessons learned should be an on-going effort throughout the life of the project (Rowe et al., 2006).

The mindset of continues improvement should be strongly encouraged by the project manager from the start of the project (Rowe et al., 2006). The participants stated that they would also like to have more knowledge management facilitation by the main organization. To not only capture lessons learned at a project level, but also on an organizational level.

The results from Zhikun and Fungfai (2009) suggested that the attitude towards knowledge sharing is much more important than the willingness of the architects to share their knowledge. The results of this

thesis shows that their findings do come with a side-note. If the employees already have a good attitude towards knowledge sharing, how much value is there to gain? It is hard to objectively measure someone's attitude. Only if the person is very vocal about his/her negative or positive attitude, can you determine someone's attitude. Most people will see themselves as the willing learner in this experiment.

5.3   Learning Diary

To reflect on the learning diary, a distinction is made between the process of running the pilot and the content of the diary itself.

5.3.1   Process

It is tough to do a thesis in such a weird time with a global pandemic. If I were to do this research again, I would have tested other means to improve attitude towards knowledge management. The fact that the majority of people work from home does put a strain on the type of research you can do within a company. You are very reliant on people willing to reply to you in due time.

From the study by Williams (2008), we can see that a Learning diary is perceived to be a valuable practice even though not currently used much (Figure 5). In Williams' study, he only asked the respondents whether they believe a practice to be useful or not. The results from this thesis shows us indeed that people working in projects do perceive the use of a learning diary to be useful to some extent. A learning diary can be useful, but that is fairly subjective. One's aptitude towards learning and the position that a person is in determine whether they can maintain a learning diary such that it brings value. More research should be done to determine the optimal variables of a learning diary, be it the reporting frequency and the

This study did not find that maintaining a learning diary improved the motivation of the writer, while this was expected in the first place (Clipa et al, 2012). The reason for that was explored in the interviews. The writers in this study all stated that they already had high motivation before the pilot. The reason for this could be that the participants did not see any "extra" motivation. Huisman & Wallenius (2018) also discovered in their study with a learning diary among students, where their study showed that the level of sustainable learning was linked to the persons engagement.

The discussion on how to improve the project knowledge management in the organization could mean that the participants took more ownership of the development, which is in line with the findings by Huisman & Wallenius (2018) where the students took more ownership of their own learning goals. However, there is no proven causal connection in this thesis.

There has not been any study that examined the use of a learning diary for organizational learning purposes. A learning diary might be used to learn as a community when individuals use their personal diaries as input for the improvement of the organization.

Should you implement maintaining a learning diary in your organization. It does take a lot of effort to process the large amount of data in the diaries. This study was done with only nine participants, which is already considered to be quite a small sample. Nine diaries every week, with data of the past five days,

with three columns per day. This means that 9*5*3= 135 lines had to be interpreted each week. Should this experiment be done with fifty participants, this number would scale up to 750 lines per week. This might already be too much work for a single FTE. There are two solutions to this problem. First, the participants could rank the input themselves into the pre-determined categories. This does obscure the data, as not everyone would categorize things the same. Secondly, the diary could be made in a weekly format to limit the amount of data and keep it manageable. This would also make it more manageable for the participants to maintain the diary.

5.3.2 Content

The Learning diary Content analysis in table 2 on page 22 does give a skewed image, because not everyone filled in the diaries consistently. Also, some points raised by the participants had a higher contextual weight than others in the same category.

The fact that De Groene Boog is a combination of different companies that use a multitude of different tools and databases makes it hard to translate the lessons learned to one organization. The participants also said that this is a difficult issue for them.

The entries in the diary are mainly based on the project itself and not so much based on lessons learned for the organization Dura Vermeer. This is in line with the findings of Huisman & Wallenius (2018).

The contents of the diaries were categorized into the previously mentioned categories, but how to categorize them is still a bit of a grey area. For instance, an issue working together with a stakeholder can be categorized as a "collaboration", "contract management" or "communication" topic depending on the specific context that the entry was made in. This makes the usefulness of the current diary less conclusive. It would probably help if the writer could categorize the entry themselves with a self-reported score on the severity and usefulness. An independent person would then check the entry to verify that it indeed fits the chosen category.

Every participant stated the same thing. They saw that a lot of mistakes from previous projects were also made in current projects. Some of the participants had an explanation for this. Namely that every project that Dura Vermeer does is a collaboration between different parties. When a group of different parties starts a project, it is decided up front which systems will be used in the project. This way the project has a document system from company A, planning software from company B and a customized design tool from company C. This makes it very hard for an organization to generalize lessons learned that revolve around the use of these systems. Other participants stated that Dura Vermeer was not yet mature enough with their lessons learned, because having a single post project review at the end of a project is very ineffective. A lot of the project members would have switched roles throughout the project and it is almost impossible to remember certain important details that occurred several years ago, since that is the typical runtime of their projects. Everyone did say that Dura Vermeer could benefit from having a more systematic approach to their own lessons learned process.

6 Conclusion

Project-based organizations use lessons learned in order to improve the performance of projects. They aim to repeat successes by using positive lessons learned, and to avoid repeating negative experiences by using negative lessons learned.

The introduction indicated that organizations can be ineffective in collecting and using lessons learned. To address this issue, this thesis focused on exploring the possible use of a learning diary to improve the attitude towards sharing knowledge by answering three research questions:

- RQ1: What is the value of LL?
- RQ2: What are the barriers that make the implementation of lessons learned so challenging?
- RQ3: How does a learning diary influence the attitude towards Project Knowledge Management?

The first research question **RQ1** to determine the value of lessons learned is widely studied in the literature. The value of lessons learned is regarded of vital importance to sustain a competitive advantage. The need to keep solving the same problems every problem is very inefficient. This recurring issue will remain without companies reusing existing knowledge or exploring new knowledge from existing solutions. The general consensus among academics is that using lessons learned in a systematic way can help to improve the efficiency of how an organization runs a project. They also agree that the general belief in the usefulness of lessons learned is there, but the implementation of the knowledge gained from them has yet to reach maturity. There is no universal standard yet to engage in these practices. At least not implemented by the majority of organizations.

There are several reasons why this is not implemented by the majority of organizations. From the literature review (Chapter 2.5) for research question **RQ2**, the biggest factor that proved a barrier for effective knowledge transfer lied in the creation of a corporate culture that stimulates knowledge sharing. This was also voiced by the participants in the pilot. When asked if the participants had ideas to improve the current project knowledge management structure, they all pitched their ideas that were tailored to their employer. Another major obstacle that was present in both the literature and in the pilot was the challenge to translate the lessons learned from one project to the other. While there is a framework that every company follows when going through a project, there are major differences that limit the transferability. For the case of Dura Vermeer, all of their projects consist of a consortium of other companies that make the project infrastructure different for each project. This in turn further inhibits the possibility to transfer project specific knowledge. Some creative solutions that were brought to live by the project members are mainly shared because of the project members themselves. This is not facilitated by the organization. The way projects are evaluated by Dura Vermeer now is considered to be ineffective by both the participants and the literature. A single post project review is not suitable for a project that spans over several years. Project knowledge management is a long-term investment, the effects are not explicitly visible in the short-term. If organizations would review their projects on a smaller interval, the value of those lessons learned should increase.

To answer research question **RQ3**, whether or not a learning diary is the tool to invoke a change in attitude towards knowledge management is not yet clear. The pilot in this study can be changed to a longer timeframe, a larger sample size and/or a different interval to maintain the learning diary. To provide a more definitive answer to research question RQ3, the variables of this research should be altered to get a clearer understanding of its workings. During the interviews, the participants did not see the change in attitude in the current format. While the participants did come up with alternate strategies to improve the project knowledge management, there is no clear causal connection between the pilot and the discussion.

During the pilot it became apparent that maintaining a daily diary asks a lot of effort from the writer. When the content of the diary is not acted on, the writers quickly lose interest in maintaining the diary as told in the interviews. It becomes another tedious task that does not incite action in the company, like the current situation. One can still use the exercise to improve the writer's personal learning process. Therefore, a learning diary in a project setting works best if the intention is to improve the writer's own learning. The diary did not incite change into the general attitude on a wider level. It is also very personal whether this tool is effective. A person that considers himself or herself to be highly efficient in identifying and sharing knowledge might not have much to gain by this exercise. Perhaps the effectiveness is also linked to the position. I would not recommend to force this tool on people, as the majority has difficulty maintaining it consistently. Perhaps the people who felt that the tool worked for, can reduce the workload to one diary per week. The learning diary could be used as a personal reference for future work.

The exercise of maintaining a learning diary and summarizing the results in a matrix like Table 2 on page 22 can be used by the company to tackle the most stressed problems. This allows a company to utilize their resources more effectively. The learning diary did make a clarification of the most apparent day to day issues at hand. The organization could use the resulting ranking to better focus their improvement effort. For instance, in this research the issue of poor personal time management was noted as the most apparent issue. With this observation, the organization could determine to provide time management courses for their employees. This course of action would allow the company to help their employees in a personalized manner with the most optimal personal improvement. If an organization is to use a learning diary this way, the learning diary might even be seen as a low-cost analysis tool. Given that the employees do not take too much time to fill in the diary.

6.1 Limitations

There are some limitations to this research. First off, the way people handle the lockdown and the work-from-home mentality is silently becoming the "new normal". This does impact how people communicate with each other. This applies to this research, because sharing knowledge is based on how to communicate Lessons learned. The Corona pandemic has left a mark on the professional world and how we work altogether. Instead of having face to face meetings, we use some form of video conferencing tool, like Zoom, Teams or Skype. Instead of working with other colleagues in the same office, you work on your own at home. The winter holidays had a big impact on the continuation of the pilot, which impacted the research. Ideally, the pilot would have ended before or started after the winter holidays.

Translating the diary to certain topics is not only subjective, the gravity of one comment is not always in good balance with other comments. What this means is that a comment about a person not being happy with their time spending and another comment about the project running late because of a critical timing error both have the same weight.

Other limitation of the research was that the sample size could have been larger if there would be a lot more commitment from the organization.

6.2   Future Research

The research in this thesis improved my understanding of lessons learned and the use of a learning diary. This improved understanding has opened up a selection of possible research that might help to further understand and improve the usage of lessons learned efforts.

Future research could find out how if a Weekly/monthly reflection would work better than a stage-gate process. This would mean that a project is not entirely defined by a stage, but evaluates the project based on a calendar. This could help a project-based organization, as some project phases take multiple months, which is too long to remember the beginning of the phase during evaluation

The research in this thesis could stand to gain from a larger sample size and a longer runtime than the one in this thesis. As most projects have a runtime of longer than 6 months. Also, a full commitment by the participants could give a better reflection of the perceived usefulness of a learning diary in a project management setting.

How does one measure the knowledge management maturity per department? In most companies, the knowledge management is centralized. However, every department has their own separate method to collect, store and retrieve lessons learned. It would be of great benefit to find out how you can measure the maturity of such any department.

The intrinsic motivation to collectively learn is a hard to grasp concept that requires further research to understand. Should an organization want to improve their organizational learning, it might be interesting to see how you can inspire an individual to share knowledge with the company.

A learning diary might be used to learn as a community when individuals use their personal diaries as input for the improvement of the organization.

7 Recommendations/Discussion

This chapter recommends alteration to the research from this thesis and discusses its possible applications. The current format of the learning diary is analyzed and a new proposed format is discussed for future research purposes.

7.1 Learning diary usage

To prove that a learning diary indeed does not incite a change in attitude in a project-based organization, I would recommend to test this theory with a larger sample size and a longer timeframe. This would give a better representation of the effects, because a project consists of multiple phases. The project that was used in this research span multiple years. While the timeframe for a thesis is just half a year. Therefore, the theory in this case could only be tested in a section of a single phase. A different format for the diary could also provide different results. To further explore the possibilities of a learning diary, the current format and the proposed format is discussed below.

7.1.1 Current format

The learning diary pilot in this thesis has given a valuable insight into the usage of a learning diary in a project-based organization. The participants did see the value of a learning diary, but were still reluctant to maintain the diary consistently. This shows that the current workload of the diary is too high and should be lowered. The content of the diaries showed the issues that people struggle with on a daily basis. The organization should take note of these issues and act on them to improve the job satisfaction of their employees. If the diary was maintained on a weekly basis, the content would probably cover somewhat bigger issues. This way, broader issues would come to light without being drowned in details.

7.1.2 Proposed format

Should you implement maintaining a learning diary in your organization. It does take a lot of effort to process the large amount of data in the diaries. This study was done with only nine participants, which is already considered to be quite a small sample. If this research spans over more people that each deliver diaries each week, it will be hard to process and analyze the data due to the sheer amount. I would also start with a large survey throughout the company to ask what they believe would bring the best improvement in knowledge management in the company. This would also get the majority of the company thinking about change and also get them committed to the research as they bring the input themselves.

To further investigate the use of a learning diary in a project-based environment, the variables of the format should be altered. It is probably better to minimize the workload by using the learning diary less frequent. At the end of a working day, most of the people are not willing to sit down and reflect upon their day. This requires specific individuals that are extremely eager to improve their own way of working. By asking the participants to maintain the diary on a weekly or on a monthly basis, the workload for both the participants and the researcher should be reduced. This in turn should result in a higher participation grade. The guideline, as listed in Appendix 2, could be altered. One suggestion that came up in the interviews was to add another column: "What should be communicated". This new

column should create actionable items that can be readily communicated to the relevant parties in the organization.

7.2   For Dura Vermeer

There are some very interesting results that can have positive implications for Dura Vermeer. All the people in the pilot agreed that having just one post project review at the end of a project is not suitable to review an entire project. They all agreed that a more regular reflection meeting, as discussed in chapter 4.2.3, would be a better option to capture the lessons learned.

I would highly recommend Dura Vermeer to provide a platform for every team to manage a lessons learned database. The first thing for Dura Vermeer to do is to replace the current structure of one post project review at the end of a project with a more frequent evaluation. All of the participants in the pilot have mentioned during the interviews that they believe this is a very ineffective form of evaluation. At the end of a project, the project members have shifted, the memory does not reach that far into the history and the project cannot be evaluated based on numbers in a database alone.

While the exercise with a learning diary did not gain a lot of enthusiasm from the participants, they did say during the interviews that the project knowledge management of the company needs to improve. They want a better knowledge management system facilitated by Dura Vermeer. This database should be divided by phase of the project and by functional discipline in the project, as those 2 factors remain the same in every project. This should make it easier for Dura Vermeer to store and retrieve the lessons. The retrieval and storage of those lessons learned should also be implemented into the methodology used by Dura Vermeer. This should make the employees reflect more on the organizational learning process. Also, I would recommend Dura Vermeer to facilitate project teams to have the monthly reflection meetings as discussed before in chapter 4.2.3. This should make the sharing of knowledge more efficient.

The organization could use the results in Table 2 from page 22 to better focus their improvement effort. For instance, in this research the issue of poor personal time management was noted as the most apparent issue. With this observation, the organization could determine to provide time management courses for their employees. This course of action would allow the company to help their employees in a personalized manner with the most optimal personal improvement. If an organization is to use a learning diary this way, the learning diary might even be seen as a low-cost analysis tool. Given that the employees do not take too much time to fill in the diary.

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Appendices
Appendix 1
Interview Structure (DUTCH)

Datum:

Locatie:

Geïnterviewde:

Organisatie:

Functie:

Bedankt voor uw deelname aan het interview. Ik zou graag uw toestemming willen vragen voor het opnemen van dit interview d.m.v. Microsoft Teams.

De vragen zullen naar volgorde behandeld worden. Eventuele vervolgvragen kunnen afwijken van het onderstaande. U mag ten alle tijden stoppen met het interview of weigeren een vraag te beantwoorden.

A. Background Information – Interviewee
1. Wat is momenteel uw functie bij de Groene Boog? Zou u deze kort kunnen beschrijven?
2. Kunt u kort beschrijven wat uw verantwoordelijkheden zijn of waren?
B. Project Context
1. Zijn er overeenkomsten met andere projecten die laten zien dat er nog steeds dezelfde fouten gemaakt worden? Fouten waarvan men geleerd zou moeten hebben op de vorige projecten?
2. Waarom denk u dat deze fouten herhaalt zijn?
3. Vindt u dat Dura Vermeer/De Groene Boog volwassen is in het verzamelen en verspreiden van lessons learned?
C. Learning Diary
1. Hoe vond u het om met het dagboek te werken de afeglopen 3 maanden?
2. Op welke momenten heeft u het dagboek op een andere manier gebruikt dan origineel bedacht?
3. Denkt u dat een leerdagboek nut heeft binnen de organisatie?
4. Zo niet, welk format zou mischien beter passen binnen de organisatie?
D. Reflection
1. In welke zin is uw beeld tegenover knowledge management veranderd na het gebruiken van het leerdagboek?
2. Vindt u dat uzelf volwassener bent geworden in het verzamelen en verspreiden van lessons learned?
3. Zou het nut hebben om het leerdagboek breder door de organisatie te dragen?

E. Additional
    1. Zijn er mischien nog vragen/opmerkingen die u heeft over het onderzoek?

Ik wil u bedanken voor uw tijd en medewerking! Mocht u de resultaten van het onderzoek willen inzien, dan kunt u contact met mij opnemen via de mail.

Appendix 2

Leer dagboek (DUTCH)

Dit leerdagboek is te gebruiken om bij te houden wat er is gebeurd vandaag. De bedoeling is dat u elke dag nadenkt over zaken die binnen het bedrijf/project beter kunnen. Op deze manier kunnen we samen groeien en vaak voorkomende problemen oplossen.

Dit dagboek kunt u aan het eind van elke week anoniem naar mij opsturen: k.v.d.welle@duravermeer.nl

De volgende vragen kunt u gebruiken als leidraad.

- Wat ging er goed vandaag?
- Wat kon er beter vandaag?
- Hoe heb ik de lastige dingen opgelost?
- Is dit probleem/deze oplossing projectspecifiek of kunnen mijn collega's dit ook gebruiken?
- Is dit probleem nieuw of komt dit vaker voor?

Op de volgende pagina kunt u het dagboek invullen

Hieronder is een voorbeeld hoe het dagboek bijvoorbeeld ingevuld kan worden:

Week 48 2020	Wat ging er goed	Wat kan er beter	Wat kan er geleerd worden
Maandag	Weekly stand werkt goed	Te veel tijd verloren door overleggen	Weekly stand bij andere afdelingen doorvoeren?
Dinsdag		Onveilige situatie slecht gecommuniceerd	Opgelost door een strakkere voorbereiding
Woensdag	Vaker voorkomend probleem: de communicatie met Rijkswaterstaat opgelost op deze manier		Communicatie met bepaalde stakeholder
Donderdag			Vandaag niks bijzonders gebeurd
Vrijdag			

Week 48 2020	Wat ging er goed	Wat kan er beter	Wat kan er geleerd worden
Maandag			
Dinsdag			
Woensdag			

Donderdag			
Vrijdag			