



APPLYING LESSONS LEARNED

Cover illustration made by

Floor Beeftink

Floorbeeftink-art.nl

Instagram.com/floorbeeftink

APPLYING LESSONS LEARNED

HOW PROJECT-BASED ORGANIZATIONS CAN APPLY LESSONS LEARNED RETRIEVED FROM PAST PROJECTS

A multiple case study and exploratory research
in collaboration with Royal HaskoningDHV

Conducted by

Gigi Teodoro Pasquale Zacheo

In partial fulfilment of the requirements for the degree of

Master of Science

in Construction Management and Engineering
at the Delft University of Technology

30th of August 2018

Composition of the graduation committee:

Chair	Prof. Dr. H.L.M. Bakker	TU Delft
First supervisor	Dr. Ir. G.A. van Nederveen	TU Delft
Second supervisor	Dr. Ir. F.E.H.M. Smulders	TU Delft
Company supervisor	MSc. A.S. de Ruiter	Royal HaskoningDHV

*Copyright in this work rests with the author. Please ensure that any reproduction or re-use is done in
accordance with the relevant national copyright legislation*

PREFACE

This report represents the final step in completing the Master Program Construction Management and Engineering at the Technical University of Delft. In the past seven months, I have dived into the subject of lessons learned and everything that is associated with it. The term ‘lessons learned’ is used in life’s every day moments and people can easily relate to what a lesson learned might be for them. For me, this graduation process has provided me multiple lessons learned which I will carry with me for the rest of my life.

The first lesson I will carry with me is to never say no to a challenge. My graduation process has not always been ideal and this resulted in some serious issues along the way. The proposed planning seemed unrealistic several times, but I still wanted to push forward as hard as I could to meet the proposed deadlines. This would not have been possible without all the support I got throughout my research; committee members who were always available for a chat, project managers and other interviewees who invested a lot of time and effort in providing valuable information, and the support of my family, close friends and fellow graduates.

A second lesson that I retrieved out of this research is that time is valuable. Don’t waste a moment! As my graduation process encountered some critical setbacks, the time left had to be effectively invested. I have learned that sometimes it is more valuable to invest time in other things like hobby’s, sports, getting your driver’s license and hanging out with friends. I believe that these activities are a necessity in a graduation process and helped me in my work.

Also, a very important lesson is that good relations make good work. I want to thank my graduation committee for supporting me in writing this thesis and giving me their experiences and expertise during the process meetings and beyond. Also, I would like to thank all the people involved during my research; the interviewees, the experts, the validation participants and the friendly and open-minded people at RHDHV. And of course, I want to thank my parents for keep believing in me, Floor for supporting me in every way possible and creating the most awesome cover ever, and my close friends and fellow graduate students for all the contributing discussions and laughs along the way!

With this research, I hope to have contributed to the scientific knowledge about using lessons learned, and to have provided useful insights for the current practice in the construction industry. I hope you enjoy reading the results!

Best regards,
Gigi Zacheo

SUMMARY

A lesson learned is *a text or (multimedia) document that is based on experiences made in a project and that has the potential to provide value for future projects*. Using a lesson learned is *a process* (in a *project-based* or an *organizational* context) that takes a lesson learned as one of its *inputs*, and *applies* it with the intent *to improve* the same, future or other projects. This process needs to result in *an output* that goes *beyond the modification or dissemination* of a lesson learned (Buttler, 2016). The process of using lessons learned can be divided into three phases; *identification*, *dissemination* and *implementation* (Duffield & Whitty, 2014). Lessons learned can be both *positive* (best practices) and *negative* (challenges), and can be identified, disseminated and applied in an *internal* and *external* context.

Project-based organizations (PBO's) remain to struggle with the dissemination and implementation of lessons learned, although the ability to learn from projects and transfer these lessons from one project to the next has been identified as a critical success factor for PBO's. The challenge that PBO's face is to ensure effective processes of sharing and integrating lessons learned within projects, to avoid the risk of reinventing the wheel or repeating past mistakes. Research on the actual usage of lessons learned is limited, especially when incorporating the process of using lessons learned as a whole. This research provides insight in how the lessons learned, retrieved from previous projects, can be used by other projects and managers. The current practice, enabling factors, hampering factors and required characteristics are investigated to answer the following research question used in this thesis.

“How can lessons learned, retrieved from previous projects, be shared with and used by other projects and managers?”

This research uses qualitative research methods to investigate what the current practice of using lessons learned is, what factors enable the usage of lessons learned, what factors hamper the usage of lessons learned, what required characteristics are needed for a lesson learned to be used, and what intervention is needed to embed the process of using lessons learned into an organization. A literature review, case studies and interviews give an answer to the proposed sub research questions and are analyzed and combined afterwards. The case studies are conducted on three greenfield brewery projects from the client account and the responsible project managers are interviewed. In addition, expert consultations are held to give a more broadened insight, and focus more on the needed intervention for embedding the process into the organization. After the results are analyzed by a cross-method analysis, a cross-case analysis and a MoSCoW analysis, a conceptual framework is presented in the conclusion which incorporates all findings derived from this research.

This research is conducted in collaboration with Royal HaskoningDHV, a large engineering and project management consultancy firm that combines global expertise with local knowledge to deliver a multidisciplinary range of consultancy services.

The literature review results show that the current practice of using lessons learned is not functioning properly. Although the identification of lessons learned is done quite well, the dissemination and implementation of these lessons learned remain a challenge for PBO's. Literature stresses that the process of using lessons learned is a social endeavor and 'people-to-people' knowledge transfer is considered to be the most effective. Lessons learned need to be available through a centralized, structured and consistent medium. A just culture and alignment is needed to ensure an effective process. Cultural backgrounds, personal perceptions and the dispersing project teams are not supporting the usage of lessons learned. Furthermore, information overload, product instead of process content, the lack of structure and conciseness also hamper the usage of lessons learned. Lessons learned should be actionable, standardized and written in a generic way so it can be used in different scenarios. A sense of urgency, belief and understanding the culture is needed to embed the process of lessons learned into an organization.

In the case studies, distinctions are made between positive lessons learned (best practices) and negative lessons learned (challenges). It was found that several evaluation tools which can identify lessons learned were used in the projects, however the process of disseminating and using specific lessons was not found. A standardized project organization, tooling to stimulate process and project management intervention sessions are enabling factors to the process of using lessons learned. On the other hand, incomplete and contradicting sources, no clear structure, information overload, inconsistent and too detailed documentations are a negative influence on the process of using lessons learned. Also, the lack of internal meetings on a regular basis, time pressure and the lack of constant monitoring the process of using lessons learned are considered hampering factors. The tooling used for lessons learned practice should be limited, correlated and user friendly. Personal preferences and the use of keywords and summaries are a required characteristic. Lastly, the content of a lesson learned should be consistent and credible.

The in-depth interviews confirmed the current state of the lessons learned practice and added the distinction between internal and external use of lessons learned. Lessons learned are currently disseminated through verbal communication streams. These lessons are not documented by the originating author and it cannot be confirmed that the lessons were used by other projects and managers. Enabling factors identified in the interviews included the need for a central "lessons learned team" who oversees the whole lessons learned practice within an organization. Also, standardization in products and processes, stimulating the conversation and a culture of honesty can enable the usage of lessons learned. Time and client pressure are hampering the process of using lessons learned. In addition, the lack of standardization, cultural differences, a guilt and shame culture, and the switch of project team members are negatively influencing the process of using lessons learned. On behalf of the characteristics, lessons learned should be written in a generic way and focus on the process. Lessons learned should be anonymous, but the author should be named to stimulate the conversation. Using keywords and making the lessons actionable are considered required characteristics. Lastly, the user friendliness of tools needs to be ensured. In addition, the expert consultations stressed that both the bottom-up and the top-down approach is needed to embed the process of using lessons learned in an organization. The sense of belief, urgency and understanding must be created by leadership. Support from higher management needs to encourage people to follow the vision and new way of working.

Currently the interest and priority of the lessons learned practice is too low. Higher management believes that new methods, like for example the Health Check, seem to function properly. But this research shows that this is not the case. People within an organization do not believe that investing time and effort in lessons learned practice will be beneficial, they remain pessimistic on the returns of lessons learned practices and are more likely to directly contact someone within their own company network. This is one of the pitfalls in the usage of lessons learned; the reactive use instead of the active use of lessons learned. Most of the time a solution to a certain problem in a lesson learned is most effective at the beginning of a project, and when using a lesson learned as a reactive measure it is often too late.

The lessons learned practice is a process (Buttler, 2016) which can be divided into three phases; identification, dissemination and implementation (Duffield & Whitty, 2014). This research identified that 'people-to-people' knowledge transfer is perceived to be most effective in using lessons learned. By stimulating the conversation, a more deepened and scenario-based version of the lesson learned can be transferred and used by other projects and managers.

For lessons learned to be shared and used by other projects and managers, this research emphasizes on the alignment and completion of lessons learned processes. This research found several cases which indicated the incompleteness and lack of alignment in the processes of lessons learned practices. MPRs were lacking, in one case the Project Plan was not constructed, the correlation between project management tools is perceived to be minimal and there is an information overload in contradicting sources.

This research stresses that a central "lessons learned team" should be assigned who is responsible for the lessons learned practices within an organization. By making the lessons learned practices centralized and structured for all projects, the lessons learned can be shared and used in the most optimal way. Alongside this, the intrinsic motivation of all employees must be stimulated accordingly. A company should create a comfortable culture in which the lessons learned are actively shared and used without feeling ashamed or guilty. Higher management needs to be stimulating people to share their challenges and best practices so that the company can benefit from it. Rewarding and monitoring the lessons learned practices can be used as a stimulant, but first project managers and department directors need to fulfil the role of a leader and be the example. These leaders should create awareness, a sense of urgency and belief to stimulate the usage of lessons learned by other projects and managers.

This page is intentionally left blank

CONTENTS

Preface	i
Summary	ii
Contents	vi
List of figures	ix
List of tables	ix
List of abbreviations	x
1. Introduction	1
1.1 A lesson learned	1
1.2 Research gap	3
1.3 Research context	4
1.4 Research scope	4
1.5 Research goal	5
1.6 Research question	6
1.7 Research relevance	6
1.8 Report structure	7
2. Research design	8
2.1 Research approach	8
2.2. Research methodology	9
2.3 Research framework	14
2.4 Research validation	14
3. The current state	15
3.1 Literature review	15
3.2 Case studies	17
3.3 In-depth interviews	19
3.4 Conclusion	21
4. Enabling factors	22
4.1 Literature review	22
4.2 Case studies	23
4.3 In-depth interviews	25
4.4 Conclusions	26

5. Hampering factors.....	27
5.1 Literature review	27
5.2 Case studies	29
5.3 In-depth interviews	31
5.4 Conclusions.....	32
6. Characteristics.....	33
6.1 Literature review	33
6.2 Case studies	35
6.3 In-depth interviews	36
6.4 Conclusions.....	37
7. An organizational intervention	38
7.1 Literature review	38
7.2 In-depth interviews	39
7.3 Conclusions.....	41
8. Analysis of results.....	42
8.1 Cross-method Analysis	42
8.2 Cross-case Analysis	48
8.3 MoSCoW Analysis.....	50
8.4 Conclusions of analysis	54
8.5 Validation of results.....	55
9. Discussion	57
9.1 Discussing the results	57
9.2 Discussing the implications	59
9.3 Learnings on different levels	59
10. Conclusions, recommendations & reflection	61
10.1 Answering the research question.....	61
10.2 How to embed in the organization.....	64
10.3 Limitations of this research	65
10.4 Recommendations.....	66
10.5 Personal reflection	68
References.....	69

APPENDICES	77
Appendix A – Case study results.....	77
Appendix B – Client partnership.....	83
Appendix C – Project evaluation forms	85
Appendix D – Financial wrap-up.....	91
Appendix E – Project Health Check	93
Appendix F – Organogram XXX.....	95
Appendix G – Interview results	96
Appendix H – Validation	100
Appendix I – Root Cause Analysis Method: 5 Why’s.....	103

LIST OF FIGURES

Figure 1 - Lessons Learned Phases.....	2
Figure 2 - Explicit, implicit and tacit knowledge	3
Figure 3 - Visualization Research Scope.....	5
Figure 4 - Overview of report structure	7
Figure 5 - Case study research	11
Figure 6 - Research Framework	14
Figure 7 - The Swiss cheese model & Systematic Lessons Learned Knowledge (Syllk) model	17
Figure 8 - Current Project Excellence Management practice	20
Figure 9 - Intervention with and without further actions over time	39
Figure 10 - Conceptual framework for the use of lessons learned.....	64
Figure 11 - Vision of partnership between client & RHDHV	83
Figure 12 - Organogram of Project Structure XXX	95
Figure 13 - Validation session V1	100
Figure 14 - Validation session V2	100
Figure 15 - Validation session V3	101
Figure 16 - Validation session V4	102

LIST OF TABLES

Table 1 - Selected case studies	10
Table 2 - Interviewees for in-depth interviews.....	12
Table 3 - experts for consultation meetings	13
Table 4 - Cross-method analysis overview.....	47
Table 5 - Case specifics per project.....	48
Table 6 - Cross-case analysis overview	49
Table 7 - Overview of findings	51
Table 8 - Results of the MoSCoW analysis.....	53
Table 9 - Participants of the validation session	55
Table 10 - Case study results XXX	77
Table 11 - Case study results XXX	79
Table 12 - Case study results XXX	81
Table 13 - Project evaluation form Sr. PM.....	86
Table 14 - Project evaluation form Jr. PM	88
Table 15 - Project evaluation form Jr. PM	90
Table 16 - In-depth interview results.....	99
Table 17 - A 5 Why analysis question table	103

LIST OF ABBREVIATIONS

EIM	Enterprise Information Management
FMCG	Fast Moving Consumer Goods
HC	Health Check
HRO	High-reliability Organization
ICT	Information and Communication Technology
IM	Information Management
KM	Knowledge Management
LLCP	Lessons Learned Collection Process
MPR	Monthly Progress Report
PBO	Project-based Organization
PEM	Project Excellence Management, Project Excellence Manager
PM	Project Manager, Project Management
PMI	Project Management Intervention
RCA	Root Cause Analysis
RQ	Research Question
SQ	Sub Research Question

This page is intentionally left blank

1. INTRODUCTION

The ineffectiveness of knowledge sharing over time, between project teams, is perhaps the most prominent issue that project-based organizations (PBO's) must deal with (Almeida & Soares, 2014). The ability to learn from projects and transfer knowledge from one project to the next has been identified as a critical success factor for PBO's (Cooke-Davies, 2002; Disterer, 2002). For PBO's it is important that the information produced in one project will be accessible by a subsequent one (Pemsle & Wiewiora, 2013), but it appears that PBO's face substantial obstacles in capturing knowledge and in the recycling of project-based learnings (Bakker et al., 2011; Bartsch et al., 2013; Bresnen et al., 2003).

1.1 A lesson learned

Lessons learned can be defined as documented "knowledge gained from experience, successful or otherwise, for improving future performance" (Gibson, Caldas, Yohe, & Weerasooriya, 2007). An extensive literature review is conducted by Buttler (2016), who defined lessons learned as "*a text or (multimedia) document that is based on experiences made in a project and that has the potential to provide value for future projects. Using a lesson learned is a process (in a project-based or an organizational context) that takes a lesson learned as one of its inputs, and applies it with the intent to improve the same, future or other projects. This process needs to result in an output that goes beyond the modification or dissemination of a lesson learned*" (Buttler, 2016).

Lessons learned can be considered 'positive' (best practices) and 'negative' (challenges), both equally valuable for an organization. Referring to the definition by Buttler, both best practices as well as challenges are based on experiences made in a project with the potential to provide value for future projects. The goal of a PBO is to ensure the effective processes of knowledge sharing and integration, within and between projects, to avoid the risk of reinventing the wheel or repeating past mistakes (Pemsle & Wiewiora, 2013; Bartsch, Ebers & Maurer, 2013).

The lessons learned process

The process of using lessons learned can be divided into three different phases; the identification, dissemination and application of lessons learned (Duffield & Whitty, 2014) (figure 1). The *identification* phase is considered up to the point where a lesson learned is acknowledged, identified and stored in a (multimedia) document. The *dissemination* (transfer) of a lesson learned is conducted when this document is passed on from the originating source to another project team or project manager. When the lesson learned is correctly transferred to the other project, the lesson learned can be *implemented* in another project context. It appears that this implementation step is the most difficult to operationalize (Duhon & Elias, 2008; Keegan & Turner, 2001; Williams, 2007).

The identification phase is perceived to be functioning properly (Duffield & Whitty, 2014); Project evaluations, Monthly Progress Reports (MPRs) and audits are examples of tools used to identify lessons learned. Corporate knowledge systems where organizations store their identified lessons learned are considered inefficient in retrieving (thus transferring), and afterwards implementing identified lessons learned, resulting into the losses of valuable knowledge.

Before it is possible to use an identified lesson learned, it first needs to be transferred in such a way that the next project team and manager can make proper use of it.

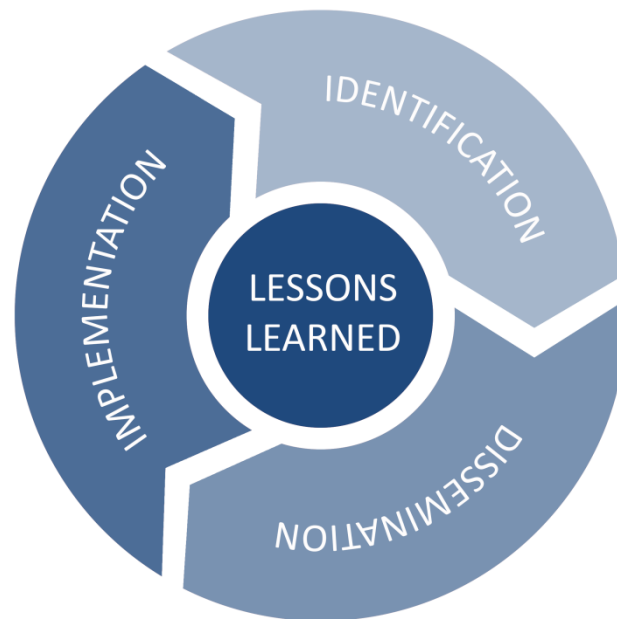


Figure 1 - Lessons Learned Phases (based on Duffield & Whitty, 2014)

Tacit knowledge

“Tacit knowledge cannot be given in lectures and it cannot be found in databases, textbooks, manuals or internal newsletters for diffusion. Different methods like apprenticeship, direct interaction, networking and action learning that include face-to-face social interaction and practical experiences are more suitable for supporting the sharing of tacit knowledge. To rely on personal tacit knowledge in organizations is risky. Conversion of tacit knowledge to explicit or at least ability to share it offers greater value to the organization.” (Mahroeian & Forozia, 2012).

Smulders, Lousber & Dorst (2008) made a distinction between the different ‘levels’ of knowledge each individual can possess; explicit knowledge & understanding, explicable implicit knowledge & understanding, and tacit knowledge & understanding (figure 2). The explicit knowledge from people will, for a great part, be included in lessons learned, while tacit knowledge will always remain disclosed. A contributing lesson learned however also includes as much explicable implicit knowledge as possible, as this is the knowledge most likely to be new for other people and project teams.

Current information management principles, tools and knowledge management approaches addressing tacit knowledge exploitation are an important contribution to retrieve as much information from an individual as possible. Nevertheless, the bridge between such related disciplines and tools is still missing (Päivärinta & Munkvold, 2005; Hansen, Nohria, & Tierney, 1999; Jackson & Koblas, 2008; Bakker et al., 2011; Bouthillier & Shearer, 2002; Coakes, Coakes & Rosenberg, 2008).

Multiple tools are available to retrieve these lessons, and they are actively used in the first phase of the lessons learned process; the identification phase. Although the identification phase appears to be functioning quite well in most organizations, the challenge in this phase lies in the ability to retrieve as much knowledge out of the individual.

This research acknowledges the existence of tacit knowledge and the difficulty in retrieving this from the individual. Methods that include face-to-face social interaction and practical experiences are highly considered in the remainder of this research to support the sharing (and eventual usage) of tacit knowledge.

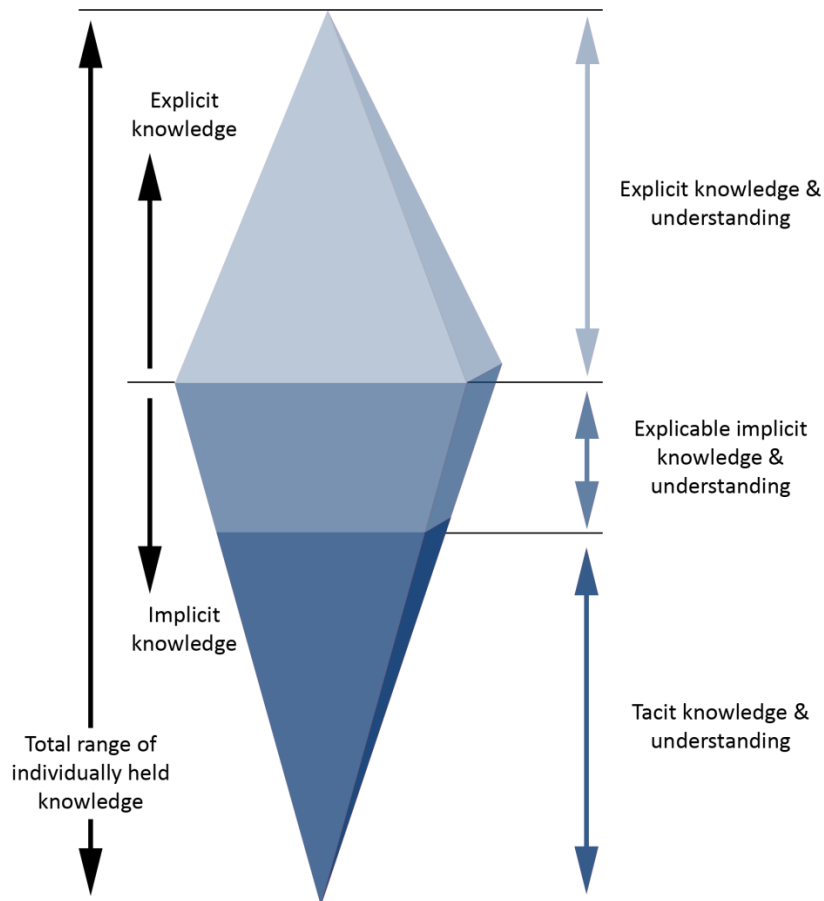


Figure 2 - Explicit, implicit and tacit knowledge (based on Smulders, Lousberg & Dorst, 2008)

1.2 Research gap

About Knowledge (KM) and Information Management (IM), multiple researchers have conducted a wide variety of studies (Ajmal, et al., 2009; Barnes, 2011; O'Dell & Hubert, 2011; Liebowitz, 2008; Hislop, 2005; Neef, 2005; Bouthillier & Shearer, 2002). A recent study on the collection of lessons learned by Buttler (Buttler, 2016) has focused on the Lessons Learned Collection Process (LLCP), which aimed to “improve our understanding of how the outcomes of a LLCP relate to the usage of lessons learned, identifying challenges that may result in missing or difficult to use outcomes of LLCPes, and then investigating how instruments in LLCPes shape outcomes of a LLCP.” (Buttler, 2016).

This recent study focused on the identification phase of lessons learned, while a research gap remains about actually using the lesson learned in other projects. Although it is repeatedly addressed in literature and acknowledged by the sector, until this present day it remains a challenge for PBO's to properly use a lesson learned in future projects (Almeida & Soares, 2014; Bartsch et al., 2013; Bakker et al., 2011; Bresnen et al., 2003).

To use lessons learned in future projects, it is essential to know what is withholding projects, what is enabling projects and what characteristics are needed, before a contribution to the research gap can be given. With a total overview of all the influential aspects, starting points for improvements are generated on which recommendations can be given.

1.3 Research context

This study is conducted in collaboration with the engineering and project management consultancy firm Royal HaskoningDHV (RHDHV). Backed by the expertise and experience of 5,900 colleagues all over the world, RHDHV combines global expertise with local knowledge to deliver a multidisciplinary range of consultancy services covering aviation, buildings, energy, industry, infrastructure, maritime, mining, rural and urban development and water.

For this study three case studies are conducted within the industry and buildings department of RHDHV, focusing on brewery projects. RHDHV has a background in designing, engineering and managing brewery construction projects, until five years ago all with one client. The relationship between RHDHV and the client has had its ups and downs, mostly relating to projects and their difficulties.

A recent development worth mentioning is the mutual goal of both RHDHV and the client to start a partnership. With this partnership both parties strive to align scope of services and project phases, plan ownership and acceleration, standardize all works, cooperate as a partner and be clear in expectations and responsibilities. This partnership is an example of the need to reduce project inefficiency, in which sharing knowledge and lessons learned from both sides are important goals.

1.4 Research scope

The scope of this research is defined in different layers; the sector, industry, project and project life-cycle layers. Together these layers define the boundaries in which this research is conducted, thus also emphasizing where the limitations of this research might be. Below the different scope layers are explained in more detail and visualized in figure 3.

Sector - Construction Project Management and Engineering

For the research scope, this thesis is written within the boundaries of construction project management and engineering. The whole research has been conducted in the Project Management & Consultancy Business Unit of RHDHV and focused on the construction project management of three case study projects. Interviews were conducted with, amongst others, several project managers whom combined possess over a hundred years of experience in the field. With the focus on construction project management a valid comparison between the case study projects and interviews can be given, especially needed because of the qualitative research methods used. Chapter 2 will elaborate more on the research approach and methodology.

Industry – Client specific brewery projects

Within the department of Project Management & Consultancy at RHDHV, a specialization is made in the Fast-Moving Consumer Good (FMCG) sector. A large part of this sector is the design, engineering and (partly) construction management of brewery projects. As mentioned in section 1.3, a long relationship exists between the client and RHDVH in building breweries all over the world. To obtain enough data and input for the research, and because the projects need to be compared, this research focus only on the client account of the client.

Project - Greenfield projects

Greenfield projects are projects which are built from nothing but an empty field and are (almost) always constructed in the same way, led by regulations and client demands. Within the brewery projects a distinction is made between so-called 'greenfield' and 'brownfield' projects. Brownfield projects are projects in which an extension or alteration is made to the existing brewery. This can contain an additional production hall, adding a second factory aside the existing one or something smaller like an extra depot for storing raw materials. As the brownfield projects can vary in scope of work and product specifications, it is not possible to compare these projects. To ensure enough comparability between the case study projects, this thesis only focuses on greenfield projects.

Project Life-cycle - Involvement of RHDHV

Within the project life-cycle of a (brewery) project, RHDHV is only involved in certain phases. Specific in the greenfield projects, RHDHV is (almost) always responsible for the tendering, procurement, design, engineering and construction management of the project. After the civil works are finished and the client agrees with the result, the project is considered finished and no further involvement of RHDHV is needed. It is however common that RHDHV remains attached to the project and provide back-office consulting.



Figure 3 - Visualization Research Scope (own illustration)

Lessons learned phases – Dissemination & Implementation

A final addition to the research scope is that this research focusses on both the dissemination and implementation phase. As described in section 1.2, these phases still encounter difficulties and this research strives to minimize these difficulties as much as possible.

1.5 Research goal

This research aims to decrease or ideally fill the research gap as described in section 1.2; the existing struggle for PBO's to use lessons learned in other projects. With the qualitative research performed through a literature review, case studies and interviews, an overview can be given of what factors are enabling and hampering the usage of lessons learned. Furthermore, with these results the required characteristics for using lessons learned are identified.

Based on the results a recommended conceptual framework on how to use lessons learned in project-based organizations can be designed. With all this in mind, the goal of this research is:

“to contribute to the knowledge of using lessons learned in project-based organizations by identifying the enabling and hampering factors and, based on the identified desired characteristics, develop a recommended conceptual framework to enable the use of lessons learned”.

1.6 Research question

To support the research goal described in section 1.5, the following research question (RQ) needs to be answered:

“How can lessons learned, retrieved from previous projects, be shared and used by other projects and managers?”

In support of this research questions, the following sub-questions (SQ) are formulated:

1. How are lessons learned currently shared and used?
2. What are the enabling factors for using lessons learned, retrieved from different projects and managers?
3. What are the hampering factors for using lessons learned, retrieved from different projects and managers?
4. What are the characteristics that are needed to use lessons learned, retrieved from different projects and managers?
5. Which requirements are needed to embed the usage of lessons learned into the organization and its culture?

1.7 Research relevance

The need of this research is addressed by both the scientific field as the construction sector. The subject is both discussed in literature and in practice. This section elaborates on both perspectives.

Scientific Relevance

From the scientific perspective, the need for this research is highlighted by several academic writings. Almeida and Soares state that *“since the concepts of organizational learning are themselves intrinsically complex and adhere to several assumptions in the literature, future studies should reflect their characteristics in more PBO’s”* (Almeida & Soares, 2014). Another relevant recommendation for future research, stated by Duffield and Whitty that *“their research support the premise that the project management lessons learned processes today can largely be considered incomplete and somewhat ill-conceived. Future research themes could focus on how project management lessons learned is best represented to the practitioner community and their organisations in a way that could be captured in project management methodologies and bodies of knowledge”* (Duffield & Whitty, 2014).

A second relevant notation on the subject of conducting research on using lessons learned was made by Buttler, stating that *“the design and evaluation of usage processes might be one avenue for future research. Another avenue might utilize the methodology used in this thesis to explore how lessons learned are used in project-based organizations”* (Buttler, 2016).

Studies are particularly stressing that knowledge management and knowledge transfer in project management literature is a field of research that will have great attention in following years (Holzmann, 2013). Empirically, there is strong evidence that the effective sharing of knowledge across projects will reduce the organizational costs of duplicating efforts for solving the same problem (Boh, 2007).

Practical Relevance

As already mentioned in the introduction PBO's are still encountering difficulties in transferring and using lessons learned retrieved from other projects. Although attempts have been made, PBO's are not able to pinpoint the lessons learned which were actually used in other projects. A large company like RHDHV remains to be unable to fully utilize corporate knowledge from lessons learned.

1.8 Report structure

This report continues with presenting the research design, discussing the research approach, methodologies and the research validation. The following chapters (3 – 8) present the results derived from this research, finishing each chapter with an answer to the five SQ's presented in section 1.6. Chapter 8, the last chapter of part II of this graduation report, presents an overview of the findings per methodology for each chapter (thus SQ).

Part III presents the analysis of the results, discussing the cross-method analysis, cross-case analysis and the MoSCoW analysis conducted on the findings of this research (chapter 9). The results of the analysis are incorporated in the conclusions of this research.

Finally, part IV contains the discussion (chapter 10), conclusions, recommendations and personal reflection (chapter 11). Figure 4 presents an overview of the report structure.

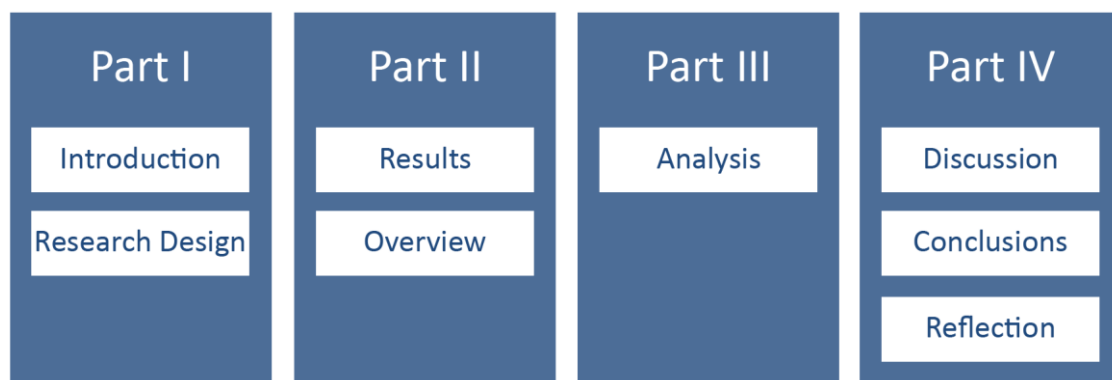


Figure 4 – Overview of report structure

2. RESEARCH DESIGN

This chapter elaborates on how the research has been structured and executed. In section 2.1 the research approach is explained. Section 2.2 describes the specific research methods used for this thesis in more detail. An important feature of academic research is the validation of research findings. The validation method used in this thesis is described in section 2.3. To give a clear overview, section 2.4 and 2.5 visualize the research framework and research structure.

2.1 Research approach

This section elaborates on the steps conducted for this research, focusing on the (sub) research questions asked in section 1.6. The research approach is based (and thus structured) according to the sub-questions (SQs).

Based on the results of the different methodologies used for this research, insights are gained to what the current state of lessons learned practices is in the sector and the academic field. When the current state of practice is defined, it becomes clearer what distance needs to be traveled until the sharing and using of lessons learned can function properly (SQ1).

Secondly, this research strives to identify the enabling factors for using of lessons learned. Based on the findings in the literature review, case studies and in-depth interviews, an overview can be listed. These identified factors need to be treated like opportunities or a positive risk, as they are key in stimulating the use of lessons learned (SQ2).

In opposite relation to the enabling factors, this research also requires identifying all the hampering factors influencing the usage of lessons learned. Logically, these identified hampering factors should be treated like a threat or a negative risk, meaning these factors can be avoided, reduced or accepted (SQ3).

Aside from the enabling and hampering factors influencing the usage of lessons learned, it is also important to define which characteristics are needed for the eventual use of lessons learned. In contradiction to the enabling and hampering factors, the characteristics have no influence on the usage of lessons learned. Instead, the characteristics are the basic needs (guidelines) for the conceptual framework to function (SQ4).

Lastly, the findings retrieved from all the previous steps are used as input for the conclusive framework presented at the end of this report (chapter 11). This conceptual framework on its own would still not be able to function ideally, because it needs to be properly embedded into the organization. By conducting a literature review and performing expert consultations, an organizational intervention is defined for embedding the conclusions into an organization (SQ5).

This research makes use of three different methodologies: a literature review, case studies and in-depth interviews. Each individual methodology has its contribution to each answer on the proposed SQs, with the exception of the case studies in SQ5. As described in section 1.5, this research aims to contribute to the knowledge of using lessons learned in project-based organizations. By comparing and combining the findings in theory (literature review) and practice (case studies and interviews), an answer to the proposed research question can be formulated.

The following section (2.2) presents and discusses the three methodologies used for this research. Furthermore, this section will elaborate further on the analysis of the results; discussing the three different methods used for the analysis: the cross-method analysis, the cross-case analysis and the MoSCoW analysis.

2.2. Research methodology

This section describes the methods used for this thesis. There are three main research methodologies used; a literature review, three case studies and interviews with the corresponding project managers and other key roles in the process of lessons learned usage. The methods are often used in parallel, but this section describes the methodologies one at a time. Furthermore, this section elaborates on the analysis of the results

2.2.1. Literature review

The first method used to gain insight into the questions asked in section 1.6 is a literature review, which focusses on previous lessons learned studies. As with the case studies and the interviews, the literature review aims to gain more insight in the current state of lessons learned practice. Also, the literature review aims to give an overview of all the enabling factors, hampering factors, required characteristics and organizational intervention strategies for using lessons learned in other projects.

The available literature on the usage of lessons learned is scarce, however it is often addressed as a recommended topic for research (Buttler, 2016; Duffield & Whitty, 2014; Almeida & Soares, 2014; Bakker et al., 2011). As mentioned in section 1.1, lessons learned can mature in three different phases; a lesson learned can be identified, disseminated and eventually used in other projects (Duffield & Whitty, 2014). Most literature focusses on the identification phase, in which for example Buttler (2016) made an effort in the research of Lessons Learned Collection Processes (LLCPs).

As Buttler (2016) recently updated the academic field, her thesis and findings are a leading source for this research. Relevant articles are retrieved through Scopus, Google Scholar, the TU Delft Repository and articles which are previously used as a source. As far as search keywords are concerned, amongst others, terms as 'using lessons learned in project management', 'project management lessons learned use', 'project management lessons learned usage', 'applying lessons learned', 'lessons learned', 'lessons learned phases', 'lessons learned influencing factors', 'lessons learned retrieval', 'lessons learned project-based organization' and 'lessons learned transfer' have been used.

2.2.2. Case studies

Case studies were conducted to investigate how the lessons learned are used in practice. According to Yin (1981) case studies investigate a contemporary phenomenon in practice, which is in line with this research. For this research three different projects are analyzed, based on several criteria as already discussed in section 1.4 and more elaborated on later in this section. For these case projects, a research is conducted to see whether lessons learned from one project are used in another project, and if so how this process went. Also, it is investigated whether projects could have been more successful when considering lessons learned from other projects, and if so how this could have been realized. One of the case selection criteria states that the projects need to be comparable. For this reason, projects from one single client account were investigated. An advantage of choosing solely projects from one client account is that the lessons learned, retrieved from other projects and managers are more likely to be used in other projects of that same client account. However, at the same time it is also a limitation of this research as lessons learned captured and disseminated from outside the client account are less likely to be incorporated into this research.

Case study selection

The selection of case studies is based on the defined scope as presented in section 1.4 and contains the selection criteria presented in this section. Because of the qualitative approach, the selected cases must be comparable. Therefore, the following case study criteria are set up; the case studies projects:

- are complex brewery projects;
- are greenfield projects;
- are from the same client account;
- have been completed;
- have a project manager available for conducting in-depth interviews.

Code number	Project code	Project country	Project name
c1	XXX	XXX	XXX
c2	XXX	XXX	XXX
c3	XXX	XXX	XXX

Table 1 - Selected case studies

Case study data retrieval approach

To retrieve valuable data from the case studies, in order to give an answer on the SQs, the following approach is used. In line with Yin (1981), the case studies investigate a contemporary phenomenon in practice. For the first SQ the cases are examined on the process of producing, sharing and using knowledge from and for the other projects. As the projects are selected on the basis of comparability, this first part strives to see whether the projects have learned from each other and made this traceable in their documentation (SQ1)

Second, for each case it is investigated how knowledge and lessons learned are identified, shared and used in the projects. If it appears that none of this is found in the case study, the more reason for this research to be performed (SQ1)

Third, it is investigated whether there are signs of enabling and hampering factors to the use of lessons learned in the case study documentation. Although direct factors might not be discovered, indirect indicators such as for example an increasing number of people added to an email-conversation or contradicting MPRs are likely to be caused by hampering factors (SQ2 & SQ3).

As there will probably be no direct answer to what characteristics are needed for lessons learned to be used in subsequent projects, only at the end of all the case studies this question can be answered (SQ4)

Case study setup

The case studies aim to support and provide input for the answers on the proposed SQs presented in section 1.6. As a follow-up, in-depth interviews are conducted to enrich the results found in these case studies and investigate the case specific findings. A structured case study setup is required in order to collect usable data out of the three case studies, because each case study project contains around 3,000 documents. The documents in this context include MPRS, audits, evaluations, email conversations, presentations, financials, contracts, letters, and so on.

The findings from the case studies are organized in a case study document, which are afterwards compared in the analysis (chapter 8). Each case study finding is numbered and corresponds to the description in the second part of the case study document. Dependent on what type of document and content the finding is, it can be labeled in accordance with the SQs.

Appendix A shows the full case study documents created during the case study research. Figure 5 illustrates the process of case study research. First ten suitable case study projects were identified with the support of the Account Manager and the Associate Director Project Management & Consultancy. By cross-referencing the suitable case study projects with the case study selection criteria, three suitable case study projects were identified (table 1).

Figure 5 shows that SQ5 is not investigated with case studies. The reason for this is that the case study documentation did not reveal any findings of interest regarding the organizational intervention. Although the documentation does indicate the current practice which clearly needs a change, it does not provide any insights into the content of an organizational intervention.

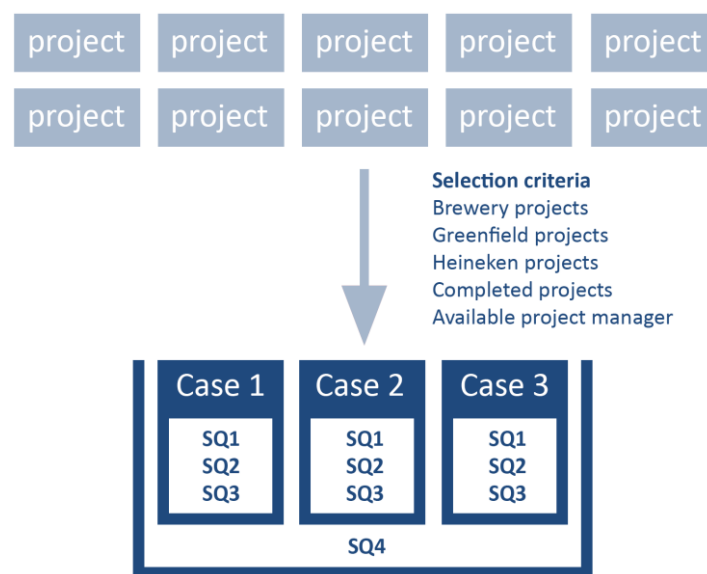


Figure 5 - Case study research

2.2.3. In-depth, semi-structured interviews

When the case studies are finished, in-depth, semi-structured interviews are conducted with the corresponding project managers and other key role RHDHV personnel. The reason for conducting these interviews is that case studies never give a full version of a certain situation (Yin, 1981). With the use of interviews, some remaining questions regarding the case study findings are answered. Because of the exploratory character of the interviews, a semi-structured interview method is used. The next part of this section elaborates more on the interview selection and design of this research method.

Just as with the case studies, there are advantages and disadvantages when conducting interviews. Advantages might be that the richest data is yielded: topics are explored in depth and help the interviewee to clarify certain assumptions. Expensive and time-consuming, the distortion of information by the interviewee and a large volume of information are considered to be disadvantages (Frechtling & Frierson, 2002).

The interviewees are also asked to give their definition of a lesson learned, as this might enrich the current definition used. Although literature gives a thorough and extensive definition (Buttler, 2016, p.4-7), the project managers in the field also have their interpretation of the words ‘lessons learned’. Also, their opinion on enabling factors, hampering factors and required characteristics concerning the usage of lessons learned may contribute to collective result as they are experienced in practice and might have interesting new suggestions.

Interviewee selection

The selection of interviewees for the deeper investigation is very straight forward: the project managers of each case study project are asked more thoroughly about the specific case study findings. In addition to this, the interviewees are asked questions related to the five SQs presented in section 1.4. Table 2 displays the interviewees codified with ‘i1’ up to ‘i4’. Their current function is displayed, the related case project and their years of experience within the industry is shown. Table 2 shows that ‘i2’ is not the corresponding project manager, but the overarching account manager. As the corresponding project manager of c2 is no longer working at RHDHV, it was not possible to conduct an interview. But as the account manager is monitoring the projects from a close distance, the eventual interviewee still provided all the information necessary for this research.

Code number	Current function	Case study project	Years of experience
i1	Senior Project Manager	C1	>40
i2	Account Manager	C2	>35
i3	Senior Project Manager	C3	>25
i4	Senior Project Manager	C3	>10

Table 2 - Interviewees for in-depth interviews

Interview design

Already mentioned earlier is that the interviews are semi-structured and divided into three parts; the first part focusses on the introduction of the project manager and its background, the second part is focusing on answering the SQs and the third part aims to investigate the case specific findings more thoroughly. The full results of the interviews are presented in Appendix G.

The introduction sketches a profile of the project manager and also investigates the project specifics from their point of view. This includes a short description, the scope, the planning, budget and finally asks the project manager to grade the appreciation towards the project. This is done because in the end of the interviews the same is asked, and it is interesting to see whether the appreciation towards the project deviates after case specific questions have been asked (bias).

Second, the questions related to the SQs are asked including their definition of lessons learned, the current practice in sharing and using lessons learned from their own point of view and also strive to identify the enabling and hampering factors from their perspectives. In line with the SQs, indications of required characteristics are also identified due to the semi-structured style of interviewing.

In the third part, the interviewees are asked questions related to the case specific findings presented in the case study documents. Although some case specific findings might not directly indicate for example any enabling or hampering factors, the answers on these questions are still valuable in completing the picture of the case studies. Together with the case study results, the interview results are analyzed by means of a cross-case analysis presented in section 9.2.

Expert selection

Aside from the interviews conducted with the corresponding project managers of the case studies, expert consultations have taken place to incorporate a wider perspective than the case studies alone, especially aimed to provide insight into the final sub-question (SQ5).

Related to the content of this research and sometimes related to a specific SQ, the selection of these experts was based on their experiences and current function within RHDHV. Table 3 displays the experts codified with 'e1' up to 'e3', their current function and their contribution to the different SQs.

Code number	Current function	Contribute to SQ
e1	Director Project Excellence	1, 2, 3, 4
e2	Global Corporate Director Human Resources	5
e3	Business Line HR Partner Transport & Planning	5

Table 3 - experts for consultation meetings

Expert consultation design

The expert consultations were not as structured as the interviews, because the goal was not related to specific answers on the SQs. More it was to function as a brainstorm on the subject of this thesis and the organizational intervention to embed the results into the organization. Another reason why the expert consultations were not structured as the interviews with project managers was because their field of work was not specified in one single discipline, while for the project managers the field of work was very much aligned.

For instance, the Director Project Excellence is responsible for a group of Project Excellence Managers (PEM'ers), with the goal to improve every project just a bit more by incorporating amongst other things the lessons learned identified from other projects. This is completely another field of work compared to e2 and e3, who amongst other things fulfil a role in the culture change for the organization. This specific PEM department is discussed in more detail in chapter 3.

2.2.4. Analysis

The analysis of the results derived from the literature review, case studies and interviews is done in three ways: a cross-method analysis, a cross-case analysis and a MoSCoW analysis. As mentioned earlier all the methodologies have several aspects researched; definitions, opinions, real-life cases, hampering factors, enabling factors, required characteristics.

With the cross-method analysis, all the findings per method are compared to each other to see which findings are found in multiple methods and which findings deviate from each other. The cross-case analysis is conducted to find out what lessons learned were identified, disseminated and used in the different projects. It is of interest for this research to see which lessons learned were identified in multiple case projects and if these lessons were disseminated amongst other projects. After all the results are identified and listed, the MoSCoW analysis strives to prioritize these findings by placing the findings into four categories: 'must have' (M), 'should have' (S), 'could have' (C) and 'won't have' (W). All the different methods used for the analysis are described more thoroughly in the analysis chapter itself (chapter 8).

The results and conclusions of the analysis will be used as further input for answering the research questions, which are presented in chapter 10.

2.3 Research framework

As becomes clear from the previous sections in this chapter, multiple methodologies are used to answer each individual SQ. Figure 6 illustrates the research framework used in this thesis, portraying the grid in which each research methodology generates input for each individual SQ.

		Literature	Case study	Interviews	
Chapter 3	SQ1	Result	Result	Result	Answer SQ1
Chapter 4	SQ2	Result	Result	Result	Answer SQ2
Chapter 5	SQ3	Result	Result	Result	Answer SQ3
Chapter 6	SQ4	Result	Result	Result	Answer SQ4
Chapter 7	SQ5	Result		Result	Answer SQ5
					Analysis Chapter 8
					Discussion Chapter 9
					Answer RQ Chapter 10

Figure 6 - Research Framework

2.4 Research validation

Every academic researcher needs to validate their findings in order to create a stronger basis for the results derived from this research. As this research is conducting case studies on three different projects, which are later analyzed through comparing them, the validity of the research can be negatively influenced regarding the researchers' bias (Verschuren & Doorewaard, 2010).

To ensure research validity, the validation through expert panel method is used. A meeting is organized with several experts in the field of project management to validate the findings and results of this thesis. As the research is conducted within the scope of greenfield brewery projects within one single client account, validation in a broader project management perspective is a must.

The content of the meeting consists of presenting the results, findings and suggestions to the expert panel and start the dialogue whether the content is applicable outside of the research scope. The outcomes of the validation session are presented in section 8.5, which elaborates more on the similarities and differences found between the results of this research and the expertise of the validation panel. This section also gives a more detailed overview of the validation set-up and context.

3. THE CURRENT STATE

This chapter presents the results on the first sub-question “*How are lessons learned currently shared and used?*”. As presented in chapter 2 the results are structured per research methodology, starting with the literature review (section 3.1), followed by the case studies (section 3.2) and the in-depth interviews (section 3.3). After the results are presented a conclusion and answer on the sub-question is presented in the last part of this section (section 3.4).

3.1 Literature review

The need for improvement

Whilst the lessons learned process is popular, it fails to deliver the intended results. Lessons learned are identified, but often not followed through and integrated into the organization (O’Dell & Hubert, 2011). In practice, organizational learning form projects rarely happens, and when it does it fails to deliver the intended results (Atkinson et al., 2006; Keegan & Turner, 2001; Kerzner, 2009; Klakegg et al., 2010; Milton, 2010; Schindler & Eppler, 2003; Williams, 2008; Wysocki, 2004, 2009). The problem is that organizations are unable to apply or implement the lesson learned (knowledge) they have. Both knowledge and project management literature suggests that in practice lessons learned processes rarely happen, and when they do, they are concerned with lessons identification rather than organizational learning (Duffield & Whitty, 2014). The literature already shows that the identification of lessons learned appears to be done quite well in most organizations, whereas the dissemination and application of lessons learned fail to deliver the intended results (Atkinson et al., 2006; Keegan & Turner, 2001; Kerzner, 2009; Milton, 2010; Schindler & Eppler, 2003; Williams, 2008; Wysocki, 2004). Amongst other reasons, projects fail due to a lack of lessons learned among the project team or lack of knowledge sharing. Identification practices are often mistaken as complete lesson learned processes (Duffield & Whitty, 2014). Once a project is finished, the knowledge created should then be transferred to the organization as a whole, for the purpose of organizational learning, and contributing in this way for a common knowledge-basis across projects (Almeida & Soares, 2014). Much of the literature re-enforces the point that people factors influence the success of the lessons learned process and that a learning organization culture is critical to successful dissemination of lessons learned (Andriessen & Fahlbruch, 2004; Fernie et al., 2003; Leistner, 2010; Sense 2007).

A project-based context

Because of a project’s volatility, different from the usual organizational tasks, projects became an interesting informational problem: being transient settings, mostly using distributed resources, partially or totally virtualizing with respect to interaction, involving intensive information flows and resulting in big amounts of content to managed (Almeida & Soares, 2014). Projects are not only the pragmatic mean of controlling work and the workforce in a dynamic environment (Cicmil & Hodgson, 2006), they are also the activity that organizations use to gain and capture knowledge (Sherif, 2006) about their environment (Sense, 2009), to innovate and explore new markets (Gann & Salter, 1998), and to compete against others (McKenna & Whitty, 2012). The degree in which lessons learned are identified shared and used are strongly dependent to the environment they are in. Currently a project-based context is considered to be forming obstacles instead of possibilities for lessons learned to be functioning in a proper way.

The internal organization network is a must

When it comes to sharing project knowledge, generally, people first use their personal network of contacts inside the institution. After this, they can make use of some supportive written information. Generally, people are more open to the idea of talking to someone directly and by using typical personalization mechanisms, instead of reading documents archived in the project repositories and tools, which are found "boring and heavy to read" (Almeida & Soares, 2014).

The current usage of lessons learned

The usage of lessons learned varies: they are applied in the next project or used directly within the organization. Lessons learned have been used to motivate changes, create awareness and to update knowledge assets. The usage of these mechanisms aims to get people and projects to work in the same way, and to achieve consistent work practices across disciplines. In total there are seven ways to use lessons learned in order to improve the performance of future projects. [1] Lessons learned can be stored in a knowledge repository or database and retrieved in future projects. [2] Lessons learned may be used as input for decisions made independently of projects (Buttler, & Lukosch, 2013). [3] Lessons learned are used to change standards and working processes (Gibson et al., 2007), or modifying training given to employees (Gibson et al., 2007; Birk, Dingsøyr, & Stålhané, 2002). [4] Several sources consider lessons learned as a resource for future projects (Kasi, Keil, Mathiassen, & Pedersen, 2008; Keegan, & Turner, 2001; Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006; Liebowitz, 2008). [5] Lessons learned have been used to create awareness. [6] Lessons learned have been used to pro-actively prevent problem by adapting and implementing an approach described in a lesson learned. And [7] lessons learned also have been used to evaluate a design by checking whether there are any unanticipated problems with the design or solution developed in a project.

A proof of concept

Aspects of health care, nuclear power, rail and aviation organizations have successfully implemented organizational learning by way of the Swiss cheese model (figure 7) for safety and systemic failures (Duffield & Whitty, 2014). Based on the Swiss cheese model (Reason, 1997), Duffield and Whitty (2014) presented the Systematic Lessons Learned Knowledge (Syllk) model. The analogy of this Syllk model refers to how a lesson learned needs to be transferred through several 'layers' of the organization (technology, learning, process and people) before it is properly disseminated. At each layer, it is assessed whether the lesson learned is applicable in that specific part of the organization. A review of the BP Deepwater Horizon accident investigation revealed how lessons learned of previous "well control event incidents" and "lines of communication" were not acknowledged or addressed and was a contributing cause to the failure, showing the influence of properly using lessons learned (BP, 2010; Cleveland, 2011).

Research highlights that high-reliability organizations (HROs) learn their lessons through the safety process of collecting, analyzing and disseminating information from errors as well as proactive checks on the organization vital signs (Hopkins, 2009; Vogus & Sutcliffe, 2007; Weick & Sutcliffe, 2001). High risk and reliability industries have demonstrated that the implementation of incident reporting systems is essential, and their benefits far outweigh their costs to the organizations. Furthermore, they accelerate the transformation of lessons learned (Barach & Small, 2000).

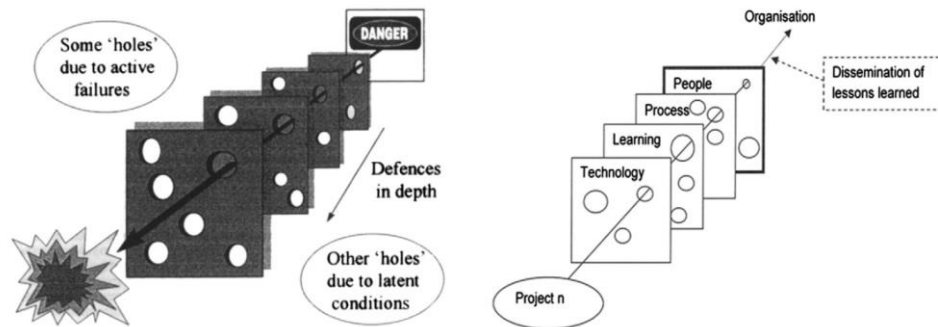


Figure 7 - The Swiss cheese model & Systematic Lessons Learned Knowledge (Syllk) model
(Reason, 1997; Duffield & Whitty, 2014)

3.2 Case studies

The current practice of sharing and using lessons learned in the case studies were observed to be minimal to none. Although the case studies do not include the face-to-face conversation between different project teams and managers, still no documentation was found suggesting that lessons learned were shared and used within other projects. Evaluation tools like MPRs and project audits were present in the case study documentation, but no documentation was found in which it became clear that lessons learned from a project were transferred to another project. Not to mention the usage of these lessons in another project context. In line with the literature, the identification phase of lessons learned is done quite well.

However, the documentation found in the case studies was incomplete. MPRs were not conducted monthly, in one project the Project Plan is missing, and so on. Based on the case study results, it becomes clear that the dissemination and implementation of lessons learned is lacking or does not happen at all. This section elaborates more deeply on the findings in the case studies regarding the current practice of using lessons learned.

Alignment with client

Although the practice of sharing and using lessons learned is not found in the case studies, some documents do appear to strive towards the alignment of internal disciplines and the client. An example of this is the desired partnership between RHDHV and the client, with the goal to align the workflows and expectations, work fast and agile, and apply insights from the Data & Digital discipline. Appendix B gives an overview of the vision both parties have constructed during the “Client Workshop Optimum Workflows”, which took place on the 7th of December 2017. In general, five different themes form the structure of the proposed partnership:

1. Alignment – scope of services and project phases
2. Planning – ownership and acceleration
3. Standardization – BIM 3D and Virtual Design
4. Cooperation – as a partner / team
5. Expectations – and responsibilities

This attempt to construct a partnership indicates that RHDHV and the client want to improve their current practice in project management and join forces to improve the process. Content wise the workshop maintained the “Start-Stop-Continue” structure, in which people from RHDHV and the client mixed up in little groups and brainstormed on what practices should be started, what should be stopped and what practices should be continued as it is going at the moment. Results included to start the sharing of lessons learned, the need for standardization and aligning project deliveries.

3.2.1 Case specific results

On the level of case specific findings, no indication was found of lessons learned sharing and usage in the project. However, on the subject of lessons learned identification, the first phase of lessons learned usage described by Duffield & Whitty (2014), in all cases documents were found which contained lessons learned. These documents included internal project evaluation forms (C1), MPRs (C2, C3), audits (C1) and a financial wrap-up (C3).

Internal project evaluation

The internal project evaluation forms found in C1 gave a rich amount of identified lessons learned, including; lack of communication, unclear communication due to a language problem, too much reviews which led to a budget overrun, too much time needed for procurement, poor cost estimations on materials and import costs, the need for improved coordination and the required internal meetings conducted weekly (or at least on a standard basis). But again, no findings suggested that these lessons were shared and used in other projects (Appendix C).

Audit

A second finding worth mentioning is the audit conducted in C1, evaluating project management practices of the project manager. Some findings in the audit included the lack of a Project Plan, the lack of MPRs, the lack of a completed and approved Change Order form and no incorporation of the agreed changes into the Project Plan. Furthermore, the question on project closure was left blank. The next section will elaborate further on the causes and reasoning behind the results of the audit as this finding might reveal larger problems at hand. When critical lessons learned identification documentation is missing, the eventual use of these lessons learned in other project contexts will be almost impossible.

Monthly Progress Reports

Only C2 and C3 have documented MPRs, however the MPRs in C3 were mostly found empty and there was no consistency found within the other MPRs. The MPRs found in C2 were conducted five months in a row in which it was possible to map the progress of the project. Also, these MPRs were structured more properly in a way that monthly the subjects; project, contract management, site management, time management and cost management were assessed. Still, some inconsistencies were found on the subject of cost management which needs deeper investigation by the in-depth interviews and later discussed in the analysis of the results.

Financial wrap-up

Lastly there was a financial wrap-up document found in C3 (Appendix D), discussing the causes for additional work and thus heightening the financial ceiling. Because of the missing agreement on heightening the financial ceiling of the project, RHDHV was forced to lay down their work until an agreement was reached. Because of malfunctioning communication between RHDHV and the client, and the absence of approval towards the additional work conducted by RHDHV, the project was dealing with a 30% budget overrun (worth €520.000). Although this is a prominent issue in the project, no lesson learned was found in the documentation suggesting improvements for future projects.

3.3 In-depth interviews

On the current practice of sharing and using lessons learned into other projects, multiple questions were asked on awareness of available lessons learned, the know-how on dissemination of lessons learned and the dissemination and usage of lessons learned in the case study projects. Also, explanations were given on the case specific findings discussed in the previous section.

Minimal awareness

The awareness of available lessons learned within the company is considered to be minimal. Reasons for this, given by interviewees, are the fact that the lessons are not shared (i2), nobody knows how this should be communicated (i3) and there is no central location where these lessons are stored (i3). Another interesting finding is stated by i1, stating that people should call people who you assume to have knowledge on the requested subject. This is in line with the finding presented earlier which stated that the internal organizational network is currently a must have for using lessons learned from other projects (i2, i3).

It is shared, but not constructively

The next questions elaborated more on the identification, sharing and usage of lessons learned in the case study projects. In all three cases lessons learned were identified, and all implied to have disseminated them among other projects. This was done in multiple ways; evaluations with clients and partners (i2), it was shared within the client-team (i2), through verbal communication streams (i1) and through sessions with project managers (supposedly referring to the project management intervention sessions) (i3).

However, when asked if the interviewees knew how their lessons learned had affected other projects the answers deviated between some specific actions taken in the other project (i1), not being sure whether the lesson learned was the cause of a certain change (i2) and not being notified whether any effect was shown caused by the lesson learned (i3).

The other way around; two project managers implied to have used lessons learned retrieved from other projects, but could not identify the lesson learned used (i1, i3).

Lastly it was asked whether more lessons learned could have been used in the project, in which all cases stated that they would have if they knew about them. This empowers the statement that the sharing of a lesson learned is just as important as the desired usage of it.

Project Excellence Management

In the expert consultations, some interesting findings are adding value to the state of the current practice in sharing and using knowledge (e1). Within RHDHV a discipline called Project Excellence Management (PEM) aims to improve projects with, amongst other things, stimulating the sharing and using of lessons learned. The so-called PEM'ers are positioning themselves between multiple project managers, and with monthly talks stimulate the cross-fertilization of lessons learned (e1).

However, "the current practice is still not where it should be" (e1). Figure 8 displays the current Project Excellence Management practice.

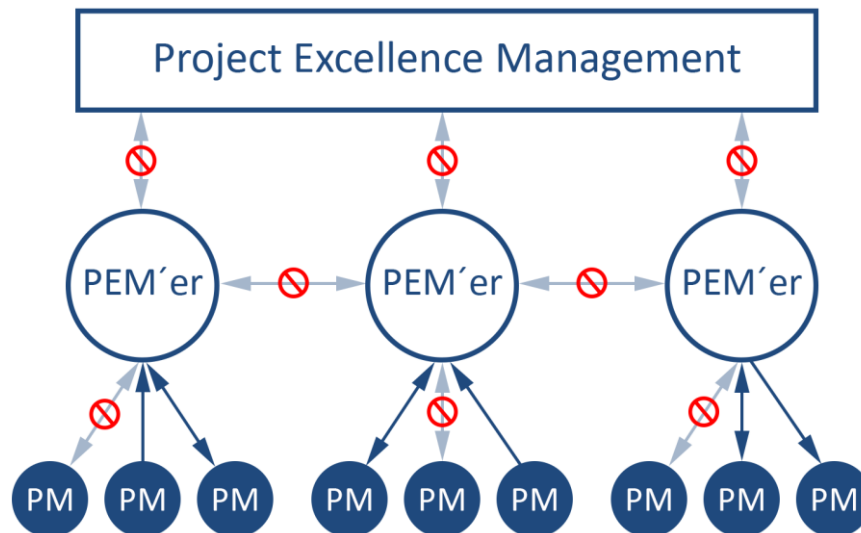


Figure 8 - Current Project Excellence Management practice

Initially PEM started with the development of a database. But as almost nobody worked with it, the focus of PEM turned back to the conversation. Every month the project manager and PEM'er sit together and discuss the project. And as the PEM'er has multiple project managers in his or her portfolio, the PEM'er can share lessons retrieved from other project managers or capture lessons which can be useful for others project managers in the portfolio.

However, this process is not going as intended: not every project manager has these sessions with a PEM'er, it is not always a two-way street of lessons sharing and the PEM'er is currently not using a (digital) repository of all lessons retrieved from these sessions. It depends on the memory of a PEM'er whether a lesson learned is shared in the conversation (e1). As displayed in figure 8, these lessons learned sessions with a PEM'er are individual; meaning that it does not directly stimulate the lessons learned sharing between different project managers.

3.4 Conclusion

Currently the dissemination (transfer) and application (implementation) of lessons learned within a project-based organization remains a challenge. The need for improvement is thoroughly stressed in literature, indicating the current lack of knowledge transfer between project teams and individuals. And when the knowledge is not disseminated within the organization, using the lesson in subsequent projects remains impossible.

In line with literature, in the case studies no indications were found suggesting the dissemination and implementation of lessons learned. In some documentation identified lessons learned were found, but there was no sign whatsoever suggesting the actual use of lessons learned in other projects. Documentation that incorporates the identified lessons learned (MPRs, audits, etc.) were missing, incomplete and inconsistent, giving no support to the actual usage of these lessons. A small indication of incentive to improve the current lessons learned practice was found in the partnership between RHDHV and the client. One of the reasons why this partnership is created is to ensure a more efficient infrastructure in which lessons learned can be disseminated and used for other projects.

The interviews with the corresponding project managers and experts on the current state in using lessons learned resulted in a slightly different conclusion; lessons learned are identified, but are also shared and used in other projects. However, when asked to pinpoint those lessons learned, no interviewee was able to provide any specifics whatsoever. One of the reasons for this is that lessons learned are shared through verbal communication streams with the support of an internal organizational network. Not only were the interviewees unable to pinpoint in what projects their identified lessons learned have been used, the other way around the interviewees were also unable to pinpoint what lessons learned were implemented in their projects.

The most lessons learned related disciplines within RHDHV (Project Excellence Management) aims to support the conversation by positioning themselves between the project managers and function as an interaction in identifying and disseminating lessons learned. The current state of this practice is however not going as intended; not every project manager has conversations with a PEM'er, the PEM'er does not properly document the identified lessons in some kind of database and the conversations are not always going in both directions.

With all this in consideration, an answer can be given to the first sub-question (SQ1).

SQ1: How are lessons learned currently shared and used?

Currently a lesson learned is shared and used in the most minimal way. Although the interviewees of this research ensure the dissemination and implementation of lessons learned in other projects, none of these lessons could be pinpointed or be found in the project documentation of the case studies. Some findings in the case studies and interviews however do suggest the incentive to improve the current state of sharing and using lessons learned, for example the perceived partnership between RHDHV and the client, and the Project Evaluation forms (c1).

4. ENABLING FACTORS

This chapter presents the results on the second sub-question “*What are the enabling factors for using lessons learned, retrieved from different projects and managers?*”. Again, the results are structured per research methodology, starting with the literature review (section 4.1), followed by the case studies (section 4.2) and the in-depth interviews (section 4.3). After the results are presented a conclusion and answer on the sub-question is presented in the last part of this section (section 4.4).

4.1 Literature review

Knowledge-sharing mechanisms

Knowledge-sharing mechanisms can be divided into two perspectives; the codification perspective and the personalization perspective. In codification, knowledge should be carefully codified and stored in databases and documents, where it can be accessed and (re)used by employees in the company. In this perspective, knowledge-sharing mechanisms are implemented by means of a “people-to-document” approach: the person who “knows” inscribes the knowledge obtained in a “document” which is reused for various purposes by someone else that accesses the “document” (Almeida & Soares, 2014). On the other hand, using personalization mechanisms, knowledge will be closely attached to the person who developed it and shared mainly through direct person-to-person contacts (Boh, 2007).

It is a social endeavor

Knowledge sharing is a social phenomenon; it involves interpersonal relationships and social interactions (Lin, Wu, & Lu, 2012). As a result, a strategy to improve knowledge sharing needs to be embedded within the social organizational practices and culture (Almeida & Soares, 2014). Knowledge sharing is best performed through the communication of individuals, and two clearly identifiable social-based processes that appear successful are networking and mentoring (Bresnen et al., 2003; Huang & Newell, 2003).

The “right” tooling

Using mainstream tools, which were familiar to all project members, is considered to have a positive effect on using lessons learned. This is consistent with previous studies: perceived ease of use is a critical determinant to decide organizational members’ acceptance of newly adopted information technology (Venkatesch, Morris, Davis, & Davis, 2003; Lee, Kim, & Kim, 2006). Studies pointed out that user-friendly IT applications and a high number of users of these applications can improve information sharing (Almeida & Soares, 2014).

The selection of these platforms and tools are based on which are familiar to the project team or organization. It is perceived that Enterprise Information Management (EIM) strategies in projects need to be closely aligned with the dominant knowledge-sharing mechanisms, in which ‘person-to-person’ knowledge-sharing is perceived to be most effective. It is thereby advised to use an IT application which stimulates the ‘person-to-person’ knowledge sharing in both a digital environment as the face-to-face encounters.

Retrievable knowledge

When a project is finished, the EIM lifecycle should assure that information produced is organized in order to fulfill the organizational needs. EIM artifacts should be addressing those issues, by providing direct channels where the unit members can retrieve for instance, information conveying knowledge acquired in past projects, and without a middle man in the process (Almeida & Soares, 2014). A proactive behavior is required in order to ensure success. For instance, the root cause analysis (RCA) can be applied to lessons learned based on positive experiences (best practices) as well as negative experiences (challenges). This rarely changes the main content of the lesson learned, but may shift the focus of the lesson learned towards an applicable level of detail (Buttler, & Lukosch, 2013).

The alignment of people and the system

Related subjects in the limited coverage in the usage of lessons learned literature are the high level of knowledge and credibility of individuals, the commitment of people to a credible process, a culture of respect, where knowledge, experience, and systems are respected and lastly a culture of helping people (Duffield & Whitty, 2014). A number of things need to come together and be supportive of each other in order to enable a beneficial practice. Culture and social attitude is a priority for capturing knowledge from learning experiences. The alignment of people and system elements has the potential to positively influence the success of an organization's lessons learned process (Duffield & Whitty, 2014).

4.2 Case studies

From the case studies some findings indicate to enable sharing and using lessons learned. As it remains unclear to what extent these factors actually made a positive contribution to the usage of lessons learned, the in-depth interviews described in the subsequent section will elaborate more on the actual outcome.

The expert families

First it is found that within the department of Project Management and Multinationals (P&M) of RHDHV, experts are clustered for bigger client accounts. For these larger accounts, the structure of each project is much more standardized than 'single-loop' projects. Giving the new projects a head start in the initiation phase. Furthermore, the kinds of "client-based groups" within an organization stimulate the dialogue between colleagues and the sharing and usage of lessons learned. A possible backside is that people tend to stop looking beyond the 'client borders' as they might be so convenient to the current way of working. The in-depth interviews are deeper investigating the actual sharing and usage of lessons learned, as the documentation of these processes has not been identified.

Central documentation system - BOX

Although the general consensus amongst the people at P&M is that the currently used storage system of project documentation (BOX) is not functioning properly, the idea of a central stored system which is operational in the cloud does support the sharing of lessons learned. People can remotely retrieve data out of this information source which can support the actual use of a lesson learned in another project context. However, these kinds of sources do need a lot of standardization and structure for people to actually find this specific documentation.

Project Health Check

A digital tool used for Project Excellence is the so-called Project Health Check (HC). Appendix E gives an overview of the purpose of these HCs. “The Health Check Process is a monthly process, consisting of review moments in which project managers assess their projects, dialogues with line managers in which project managers discuss their projects, and potential follow-up meetings and actions throughout the Business Line for projects that need additional management support” (Insight, 2018). The Project Health Check can provide substantial support in enabling people to use lessons learned in future projects as this is one of the mandatory tools every project manager must use on a regular basis.

Project Management Intervention

The Project Management Intervention sessions (PMI's) aim to distribute best practices and challenges across project teams and managers. Four times a year these intervention sessions take place with the whole project management discipline across all Business Lines of RHDHV (Industry & Buildings, Transport & Planning, Aviation and Water). The PMI's are a great medium in which lessons learned can be disseminated beyond the 'client borders' and be used in other project contexts. However, because of the low frequency in which these sessions take place it does not suffice enough social encounters for lessons learned to be properly disseminated and used.

4.2.1 Case specific results

In the case studies some enabling factors for the usage of lessons learned were identified, but because of the lack of actually sharing and using lessons learned they may be seen as indicators instead of actual enabling factors.

Standardized project organization

Because of the long relationship between RHDHV and the client, a lot of work processes have been standardized. For instance, the project organization in C3 (Appendix F) is the standard organization for each client project performed by RHDHV. Although some alterations might be necessary per individual project, this standardized project organization is maintained throughout most of the projects. This standardized project organization can be considered as an enabling factor to the usage of lessons learned because the lessons learned for these client specific projects are more likely to be used in other projects by that same organizational structure.

The incentive of identifying lessons learned

Although the results indicate that the usage of lessons learned is not identified in the case studies, the incentive of at least identifying lessons learned is a start. Although for now it cannot be concluded whether these evaluations are conducted from intrinsic motivation or because the project teams were obliged to do so, it still is a first step in the eventual usage of lessons learned (Duffield & Whitty, 2014). In-depth interviews will investigate more thoroughly whether these evaluations were mandatory and if the lessons learned identified were shared and used in other project contexts.

The storage of all e-mail conversations

Another indicator that implies the prospect of using lessons learned is the extensive documentation of e-mail conversations. Although again this is only the first step towards the usage of a lesson learned, still it shows an incentive to document the knowledge for future use. On the other side, it could be obligatory for every project team to export their e-mail conversations for project closure. This is something that needs to be investigated during the in-depth interviews. Still these findings on the identification of lessons learned do not mean that the lessons are actually used. It can only be said that there is an incentive towards documenting knowledge for future use.

4.3 In-depth interviews

In the interviews, the question was asked what factors enable the dissemination and usage of lessons learned. The findings can be put together in four themes; a central “lessons learned team”, a standardized structure and process, stimulate the conversation and a culture of honesty.

A central “lessons learned team”

One of the interviewees proposed to appoint a central “lessons learned team” that is responsible for the whole lesson learned practice. It would be their responsibility to keep the lessons learned present, aware and accessible for other people to use. This “lessons learned team” could join the kick-off of a project to distribute relevant lessons learned to the project team (i4).

In line with this, a centrally organized platform is suggested in which all the lessons learned can be placed (i2). The responsible lessons learned team is making sure that the lessons learned retrieval processes, like for instance an evaluation, is executed properly. By constructing a format or template in which the lessons learned are documented and available from the start, this could enable the eventual usage of lessons learned (i3).

A standardized structure and process

There is a need for standardized structure and process. A document which includes new insights to an existing lesson learned might enable the eventual use of it (i1), like for example on a review basis. This process should stimulate and ensure the lesson learned to mature to its most recent form, meaning that possible improvements to a lesson learned can be added in the life-cycle of a project (i3). One interviewee suggested that an enabling factor would be to structurally have lessons learned sessions on a regular basis, for example every three months (i3). This suggestion can be incorporated with the PMI's discussed in the previous section.

Stimulate the conversation

In line with literature the interviews stressed the need for communication, as this is how the lessons are properly shared and eventually used. By hosting lessons learned sessions, for example during the kick-off, the conversation is stimulated creating the possibility to use a lesson learned (i3, i4). In line with the findings in section 3.3, the Project Excellence Management (PEM) department is currently focusing on the conversation instead of investing solely on a database (e1).

A culture of honesty and respect

Lastly some findings mention the culture and its change to stimulate the use of lessons learned. People should be honest about their problems and proud about their achievements. By creating a culture in which people feel free to share the lessons learned (both positive and negative), this will

enable the use of the lesson learned in other projects. The culture within the organization should be changed to make sure that lessons are actually learned, shared and used in other project contexts.

4.4 Conclusions

The lessons learned practice remains a social endeavor. Within the knowledge-sharing mechanisms, the personalization perspective is considered to be most effective as it stimulates the 'person-to-person' knowledge transfer and thus the conversation. The Project Management Intervention sessions (PMI's) promote an opportunity for lessons learned to be properly disseminated and used in other project contexts. With the alignment of people and the system they are operating in, the usability of lessons learned is stimulated. An example made in this research regards the Project Health Check (HC) which is currently in use for new projects. By incorporating the lessons learned practice into the HC, the use of lessons learned is stimulated. However, a critical side note must be made that this does not guarantee the actual use of lessons learned, as it only functions as a mandatory check and creating awareness.

Another example regarding the alignment of people and the systems are the expert families for bigger client accounts. Client-based groups within an organization are working in the same project structure as their colleagues and generate multiple advantages to the usage of lessons learned: [1] the adaption of a lesson learned in another project is easier, [2] the incentive to start a conversation on the lessons learned is higher and [3] as the phasing and project life-cycle of the projects are similar, the lessons learned are more likely to be used at the right moment.

Furthermore, standardization in structure, templates and processes enable the usage of lessons learned as they also stimulate the adoption of lessons learned in other project contexts. A central "lessons learned team" that is responsible for the whole lessons learned practice can create awareness to the people within the organization on the lessons learned available. This central "lessons learned team" can host the lessons learned sessions in each individual project and can present the overall results during the Project Management Intervention sessions. By stimulating the conversation in both the individual projects and the PMI's, the use of lessons learned is enabled.

A final important enabling factor to the usage of lessons learned is the culture of an organization in which people feel comfortable to share their lessons learned. As long as people do not feel comfortable in sharing their mistakes and achievements, all other investments in products and processes will have less effect on the usage of lessons learned.

With all this in consideration, an answer can be given to the second sub-question (SQ2).

SQ2: What are the enabling factors for using lessons learned, retrieved from different projects and managers?

The use of lessons learned is enabled by [1] stimulating the conversation, [2] using Project Management Intervention sessions as a podium where lessons learned are shared and stimulated to be used, [3] aligning people and the system through tools like the Project Health Check and organizational structure like client-based expert families, [4] standardizing project structure, templates and processes, [5] assigning a central lessons learned team that is responsible for the whole lessons learned practice and create awareness, and by [6] ensuring a comfortable culture in which people feel free to share their mistakes and achievements.

5. HAMPERING FACTORS

This chapter presents the results on the third sub-question “*What are the hampering factors for using lessons learned, retrieved from different projects and managers?*”. Again, the results are structured per research methodology, starting with the literature review (section 5.1), followed by the case studies (section 5.2) and the in-depth interviews (section 5.3). After the results are presented a conclusion and answer on the sub-question is presented in the last part of this section (section 5.4).

5.1 Literature review

The project team and its structure

Different professionals have different cultures and ways of working which can be conflicting with the other participants or project culture (Ajmal et al., 2008). At the same time, project teams move from one project to another usually without the time to conveniently assimilate and document all the knowledge that was acquired during the project (Bakker et al., 2011). As the project teams are continually changing membership, the familiarity with various applications and platforms will also change and thus need to be learnt again (Coakes et al., 2008).

Information overload

The massive use of ICT platforms and EIM artifacts (technologies) in projects impose further challenges to project managers, as they have to handle the existing information overload (Almeida & Soares, 2014). This is due to the decreased ability of project managers in getting the relevant, timely, and accurate information, and in managing information and knowledge flows for future utilizations and developments (Karim & Hussein, 2008). Often organizations implement an IT system solution without considering the organizational learning needs and implementations that focus on technology typically fail (Barnes, 2011). This is in line with the findings in the previous chapter on the alignment between people and the systems they operate in.

Organization of information

The importance of information organization and classification in the scope of projects is twofold: in one way, it reports the experience of increasing difficulty in finding efficiently the needed content because of increasingly larger volumes of generated content. In the other way, it shows the familiarity with an organization and classification scheme that mimics the project’s task structure (Almeida & Soares, 2014). The multiplicity of mediums to manage information is sometimes envisaged as problematic. Even when people reuse previous project information like proposals or document templates, they usually found it by personal referrals. Using personalization mechanisms reflected, however, a major issue that was the difficulty to search useful and reusable past project information (for instance, budgets, lessons learned or templates). Most of the times people do not even know where to start looking because of the lack of centralized platforms or repositories. The creation of large amounts of information, dispersed by different platforms and tools, makes it hard to use it in another context (Almeida & Soares, 2014). These findings align with the retrievable knowledge found in section 4. 1.

Process knowledge vs. product knowledge

Regarding the usefulness of lessons learned, a major obstacle for using learnings from projects lies in the type of the documented knowledge: projects typically collect product knowledge instead of process knowledge. Process knowledge is defined as knowledge about the processes that a project team has deployed to achieve their goals and why these processes seem to have worked well or badly. Product knowledge is defined as knowledge about what has actually been achieved in relation to the stated goals and objectives (Newell et al., 2006). The reactive use of lessons learned often results in mitigation measures being too late to implement. Often these mitigation measures propose actions being done differently in the beginning of a project (Kasi, Keil, Mathiassen, & Pedersen, 2008; Keegan, & Turner, 2001; Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006; Liebowitz, 2008).

The lack of structure and conciseness

In the adaptation and usage of lessons learned, understandability and standardization have a big influence. The understandability of lessons learned is reduced if they are presented in a very brief manner, particularly for employees who have not been involved in the collection process (Tan, Carrillo, Anumba, Kamara, Bouchlaghem, & Udeaja, 2006). The understandability is also reduced if the lessons learned are described too generically and not visualized when needed (Schlinder, & Eppler, 2003). The lack of a standardized, consistent format and content for lessons learned can also present a challenge to the user of a lesson learned (Tan, Anumba, Carrillo, Bouchlaghem, Kamara, & Udeaja, 2010; Buttler, & Lukosch, 2013). And lastly, lessons learned can be difficult to transfer to new projects if they are bound to specific contexts (Kasi et al., 2008).

Project-based related influencers

Project-based hampering factors which influence the usage of lessons learned are considerable in numbers. [1] Time pressure (Disterer, 2002; Leistner, 2010; Williams, 2008), [2] blame culture (Andriessen & Fahlbruch, 2004; Schindler & Eppler, 2003; Williams, 2008), [3] poor IT (Duhon & Elias, 2008; Leistner, 2010; Williams, 2008), [4] social barriers (Disterer, 2002; Duhon & Elias, 2008; Maqsood, 2006) and [5] knowledge is power (Leistner, 2010). All these factors indicate both product-based causes like poor IT, process-based causes like time pressure and culture-based causes like blame culture and social barriers.

The person of the project manager

The people element and culture factor may well be the most likely to negatively influence lessons learned in organizations (Duffield & Whitty, 2014). What causes a problem is that project managers are “people-oriented, free-thinkers, passionate, autocratic, conservative and pragmatic” and in most cases these behaviors can hinder organizational cross-project sharing of lessons learned (Pemsel & Wiewiora, 2013). A protective post lessons learned attitude weakens the process and hides the real problems of the project (Duhon & Elias, 2008). Every person has a distinctive learning technique. That learning technique depends on an individual’s capability to effectively acquire and use learnings in a timely manner (Maqsood, 2006). The people element and the indifferences in people are most likely to negatively influence lessons learned processes, and create barriers to the dissemination and application of lessons learned in organizations (Duffield & Whitty, 2014).

5.2 Case studies

Just as the enabling factors described in section 4.2, the case studies also identified several hampering factors in the sharing and usage of lessons learned. Again, these case study findings are explored more thoroughly with the use of in-depth interviews.

Two contradicting and incomplete sources

In line with the enabling factor discussed in the previous chapter, the central documentation system BOX is not the only source which contains project documentation. Another source of information can be found on the hard-drive, containing just as much information as found in BOX. However, the information in both sources is not aligned and incomplete. During the process of the case studies both sources were needed in order to create the most complete overview of the project. This indicates that there is still not one central point where all the lessons learned are stored, while in the ideal case there is only one point where information like lessons learned can be stored and retrieved.

No clear structure of documentation

Another general hampering factor which has been identified during the case studies was the unstructured manner in which the project documentation was submitted. Although almost every project folder has a standardized main project folder (Correspondence, Deliverables, Financial, Legal, Project Records, Technical Data), the structure behind this main folder was open for interpretation by each project member. During the case study research, it was hereby hard to retrieve for example the MPRs of each project, as it depended per project where in the folders these documents were placed.

Information overload

In line with literature, the amount of documentation within each project folder contained over 3,000 documents. In combination with the absence of a certain index or “how-to- find” guide, the ability to retrieve lessons learned is negatively influenced. In combination with the previous discussed hampering factors, the information overload is perceived as a strong hampering factor in sharing and eventually using lessons learned.

Missing, inconsistent and too detailed documentation

Another hampering factor is the structure with and within certain lessons learned identification documents, like for example the MPRs. Of all three case studies only one project documented the MPRs in a consistent manner, but only did this for five consecutive months. The content of these MPRs contain large slide decks in which long texts of the project status are reported, slightly structured, but still not ‘easy to read’. To allocate deviations of the original planning all MPRs need to be laid down next to each other, as there is no overview provided. In another case study (c1), the whole project plan was missing which normally includes important information regarding the project scope, resources, time, cost, risk, quality, health, safety, environment and so on. The reason why this document is missing will be retrieved through an in-depth interview with the corresponding project manager (i1).

5.2.1 Case specific results

Looking at the case specific results, some interesting findings have derived out of the research including the project manager switch in c3, the lack of internal meetings on a regular basis in c1, the time pressure found in all cases and the lack of monitoring the production of progress reports during the project and evaluations at the end.

PM switch

In one case specific (C3), the initial project manager was forced to stop due to personal circumstances. No further documentation was found on the content of this event but based on the literature written in section 3.3 this is clearly a hampering factor to the usage of lessons learned. All the lessons learned gained in the period when this project manager was active in the project could be lost due to his absence. In-depth interviews with both the initial project manager and the final project manager need to investigate whether this was the case.

No internal meetings on regular basis

Another finding in one case specifically (C1) was the lack of internal meetings held on a regular basis. In the internal project evaluation forms (Appendix C) two junior/medior project managers indicate this shortcoming, stating that this is very much needed in future projects. The lack of structurally based meetings to discuss the project's internal challenges and best practices (lessons learned) is considered to be a hampering factor as it does not stimulate the sharing and thus usage of lessons learned.

Time driver

In line with literature, quite logically because of the project characteristics, the project driver of time acts as a hampering factor to the use of lessons learned. All projects findings included project delays due to unrealistic deadlines set by the client (C1), taking too much time to sign contracts (C2) and approvals for additional work (C3), and mandatory meetings (like for instance the Health Safety Environment session in C3) not being planned. In the documentation, no findings elaborated on how these issues were dealt with. For this, the conversation with a project manager is required.

No consistent monitoring of performing, producing, sharing and using evaluations

Apparently, evaluation sessions like regular based meetings, internal project evaluations, MPRs and audits are not mandatory based on the case study findings. If so, the findings indicate an inconsistent monitoring from higher management in performing and producing these evaluations and thus lessons learned. Let alone the sharing and using of these lessons learned in another project context. The inconsistent processes in which these lessons learned are identified do not stimulate the eventual usage of these lessons learned, because the lessons will be more difficult to find in project documentation. Simply said, structure is required in order to constructively store and allocate identified lessons learned. Only then can these lessons learned be properly shared and used in other project contexts.

5.3 In-depth interviews

This section presents the hampering factors identified by the interviewees. Results are shown on the question to what factors are hampering the dissemination and usage of lessons learned.

Time and client pressure

All interviewees mentioned time and client pressure to be one of the most important hampering factors in the sharing and usage of lessons learned. In the end, all projects are on a tight time schedule in reaching the project deadline, not giving the project manager time to prioritize the practice of lessons learned higher in their tasks and responsibilities (i1, i2, i3, i4).

No standardization and standard practice

In line with the enabling factor presented in the previous chapter, the lack of standardization is seen as a hampering factor to the sharing and usage of lessons learned. There is no infrastructure available in which lessons learned are structurally identified, disseminated and implemented (i2). Also, as already mentioned, the process to deliver input and retrieve lessons learned from this infrastructure is not standardized. "People are just not thinking about it." (i3, i4). Already discussed in section 4.3, the current practice of Project Excellence Management is still not performing properly due to the lack of this standard practice (e1).

Project team member switch

In line with literature, project team members are constantly hopping from project to project as this is normal in a project-based environment. However, this switching does not stimulate, rather hamper, the desired sharing and usage of lessons learned retrieved from their previous project (i2).

Culture differences and personal failure

Also, findings included the cultural differences within project teams. Dutch people are known for their straightforwardness and their openness in sharing mistakes, but for example the Asian culture is more restrained in sharing these (personal) failures. Personal pride and sharing failure are serious hampering factors in sharing and using lessons learned as well (i2).

5.4 Conclusions

Within a project-based environment, the people responsible for the project have a big influence on lessons learned practice. Because of the cultural backgrounds and personal perceptions, the project-based structure in which project teams come and go, and the personal use of tooling. Dealing with an overload of information causes negative effects on the usage of lessons learned, especially when the sources are contradicting and incomplete. The structure and organization of the information available is a crucial factor in the dissemination and implementation of lessons learned, including the common error of describing product knowledge instead of process knowledge. In addition, a lesson learned can be described too detailed and therefore lose their ability to be adopted in another project context. Structure and conciseness of information, the project management related influencers and the personality of the project manager are all forming a threat to the ability of using lesson learned.

The lack of internal meetings held on a regular basis in which lessons learned can be discussed, and the missing infrastructure in which these lessons learned can be disseminated are also a hampering factor to the eventual use. Time and client pressure on making deadlines are forming a threat to the usage as well, because this makes the lessons learned practice to be prioritized lower on the list of the project managers' tasks.

Looking at organizational culture, blame and guilt feelings both have a negative influence on the usage of lessons learned. As long as higher management does not support, stimulate and monitor the lessons learned practice, people within the organization will not fully share their experiences with their colleagues.

With all this in consideration, an answer can be given to the third sub-question (SQ3).

SQ3: What are the hampering factors for using lessons learned, retrieved from different projects and managers?

The use of lessons learned is hampered by [1] the people, [2] the overload of information, [3] contradicting and incomplete sources, [4] the structure and organization of information, [5] describing product knowledge instead of process knowledge, [6] a too detailed description, [7] the personality of the project manager, [8] the lack of internal meetings on a regular basis, [9] the missing infrastructure in which lessons learned can be disseminated, [10] time and client pressure, [11] the organizational culture and [12] the lack of support, stimulation and monitoring by higher management.

6. CHARACTERISTICS

This chapter presents the results on the fourth sub-question “*What are the characteristics that are needed to use lessons learned, retrieved from different projects and managers?*”. Again, the results are structured per research methodology, starting with the literature review (section 6.1), followed by the case studies (section 6.2) and the in-depth interviews (section 6.3). After the results are presented a conclusion and answer on the sub-question is presented in the last part of this section (section 6.4).

6.1 Literature review

When designing a process for collecting lessons learned, planners or knowledge managers need to know how the content of a lesson learned influences the envisioned use of a lesson learned (Buttler & Lukosch, 2013). The key is to identify what works for an organization and constantly monitor, update, and keep it current and relevant (Williams, 2007, 2008).

Lessons learned content

A lesson learned needs to be practicable, actionable and actively used. This means that actions have to be formulated and a desired result needs to be sketched. Lessons learned have implications for its content. First, a focus on process knowledge is required, either for updating e.g. guidelines, or for changing the way of working in a specific project. Second, the use of a standardized format to describe a lesson learned is particularly important for lessons learned used as a resource. Furthermore, lessons learned used as a resource need to contain sufficient details and may need visualizations. And last, the approaches vary with regard to the solutions described in a lesson learned and need to be taken into consideration (Buttler, & Lukosch, 2013).

Lessons learned application

Application can be conceptualized in the form of a project learning roadmap consisting of three main components, namely (Carrillo et al., 2013);

- Key elements (various processes that bring about change in lesson learned practices);
- Actions (required actions both corporate and project team participate in);
- Implementation guide (a form of checklist to assure aforementioned processes and actions are completed)

These characteristic components strive to ensure the application of lessons learned, however as mentioned in earlier chapters multiple influencers need to come together in order to really make the difference.

Root Cause Analysis

As already mentioned in previous chapters, this research suggests using the Root Cause Analysis (RCA) method to identify the causes of a lesson learned. Currently lessons learned mostly describe what had happened, instead of why and how something has happened. By using the RCA method as a structure in which the authors of lessons learned need to describe their lessons learned, the ability to apply those lessons in other project contexts is more facilitated. The root cause analysis is a four-step process involving the following steps (Rooney & van den Heuvel, 2004):

1. Data collection: Generate and gather data to create complete information and an understanding of the event. Without this step, the root cause cannot be identified.
2. Causal factor charting: Generate a structure or framework for investigators and researchers to show their findings during the investigation. This prevents miscommunication and enhances the process.
3. Root cause identification: Begin root cause identification. The use of the so-called Root Cause Map structures the reasoning process of the investigators by helping them answer questions about why particular causal factors exist or occurred.
4. Recommendation generation and implementation: Finalize and recommend. Although the root cause analysis is often not responsible for the implementation of recommendations generated by the analysis, if the recommendations are not implemented the effort of performing the analysis is wasted.

There are multiple methods which can be used to perform a root cause analysis: Fault Tree Analysis (FTA), Failure Mode, Effects and Criticality Analysis (FMECA), fishbone diagram or the '5 Why's'. The 5 Why's is a method which is easy to use and effective in finding the root cause of the problem, undesired state, challenge or best practice.

The 5 Why's method starts with a statement and asks why it occurred. On the answer, again it is asked why this has happened. This process is continued for about five times. Although the method is called the '5 Why's', it is possible that more or less 'why's' should be asked before identifying the root cause (Sondalini, n.d.).

Appendix I illustrates an example of the 5 Why's. When using the 5 Why's method, it is tricky to keep everyone's logic straight. Humans have an enormous capacity to think, and we often clutter our thoughts with extraneous information (Casey, 2008). Appendix I presents a 5 Why's question table that can be used to structure the identification process of each lessons learned cause (Sondalini, n.d.). However, this still does not fully guarantee that the outcomes of the RCA are applicable but does stimulate it.

An important notion is that this thesis only suggests using the 5 Why's method as a structure for the lessons learned practice, other methods like for example an FTA or the fishbone diagram can also be used.

6.2 Case studies

In line with the research approach described in section 2.1, the case studies also identified required characteristics. Just as the previous case study sections in previous chapters, the results are divided in general and case specific results.

One standard and correlation between tools

In the case study documentation multiple standards, containing the same or overlapping content, are now produced by different project members and teams. In the case studies, no correlation was found between the different standards and evaluation tools, which does not stimulate the process of using lessons learned. When the different reporting and evaluation tools are brought down to a minimal number, and when the content within these tools are combined, the sharing and usage of lessons learned can gain from this.

Personal preferences and best practice guides

Another finding in the case studies is the personally developed documents and standards which are used in projects. Multiple documents found in this research were one of a kind and project specific. This is not necessarily a bad thing, but there are no indications found whether these documents are distributed across other project teams.

The self-made documents indicate that the given organizational standards and documentation do not fulfil the whole practice and thus make it necessary for project team members to develop standards and tools on their own. Gathering all the proposed best practices in a guide would contribute to the practice, including sharing and using lessons learned.

Keywords and summaries

Some documentation found in the case studies was structured with keywords and contained a summary. In relation to the information overload discussed earlier, apparently it is needed to work with keywords and summaries in order to retrieve the desired information faster from the large amount of information available.

Although the lessons learned written down in the, mostly large amounts of, evaluations are currently not structured with keywords, this finding indicates that the need for this kind of structure is present.

6.2.1 Case specific results

This section elaborates on the findings of the required characteristics for the use of lessons learned, based on the specific case study results. These findings can be framed as observations, because the actual mentioning of proposed characteristics was not found.

Limited and standardized formats

In the case studies, it became clear that the projects used a limited number of formats and tooling, indicating that this is desirable by the project members. For each main folder found in the documentation, repeatedly the same formats arose. This can partially be explained by the fact that all projects were conducted for one client account and on the other hand be explained by the fact that these standardized formats are considered to be best practicable.

This insinuates that a standard set of tools are used in each project, however not known is if these formats and tools have evolved due to the wishes and expectations by their users. Still, this finding illustrates an important characteristic for the use of lessons learned; the number of formats and tools should be limited and standardized for every project team member to use.

Retrievable documentation

Another finding in the case studies, related to the required characteristics needed for lessons learned to be used, was the ability to retrieve documentation. Although in the previous sections it was discussed that an information overload is not stimulating the use of lessons learned, making the documentation easily retrievable could on the other hand stimulate the use of lessons learned.

Making the platform in which the lessons learned are stored supportive in the ability to retrieve a lesson learned or share it, will absolutely stimulate the usage of lessons learned. In line with this, the locations and the infrastructure towards the desired information (lessons learned) should be supportive in the same way.

Consistency

In multiple case studies (C2, C3) inconsistencies were discovered concerning financial content. The MPRs in C2 indicate the civil budget to be a positive €182.700,-, however some quick math shows that the budget is actually lower. The same goes for the break down fee estimate for C3 which indicates to be within budget, but again with some quick math this came down to a budget overrun of €139.270,-. Although there possibly is an explanation for these specific cases, the inconsistencies found in documentation may cause a negative effect on the usage of the lessons learned. As mentioned previously, the credibility of a lesson learned is important in the eventual usage. So, when inconsistencies are found within the lessons learned, the usage of these lessons learned is negatively stimulated.

6.3 In-depth interviews

On behalf of the required characteristics needed to ensure the sharing and usage of lessons learned, no specific question was asked. However, the interviews did identify multiple characteristics proposed by the interviewees and expert (e1).

Be generic

Because a project is never the same, a required characteristic of a lesson learned to be used in another project context is that it should be applicable in multiple scenarios. Already derived out of the literature review, a lesson learned should be presented in such a generic way that it is applicable in other projects. Details are allowed, as long as they contribute to the eventual applicability in the other projects (i2).

If you can, be anonymous

The guilt and shame culture due to personal failure are identified as a hampering factor to the sharing and usage of lessons learned. By writing the content of the lesson learned without including the name of employees, still the lesson can be transferred but will not endanger the personal comfort of an employee (i2).

Do note that this does not mean that the author of the lesson learned is not mentioned, as all interviewees agree that eventually the conversation between people provides the best environment for transferring a lesson which can be used in another project (i1, i2, i3, i4, e1). The difference between being anonymous and mentioning the author is that the content should not mention specific names, but the person who provided the lesson learned should be mentioned in order to be contacted afterwards.

Use keywords

A last identified required characteristic for the sharing and using of a lesson learned is to use a medium with keywords. In line with the current information overload and the tooling to be already in use for people to start working with it, the use of keywords can assist people to quickly find relevant lessons learned for their projects (i1).

6.4 Conclusions

Considering the required characteristics needed for lessons learned to be used in other projects and by other managers, the results showed that lessons learned need to be actionable, actively used and focus on the process knowledge instead of the product knowledge. Not asking what has gone wrong or right, but rather why something has gone that way. This stimulates that a lesson learned can be used in different scenarios, because projects are never the same. Making lessons learned generic enough also enables a lesson learned to be used by other projects.

Another important notion made is the limited number, standardized, user friendly and correlated set of tools used for the lessons learned practice. The tooling should allow lessons learned to be easily retrieved and presented by the use of keywords and summaries. In addition, the lessons learned should gain credibility through the years of practice by incorporating the experiences of the usage into the documentation itself.

Furthermore, the content of a lesson learned should be anonymous, but the author of the lessons learned document itself should be mentioned in order to stimulate the conversation. In line with the blame and guilt culture as hampering factor: by not naming the relevant individuals responsible for a certain failure, the content of a lesson learned is expected to be more honest and pinpointing the actual pains. The author of the lesson learned does not necessarily need to be the person who was responsible for a certain challenge or best practice, but was for example the project manager and thus in charge of the project's activities.

With all this in consideration, an answer can be given to the fourth sub-question (SQ4).

SQ4: What are the characteristics needed for using lessons learned?

Lessons learned need to [1] be actionable, [2] be focused on process knowledge, [3] be standardized, [4] contain sufficient detail and visualizations, [5] be able to be used in other project contexts, [6] be incorporated in a limited number of standardized and correlated tools, [7] support personal preferences, [8] be able to improve existing documentation, [9] use keywords and summaries, [10] be anonymous, [11] mention the author to stimulate the conversation and [12] be incorporated into already used digital tools to stimulate the user friendliness.

7. AN ORGANIZATIONAL INTERVENTION

This chapter presents the results on the fifth and final sub-question “*What intervention is needed in order to embed the usage of lessons learned into the organization and its culture?*”. Again, the results are structured per research methodology, starting with the literature review (section 7.1), followed by the expert consultations and in-depth interviews (section 7.2). After the results are presented a conclusion and answer on the sub-question is presented in the last part of this section (section 7.3).

7.1 Literature review

A sense of usefulness, urgency and belief

A balance between the voluntarism of knowledge sharing and the identified need to make it instrumental needs to be found. To support more formal ways of knowledge sharing, it should be embedded in a sense of usefulness and belief that such structures will contribute to a collective good (Wang, & Noe, 2010), without forgetting the role of social bounds and behaviors that allow stronger project communities (Almeida & Soares, 2014).

To change a culture or, in a more nuanced manner, stimulate certain cultural behavior, it is required to inspire the people. Make them understand why this change is needed and let them be part of the process to reach that desired situation. A sense of urgency is critical to successfully change an organization, which is most often overlooked in the process (Kotter, 2008).

Organizational culture

Cultural and social factors can be both a problem and solution to organizational learning. Out of 74 organizations that attempted to implement lessons learned processes, a study conducted by Milton (2010) showed that 60% of the organizations were dissatisfied. Culture plays a significant part in the effectiveness of learning mechanisms (Andriessen & Fahlbruch, 2004; Duhon & Elias, 2008; Eskerod & Skriver, 2007; Leistner, 2010).

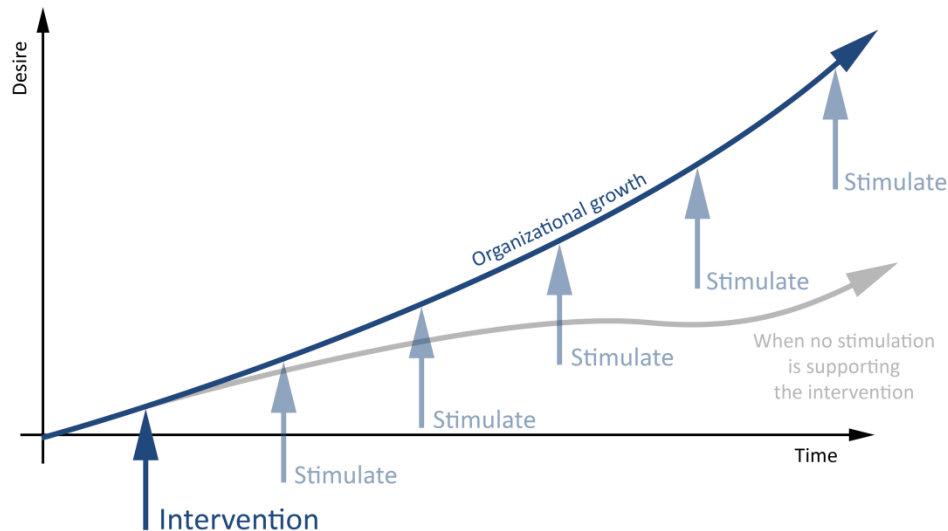
Williams (2007, 2008), Hislop (2005) and Maqsood (2006) all suggest that it is critical to understand the culture of an organization before implementing or using lessons learned processes. Broadly speaking, knowledge application often requires a significant effort, commitment, and understanding of people behavior for both the organization and individuals as this is the area where the use of lessons learned typically breaks down and fails (Duhon & Elias, 2008; Keegan & Turner, 2001; Williams, 2007).

Encouragement and reward

A key element of the aviation safety culture is the reporting incentive where people are prepared to report their errors and near misses (Duffield & Whitty, 2014). A just culture is defined by Reason (1997) as “...an atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety-related information – but in which they are also clear about where the line must be drawn between acceptable and unacceptable behavior”. Different culture and technology tools may be required to support the dissemination and application of various lessons (Duffield & Whitty, 2014). Although every industry has its own legislations, boundaries and processes, still the encouraging and rewarding atmosphere present in the aviation industry could function as an example of how the culture of sharing and eventual use of lessons learned can be stimulated.

A cultural intervention needs to be stimulated

Another important note related to the cultural intervention is that when the intervention is conducted on its own, in time the intervention will lose its effect on the organization. To ensure a gradual growth in the organization, multiple interventions or at least stimulations are needed. Figure 9 shows what will happen to an intervention when no further actions are performed over time and what happens when it does (Smulders, Kiers & van Engelen, 1998).



*Figure 9 – Intervention with and without further actions over time
(based on: Smulders, Kiers & van Engelen, 1998)*

In line with the previous finding stated that the aviation industry stimulated the people to share their lessons learned by encouragement and reward, the intervention itself also should be stimulated. These subsequent stimulations could incorporate improvements based on evaluations, rewarding employees when they perform the lessons learned process in a constructive manner and the again using proofs of concept to show that the intervention does contribute to the overall practice of the organization. It is important to note that these are just examples of how the intervention could be stimulated and that there are other stimulations to be considered as well.

7.2 In-depth interviews

Before concluding the results on the fifth sub-question, the expert consultations and in-depth interviews provided valuable additional findings which need to be considered when answering the last sub-question. Although the interviewed project managers were sometimes giving their vision on how to implement the use of lessons learned into an organization, it was only directly asked to the experts in the form of a brainstorm. As already presented in chapter 2, the group of experts contains three people who are positioned in different levels within the organization (table 3). Logically, all the experts have experience and are actively working on organizational change and organizational cultural behavior. The results derived from these expert consultations include the use of top-down and bottom-up approaches, a proof of concept, leadership and the movement between the learning and protective mode.

Top-down and bottom-up approach

A first finding in the expert consultations on the subject of an organizational intervention is the difference between the top-down and bottom-up approach. Currently investments are done from the top-down, facilitating the processes of sharing and using lessons learned in projects (e2). An example of this is the Project Management Academy which, amongst other things, strives to provide an environment for project management and their managers to share their experiences and lessons learned.

According to the expert consultations, the Project Management Academy is not functioning as it should be (e1), and therefore the focus is now transferred towards the bottom-up approach. From the organizational culture perspective, higher management is now investing in the informal conversations between project team members. Not focusing on their professional background but on their personal goals, beliefs and viewpoints. For people to share their lessons learned in a comfortable environment, they need to know each other (e2).

A proof of concept

Another finding on the subject of changing the culture within an organization is to proof the actual success in previous projects. In line with literature, people are more likely to cooperate in a change when they have already seen the possible positive outcomes of it (e3). By having showcases that can support a desired culture change, the chance of successfully implementing this organizational intervention improves.

Leadership

A very important notion is made in the result concerning the leadership within an organization. Within the research company every leader is responsible for the culture in his or her department. Where PEM is operating on a higher organizational level, the so-called Culture Champions are on the same level of the Director Advice Group (DAG) and supporting them with culture where needed (e2).

According to e3, leadership is creating a binding vision which will inspire its people. In line with literature, the interviewee named the sense of urgency, the compelling future and project support as critical success factors for an organizational culture to change (e3).

Learning mode vs. Protective mode

A last interesting food for thought is on the difference between the learning mode and the protective mode. An analogy was made in “being on the dance floor versus standing on the balcony”. Although it is recommended to switch between both modes, it is perceived that people mostly stay in one mode which is not stimulating an organization to change.

Management and leaders should stimulate people to switch between these modes occasionally, giving them time to oversee the conducted steps in the project and learn from them by diving back into the actual practice (e3).

7.3 Conclusions

Looking at the needed organizational intervention in order to embed the usage of lessons learned, a sense of urgency, usefulness and belief must be created by higher management and leadership. In this proposed top-down approach the project directors and advisory group directors should take the lead in the transition towards the culture of lessons learned practice. Leaders should focus on understanding the people and their culture before they can start changing their way of working. The intrinsic motivation of people can be stimulated by monitoring and rewarding the correct practices.

At the moment, higher management perceives the lessons learned practices to go well, however this research showed that it is not. In the past chapters of this report it becomes clear that the current practice still has a lot of work to be done, mainly explained in chapter 3 of this research. Leaders should get a wake-up call and start stimulating the usage of lessons learned instead of just performing evaluations and then leaving it at that. An example can be made towards the HROs which have successfully transferred their organizational behavior towards a reporting culture. Leaders should create a sense of urgency, usefulness and belief by emphasizing on the importance of the lessons learned practice and its potential revenue for future projects. This can be stimulated by encouraging and rewarding employees when their lessons learned practices are exemplary.

Aside from leaders providing their support and leadership from a top-down perspective, a bottom-up approach is also needed. People in the organization need to believe and realize the positive effect of the lessons learned practice on their project's outcome. By encouraging people to start providing lessons learned to the general good, in the end the organization as a whole will benefit from this. The bottom-up approach can be stimulated [1] by creating a clear infrastructure in which people can share their lessons learned, [2] by using a rewarding system for people who are actively using lessons learned in their projects and [3] by using showcases and good practices as an example to why it is worth their while.

Both the top-down and the bottom-up approach need to be addressed within the organization for lessons learned to be successfully used in other project contexts. Project managers and department directors need to fulfil the role of a true leader and create awareness and belief for the lessons learned practice. Creating an infrastructure and intrinsic motivation by the employees are, aside from leadership, key in making the organizational culture change towards the successful use of lessons learned. With all this in consideration, an answer can be given to the fifth and final sub-question (SQ5).

SQ5: Which requirements are needed to embed the usage of lessons learned into an organization and its culture?

Both a top-down and a bottom-up approach need to be used as an intervention to embed the usage of lessons learned into an organization. From a top-down perspective leaders must step up and [1] create a sense of urgency, usefulness and belief, [2] take the lead in the transition towards the culture of lessons learned practice and [3] stimulate the culture with monitoring and rewarding employees who actively use lessons learned in their projects in an exemplary manner.

The bottom-up approach requires [1] a clear infrastructure in which people can share and use the lessons learned provided, [2] showcases and good practices as an example to why the lessons learned practice can be beneficial for the project and [3] the intrinsic motivation of employees to prioritize the lessons learned practice higher in their project tasks.

8. ANALYSIS OF RESULTS

Now that all the results are discussed and an overview of the results is presented per SQ in the previous chapter, it is time to analyze the results. To give an answer to the RQ it is important to analyze what findings were found in multiple research methodologies used, and what findings deviated from each other. A cross-method analysis examines all similarities and all differences per method used (section 8.1). Also, it is of interest to see whether there are findings derived from the case studies that show deviations or similarities compared to the other case projects. The cross-case analysis looks deeper into these deviations and similarities (section 8.2).

After the results are discussed in both the cross-method analysis and the cross-case analysis, a MoSCoW analysis will bring structure to the results by dividing them into “must have” (M), “should have” (S), “could have” (C) and “won’t have” (W) (section 8.3). In this way, the results are prioritized and makes it clearer if and how each finding should be incorporated into the conclusive answer to the research question. When the results are structured in the MoSCoW analysis, conclusions on the analysis can be given (section 8.4). This chapter closes with the validation of the results, discussing both the validation structure and results (section 8.5).

8.1 Cross-method Analysis

This section discusses the results through the cross-method analysis, analyzing all similarities and differences in the findings based on the methods used in this research. In line with the previous chapters, this section is structured per SQ, discussing all similarities and differences found between the different methodologies used. At the end of this section an overview is given in table 4.

8.1.1 How are lessons learned currently shared and used?

On the dissemination and usage of lessons learned a uniform current state of practice was found in the literature review, case studies and interviews; it remains a challenge for project-based organizations to incorporate the effective dissemination and implementation of lessons learned. A lot of tools which include lessons learned identification are used, but the awareness and actual documented process of sharing and using lessons learned in other projects is still lacking. In the current practice, a lot of lessons learned sharing is done through the verbal communication streams, but this makes the actual lessons learned documentation untraceable within the organization. This means that only the people who hear the lesson learned verbally can make any use of it, leaving the other people within the organization unaware.

Another finding in literature which was supported by the results of the case studies and interviews was the reactive use of the lessons learned. Only if a problem or challenge occurred were the project members triggered to look for a solution. Although in some cases the lessons learned available could still make a difference, most of the time the lesson was considered to be presented too late for valuable use in a project.

An interesting similarity found in the results concerns the lack of a centralized place where lessons learned are documented and stored. Although in the case studies two sources were found where all project documentations are stored, no assigned folder specified solely lessons learned documentation. In contradiction, an attempt is made to create a centralized location for lessons learned which all employees can access through the internal website of RHDHV. However, [1] the interviewees are not aware of this location and [2] the lessons learned documentation only describes what has happened instead of why and how something has happened.

Although this centralized location for lessons learned storage can be beneficial for the use of lessons learned, it will have almost no contribution when people do not know where to find it and when the content solely describes the 'product knowledge'.

A difference in the findings was the excessive use of tools used to identify lessons learned. The case studies presented several tools like MPRs, internal project evaluations forms, audits and the Health Check, all aiming to identify lessons learned. The question arises on why such a broad set of tools is available to identify lessons learned, while in the end the lessons are only shared through verbal communication streams. Although this does not directly ensure the eventual use of lessons learned, making sure that the lessons learned are properly distributed within the organization does stimulate it.

Lastly, a difference was found in the current practice of the use of lessons learned in other project contexts. As literature and the case studies showed no indication was found suggesting lessons learned to be used in other project contexts. However, the interviews almost unanimous stated that they did use lessons learned derived from other projects. The interviewees also ensured that lessons learned derived from their project were used in other projects as well. But as the interviewees could not pinpoint the exact lessons learned which were used, it is doubtful that this really was the case. A reason for this could be that the lessons learned are currently only transferred through the verbal communication streams and are therefore not documented and monitored.

8.1.2 What are the enabling factors of using lessons learned?

For the enabling factors, most of the findings are supported by multiple methods. The sharing and usage of lessons learned is a social endeavor and therefore the conversation must be stimulated. Both the literature review and interviews show that the conversation must be stimulated in order to create "person-to-person" knowledge transfer. The project management intervention sessions found in the case studies stimulate the knowledge transfer as well.

A central "lessons learned team" which enables an organization to retrieve lessons learned through a centralized, structured and consistent medium is suggested by the interviewees which is supported by the findings in literature. Supported by both literature and interviews, standardized processes can make the sharing and using of lessons learned easier. A respectful and honest environment in which people are comfortable in sharing their lessons learned should be created, like for example in the project management intervention sessions. By creating awareness and structure, the usage of lessons learned can be enabled.

On the specific matter of enabling factors no contradictions or differences were found. This could be explained by the fact that all findings on their own enable the use of lessons learned and thus complement each other. What is worth mentioning is that the enabling factors identified by the interviewees and case studies are more focused on the actual usage, while the literature review mostly suggest more organizational and process-related factors. This can be explained by the fact that the interviewees and case studies, as a method, focus more on the practical side of the research. In contrary to the literature review which incorporates other researches as input for the results.

8.1.3 What are the hampering factors of using lessons learned?

This research found an excessive amount of hampering factors to the usage of lessons learned. Most of the findings are supported by multiple methods, and it is hard to determine any differences or contradictions. One of the major hampering factors is the extensive amount of information available in the organization. The information overload in combination with the contradicting, incomplete, missing, inconsistent, unstructured, unstandardized and too detailed documentation, hamper the usage of lessons learned and is supported by all three methods used in this research. However, some discussion concerning the level of detail is presented in the next section (8.1.4).

The lack of constant monitoring by higher management, internal meetings on regular basis and describing the product knowledge do also not stimulate the use of lessons learned. Due to time pressure and client pressure, the incentive to search through these lessons learned documents is a waste of time, or at least not prioritized high on the tasks of a project team.

All three methods generated a result on the switch of project teams or the project manager (C3). As people in the project are dispersing after it is finished, lessons learned can easily be lost in the process. Also, the people element plays a significant role in the usage of lessons learned; cultural background, personal perceptions, the person within the project manager and a culture of shame, guilt and blame do not stimulate the usage of lessons learned.

Comparing the results of the hampering factors with the enabling factors given by the interviewees, more similarities between the different methods used were found in the hampering factors. A reason for this could be the fact that the hampering factors found in literature are based on practical studies or because the hampering factors are more straight-forward. Even more so it can be concluded that the methods' findings on the second SQ are based on a strong point of view and are supported by both theory and practice.

8.1.4 What are the characteristics needed for using lessons learned?

The findings on the required characteristics which are needed to ensure the usage of lessons learned suggest making a lesson learned actionable. It should not only describe what has been done wrong or right, but more importantly should contain why this has happened and what can be done to prevent or stimulate it. Focusing on the process, a lesson learned should be standardized, sufficiently detailed, visualized, credible and generic to be used in different scenarios. The tooling which is needed to use a lesson learned should be limited, standardized, correlated and user friendly, preferably a medium which people already use in the company. Also, personal preferences and improvements to existing documentation should be included and the lessons learned should be retrievable using keywords and summaries. Lastly, the content of a lesson learned should be anonymous, but the author of the lesson learned should be named to stimulate the conversation. Although this might sound as a contradiction, it is not. The author of a lessons learned is not necessarily the person who has generated the lesson learned. For example, the project might add a lesson learned while it was not his or her doing, but instead it was a project team member.

Contradictions are found in the level of detail in which lessons learned should be documented. Lessons learned should not be specifying too much detail, but on the other hand lessons learned should also not be giving a too broad perspective. These findings imply that a balance should be found in what level of detail the lessons learned are described. This balance can be ensured by for instance using the RCA method as a structure for the lessons learned documentation. But the RCA can also function as a check by fellow project managers, the responsible lessons learned team or the project supervisor.

A last difference concerning the results on the required characteristics worth mentioning is the fact that the amount of tooling used by project members for, amongst other things, lessons learned practice is excessive. As one of the required characteristics states that a limited and correlated number of tools should be used, this contradicts with the findings in the case studies showing a lot of tools being used. It can be of interest to reconsider the tools used for identifying lessons learned in two ways: [1] investigate how the tools can be correlated, meaning that all the lessons learned identified in the different tools are brought back together at a centralized location. [2] Investigate how the tools can communicate with each other, to create awareness when certain lessons learned are already been identified by another tool. And [3], investigate the possibility of a decrease in tools used in projects and determine which tools could be deleted.

8.1.5 Which requirements are needed to embed the usage of lessons learned?

Based on the literature review and expert consultations, requirements for the needed intervention are identified. Both in the literature review and in the expert consultations it becomes clear that a culture will only change when there is a sense of urgency, usefulness and/or belief. A compelling future and support from management are also considered to be critical success factors for an organization to change. Leadership is needed to strengthen the vision and goals for employees, and inspire the people to follow and support the suggested changes. Furthermore, a proof of concept can stimulate people to change their way of working, by for example using showcase projects or sharing examples out of other industries like the HROs. It is important to understand the organization's culture; to understand what is driving the people in an organization.

An intervention can be directed from a top-down and a bottom-up approach, in which ideally both approaches are used simultaneously. Within RHDHV, higher management is currently directing interventions through the bottom-up approach. By organizing workshops, advisory group meetings and other events, higher management wants to address changes and ambitions in the organization.

Previously RHDHV was directing these changes in culture from a top-down perspective. But as the success rate was evaluated too low, a bottom-up approach was chosen in which smaller groups of employees are brought together and are treated in a more informal way (e2).

8.1.6 Overview results cross-method analysis

To create some structure into the findings presented in this section, table 4 presents an overview of the findings retrieved from the cross-method analysis. Again, per SQ this table shows in bullets both the similarities and differences in the findings derived from the different methodologies used. The final conclusions on the findings of this cross-method analysis will be presented in section 8.4, together with the findings of the cross-case analysis and the MoSCoW analysis.

SQs	Similarities	Differences
SQ1: Current state	- it remains a challenge for project-based organizations to incorporate the effective dissemination and implementation of lessons learned - the reactive use of the lessons learned - the lack of a centralized place where lessons learned are documented and stored	- an attempting centralized location is available by all employees through the internal website of RHDHV, however the awareness is lacking and it focusses on product knowledge instead of process knowledge - the excessive use of tools used to identify lessons learned - the use of lessons learned in other project contexts appears to be done, but no documentation can support the statement by the interviewees
SQ2: Enabling factors	- the conversation must be stimulated to create “person-to-person” knowledge transfer - A central “lessons learned team” which enables an organization to retrieve lessons learned through a centralized, structured and consistent medium - A respectful and honest environment in which people are comfortable in sharing their lessons learned - create awareness and structure	the enabling factors identified by the interviewees and case studies are more focused the actual usage, while the literature review mostly suggest more organizational and process-related factors
SQ3: Hampering factors	- the extensive amount of information available in the organization - the contradicting, incomplete, missing, inconsistent, unstructured, unstandardized and too detailed documentation - The lack of constant monitoring by higher management, internal meetings on regular basis and describing the product knowledge - time pressure and client pressure - the switch of project teams or the project manager - cultural background, personal perceptions, the person within the project manager and a culture of shame, guilt and blame	<i>No distinctive differences or contradicting findings are found</i>

SQs	Similarities	Differences
SQ4: Required characteristics	- a lesson learned should be standardized, sufficiently detailed, visualized, credible and generic to be used in different scenarios - The tooling which are needed to use a lesson learned should be limited, standardized, correlated and user friendly, preferably a medium which people already use in the company - personal preferences and improvements to existing documentation should be included - the lessons learned should be retrievable using keywords and summaries - the content of a lesson learned should be anonymous, but the author of the lesson learned should be named to stimulate the conversation	- the level of detail in which lessons learned should be documented - the amount of tooling used by project members. the required characteristics states that a limited and correlated number of tools should be used, this contradicts with the findings in the case studies showing a lot of tools being used
SQ5: Intervention needed	- a culture will only change when there is a sense of urgency, usefulness and/or belief - a compelling future and support from management are also considered to be critical success factors for an organization to change - leadership is needed to strengthen the vision and goals for employees, and inspire the people to follow and support the suggested changes - proofs of concept can stimulate people to change their way of working	- An intervention can be directed from a top-down and a bottom-up approach, in which RHDHV higher management is currently directing interventions through the bottom-up approach - Previously RHDHV was directing these changes in culture from a top-down perspective. But as the success rate was evaluated to low, a bottom-up approach was chosen

Table 4 – Cross-method analysis overview

8.2 Cross-case Analysis

Now that the results are analyzed based on their originating methodologies, this section takes a closer look at the similarities and differences found in the case studies performed for this research. As already presented in chapter 2, this research conducted case studies on three different projects belonging to one client account. Table 5 presents the case specifics of each project, showing the locations of the projects, the duration of the projects, the total costs of the project, the project scale in hectoliters (HL) and total documents found per case study project.

#	Project location	Project duration (years)	Project costs (€)	Project scale (HL)	Project documents
c1	XXX	2+	1,9 M	1,5 M	+3000
c2	XXX	2-	1,7 M	1,1 M	+3000
c3	XXX	2-	2,4 M	2,3 M	+2500

Table 5 – Case specifics per project

In general table 5 shows a lot of similarities in the case study projects. This is as expected because as described in chapter 2 (section 2.2.2), the case study selection required projects of the same scale. As already mentioned in the findings an information overload is acting as a hampering factor to the usage of lessons learned, especially when the lessons learned practice does not have its own specified location within the project folders.

Although the characteristics of the project might be quite similar, the individual projects do have their differences. Alongside with the corresponding results of the project managers (Appendix G) who were interviewed, the results of this cross-case analysis are structured in table 6. Table 6 presents an overview of the findings in all the cases and illustrates the overlap between the different projects. The similarities and differences are discussed in more detail in section 8.2.1.

#	Findings	C1 - XXX	C2 - XXX	C3 – XXX
1	Information overload	x	x	x
2	No distinction in lessons learned practice	x	x	x
3	Budget overruns	x	x	x
4	Time and budget pressure by the client	x	x	x
5	Difficulties with contractor	x	x	x
6	Lack of project coordination	x	x	
7	Communicational and technical difficulties due to cultural differences	x	x	
8	No performance of consecutive MPRs	x		x
9	Technical issues due to tight schedule and budget	x		x
10	Lack of monitoring by higher management	x		x
11	Problems with staff in project team		x	x
12	Dissatisfaction by client		x	x
13	Hard relationship with PM of the client		x	x

#	Findings	C1 - XXX	C2 - XXX	C3 – XXXX
14	Delay due to slow pace of client and/or contractor		x	x
15	Missing Project Plan	x		
16	Lack of internal meetings on regular basis	x		
17	Safety issues		x	
18	PM switch			x

Table 6 – Cross-case analysis overview

8.2.1 Discussing the results

This section elaborates more on the similarities and differences between the findings of the case studies. Starting with the similarities, it becomes clear that a lot of the findings overlap in multiple case projects. All three case study projects endured an information overload, a lack of distinctive lessons learned practice in project documentation, budget overruns, time and budget pressure by the client and difficulties with one of the contractors. Although some of these findings are the result of the organizational structure in which information is stored, most of these findings show similarities which could have been (partially) prevented when they were properly disseminated amongst each other. The same can be said for the findings which are overlapping with only one of the other case study projects, covering 9 of the 18 findings in the case studies. Similarities are found in, amongst other things, the lack of project coordination, performance of consecutive MPRs and problems with staff in the project team. An interesting observation on these findings is that these are all hampering factors to the usage of lessons learned.

Table 6 also shows a total of 4 findings which can be considered as case specific findings (findings 15 – 18). Of certain findings (15 and 18) it can be said that they only occurred during that specific project, because in the other projects the Project Plan was present and there was no project manager switch. However, the lack of internal findings and safety issues (findings 16 and 17) could have occurred in other projects as well, but the case study documentation and the interviews could not identify such findings. Although these findings (15 – 18) appear to have not occurred in multiple projects, the impact of these findings is considered to have been substantial to the project outcomes.

In the interviews, the associated project managers were asked if the lessons learned from their project were shared amongst other projects. Three out of four project managers ensured that they did share these lessons, however only through verbal communication streams. When we look at the results shown in table 6, this research can conclude two things: [1] the findings in table 6 were not (properly) shared amongst other project teams. And [2]: if they did share it by verbal communication, it didn't have any positive effect on the other projects whatsoever.

A couple of reasons can be given to why this might be the case: [1] the lessons learned practice was not prioritized high enough by the originating project team, [2] the lessons learned were used too late for valuable use in other projects (reactive use), [3] although 'person-to-person' knowledge transfer is perceived best, people still need to document their findings in order to memorize the lessons learned and [4] the lack of stimulation and monitoring by higher management to disseminate and use lessons learned from other projects. More reasons can be thought of, but the reasons just mentioned are derived from the interviews with the associated project managers and are related to these case specific results.

Looking at the differences, four distinctive findings derived solely from one case study project: a missing Project Plan, the lack of meetings on regular basis, safety issues and a PM switch. As these findings are case specific, not much more can be said about them than already discussed in the previous chapters. However, these case specific findings did have a big influence on the project and its management. Especially finding 18, the PM switch, created a lot of problems for the project and its outcomes. During the interview with the corresponding project manager it became clear that the treatment afterwards was leaving room for improvement. The project manager elaborated on the lack of support by higher management when he asked for it (multiple times). But again, he cannot say if these lessons learned are properly disseminated and used in other projects.

8.3 MoSCoW Analysis

This section discusses the results of the analysis by using the MoSCoW method, and is divided into three parts. First, a clearer explanation is given to what the MoSCoW method is and does (section 8.3.1). After this, the reasoning to why this method is used for this thesis is further elaborated on (section 8.3.2). Lastly, this section will present the results of the MoSCoW analysis and prioritize the results of this research (section 8.3.3).

8.3.1 What is the MoSCoW method?

The MoSCoW method is an approach to prioritize findings in four categories: must have (M), should have (S), could have (C) and won't have (W). Requirements are assigned to these categories based on the importance of having them implemented (Vestola, 2010). The DSDM Atern Handbook (Craddock, et al., 2008) listed guidelines regarding the differences between the categories, with the goal to make the categories mutually exclusive (Craddock, et al., 2008):

Must have	These findings provide the minimum usable subset of requirements which the project guarantees to deliver. The findings placed in this category all have a critical impact to the success of the project. If there is still some way around it, it should be placed in the 'should have' or 'could have' category.
Should have	A 'should have' finding is an important requirement, but not vital for the eventual result. It can be differentiated from a 'could have' by reviewing the degree of pain caused by not being met.
Could have	A wanted or desirable requirement, although of less importance. It is a 'nice to have', but will not influence the eventual outcome.
Won't have	These are requirements which the project team has agreed it will not deliver. Although these requirements may still be part of a solution, it will not be included this time around.

These categories enable a prioritization of the results found in this research, but still indicate nothing about the number of requirements divided into each category. The goal is to divide all findings into the first three categories, aiming to assign 60% of the findings to the 'must have' category. The other 40% is designated for the 'should have' and 'could have'. The 'Won't have' are excluded from the calculation, as they won't be part of the solution (Craddock, et al., 2008).

8.3.2 Why use a MoSCoW analysis for this research?

As mentioned in previous chapters, this research produced an extensive number of findings which are beneficial to use lessons learned in other project contexts (table 7). Until now, no prioritization has been made regarding these findings. And as it is unrealistic to conclude that all the findings should be implemented at once, a prioritization of the results is required. By using the MoSCoW method, the results can be prioritized according to their importance to the use of lessons learned. The findings in table 7 are not prioritized. As shown the findings are written in an actionable way to convert the findings into workable suggestions.

#	Findings
1	Make the lessons learned practice centralized
2	Create standards & structure for the lessons learned practice
3	Be consistent in the content of lessons learned
4	Focus on process knowledge instead of product knowledge (not what, but why or how)
5	Keep the lessons learned content concise
6	Ensure that the lessons learned practice is completed (identify, disseminate, implement)
7	Make visualizations in the lessons learned content possible
8	Make the lessons learned credible
9	Make the lessons learned content anonymous
10	Mention the author of the lessons learned
11	Make the lessons learned actionable
12	Use sufficient detail in the lessons learned content
13	Make the lessons learned generic enough to be used in other scenarios
14	Use lessons learned tools which are correlated and supporting each other
15	Use lessons learned tools that are user friendly and already known by the user
16	Make personal preferences in lessons learned tools and documentation possible
17	Assign a central “lessons learned team” that is responsible for the whole lessons learned practice
18	Create standardized processes in which the lessons learned practice is conducted
19	Create awareness of the lessons learned practice available
20	Ensure constant monitoring of the lessons learned practice
21	Organize internal lessons learned meetings on a regular basis
22	Use lessons learned actively instead of reactively
23	Create time (and money) for the lessons learned practice
24	Make sure to complete the lessons learned cycle before the project closes
25	Create a culture of honesty and respect where people feel accepted and comfortable in sharing their lessons learned
26	Create acceptance for cultural differences
27	Create a sense of urgency, usefulness and belief
28	Higher management must support the use of lessons learned
29	Use proofs of concept and showcases to motivate people in their new way of working
30	Use both a top-down and a bottom-up approach to stimulate the use of lessons learned

Table 7 – Overview of findings (not prioritized and actionable)

The following section will present the MoSCoW analysis on the results of this research. The outcome of this analysis will be concluded in the following section (8.4). The prioritization retrieved from the MoSCoW analysis will be used as input for the answer to the research question (section 10.1), together with the results from the previous sections presented in this chapter.

8.3.3 The MoSCoW analysis

Table 8 presents the results of the MoSCoW analysis on the results of this research. An important note is that this prioritization is temporary, because over time the requirements might change between the categories (Craddock, et al., 2008). For example, the possibility to make visualizations in the lessons learned content might be needed more in a later stage as it appears to be of higher importance. In that case, the possibility of visualizations in the lessons learned content (finding 7) should be moved to the 'should have' category.

The distribution of the MoSCoW prioritization presented in table 8 is based on the results presented in chapter 3 up to chapter 7. The prioritization is later validated by the validation panel and incorporated into the conceptual framework presented in figure 10. There are multiple methods which can be used to distribute the findings using the MoSCoW prioritization; [1] survey a broad spectrum of people within the organization, [2] conduct workshops in which whole project teams together prioritize the findings, or [3] prioritize the findings and validate them afterwards (Craddock, et al., 2008).

This final method (3) is used for prioritizing the findings of this research. The validation panel is asked to prioritize their 'must haves' and afterwards the comparison is made with the prioritization of this research and the resulting conceptual framework presented in chapter 10. A limitation of this way of prioritizing is that only a select group of people had influence in the eventual outcome of the MoSCoW analysis. Because of time constraints this research did not use one of the other methods. Therefore, this research suggests including a 'second opinion' by using one of the other mentioned methods as well (survey a broad spectrum of practitioners or organize project team workshops).

As section 9.3.1 explained in section 8.3.1, the requirements for the solutions should be divided into a 60% 'must haves' and a 40% 'should haves' and 'could haves'. This distribution is slightly deviating looking at the MoSCoW analysis presented in table 8 (53% versus 47%). The results also show the 'won't have' section left blank. This is because all the findings presented in table 8 are, on their own, means to make use of lessons learned, derived from other projects and managers. The numbers presented after each finding presented in table 8 refer to the numbering presented in table 7. It is important to note that this numbering does not suggest any prioritization, the prioritization is solely made in table 8 which divide the findings into the MoSCoW categories.

Now that all the results of the analysis have been presented it is time to present the conclusions of the analysis (section 8.4).

MUST have	SHOULD have
• Make the lessons learned practice centralized (1) • Focus on process knowledge instead of product knowledge (4) • Ensure complete lessons learned practice (6) • Mention the author of the lesson learned (10) • Assign a central “lessons learned team” that is responsible for the whole lessons learned practice (17) • Create standardized processes in which the lessons learned practice is conducted (18) • Create awareness of the lessons learned practice available (19) • Ensure constant monitoring of the lessons learned practice (20) • Organize internal lessons learned meetings on a regular basis (21) • Use lessons learned actively instead of reactively (22) • Create time (and money) for the lessons learned practice (23) • Complete the lessons learned cycle before the project closes (24) • Create a culture of honesty and respect where people feel accepted and comfortable in sharing their lessons learned (25) • Create a sense of urgency, usefulness and belief (27) • Higher management support the use of lessons learned (28) • Use both a top-down and a bottom-up approach to stimulate the use of lessons learned (30)	• Create standards & structure for the lessons learned practice (2) • Be consistent in the content of lessons learned (3) • Keep the lessons learned content concise (5) • Make lessons learned credible (8) • Make lessons learned actionable (11) • Use proofs of concept and showcases to motivate people in their new way of working (29) • Use sufficient detail in the lessons learned content (12) • Make the lessons learned generic enough to be used in other scenarios (13) • Create acceptance for cultural differences (26)
COULD have	WON'T have
• Make visualizations in the lessons learned content possible (7) • Make lessons learned content anonymous (9) • Use lessons learned tools which are correlated and supporting each other (14) • Use lessons learned tools that are user friendly and already known by the user (15) • Make personal preferences in lessons learned tools and documentation possible (16) • Use proofs of concept and showcases to motivate people in their new way of working (29)	<i>The reason why none of the findings is placed in the ‘won’t have’ category is because all findings presented in table 7 are means to use lessons learned in other project contexts.</i>

Table 8 - Results of the MoSCoW analysis

8.4 Conclusions of analysis

Table 4 presented an overview of all the similarities and differences found in the cross-method analysis. Although most of the findings show similarities, still some differences in the results of the used methods were found. For instance, the excessive use of different tools for, amongst other things, lessons learned purposes. One of the findings in literature suggests keeping the number of tools for the lessons learned practice to a minimum. However, based on the case study and interview results, the number of tools used in the current practice is remaining to be excessive. Another difference found between the literature review results and the interviews was the fact that lessons learned are currently not properly disseminated and used in other project contexts. However, the interviewees claim to have disseminated several of their lessons learned to other project managers. And the other way around: used several lessons learned provided by colleagues. Although this might be the case, the interviewees were not able to pinpoint which lessons learned were used, which of their lessons learned were disseminated or who could have received those lessons learned. Most probable is that this is due to the fact that lessons learned are currently disseminated through verbal communication streams, and thus not documented in any kind of system.

The results of the cross-case analysis show alignment with the findings presented in the previous chapters (3-7) of this research. This could be explained by the fact that the case studies all come from one client account, or because in all projects the standardized project organization with the same communities of practice is used. In a broader context: it could be explained by the fact that all these findings relate to the project management practice in some way. This suggests that when this research would have added an additional case study or more, still the same findings would have been discovered. Or the similarity in the findings from the case studies were just sheer luck and no correlation can be guaranteed. This research cannot give a conclusive answer on this matter, but it this research does suggest future research to include more case study projects with the same characteristics to investigate whether such correlation exists.

The MoSCoW analysis produced several interesting conclusions on the matter of using lessons learned, derived from other projects and managers. Table 8 shows the extensive list of findings derived from this research which are prioritized by using the MoSCoW method. This MoSCoW method divides all findings into four categories: must have (M), should have (S), could have (C) and won't have (W). The eventual result of this MoSCoW analysis is presented in table 8, showing that the following results *must* be implemented for the use of lessons learned in other project contexts:

As previously mentioned, the results of this analysis will be incorporated into the conclusive answers on the research questions presented in chapter 10. The next section will elaborate more on the validation of the results (section 8.5).

8.5 Validation of results

This section presents the validation of the research findings, discussing the validation structure and validation results. This validation was conducted to see whether the results of this research are in line with the thoughts and opinions of people within RHDHV and the field of practice.

Validation structure

The selection of the participants in the validation session was based on their relation to the research, the case projects, and their wide variety of experience and tasks within RHDHV. Table 9 displays the participants codified with 'v1' up to 'v4' and their current function within RHDHV.

Code number	Current function
v1	Senior Project Manager
v2	Account Manager
v3	Associate Director Project Management & Consultancy
v4	Associate Director Project Management & Consultancy

Table 9 - Participants of the validation session

The session was held at the office of RHDHV and took about one hour. The session itself was divided into four parts;

- Short introduction of the research subject
- Small brainteaser to identify their perceptions on the subject
- Present thesis results
- Discuss the overlap and differences

After the introduction of the subject, the participants were asked to answer the following question: *“What is needed to properly transfer lessons learned to projects and managers, retrieved from other projects, to ensure the actual usage of these lessons learned?”*. Before their answers were discussed, first the findings from this research were presented. By doing this, the participants could not have been influenced as they had no information given about the findings of this research. After the results were presented, the differences and similarities were discussed. The results of this discussion are presented next.

Validation results

A first result from the validation discussion was the fact that the proposed actions in this research are already partially introduced within offices other than the Netherlands, examples can be found in Asia for example. However, the expert panel confirmed that the lack of time often hampers the lessons learned to be properly used and that there is a lack of awareness. Also, it was mentioned that often the term lessons learned include a negative atmosphere, while this definitely does not need to be the case. Best practices must also be used and are sometimes the solution to the challenge (negative lesson learned) of someone else.

Aside from documented in a system, this research suggests using the existing project management intervention sessions as a platform to share lessons learned. The responsible lessons learned team which is suggested in this research will host these lessons learned sessions and stimulate people to share their experiences. Some differences appeared with v4, who suggested assigning the Director Advisory Group, Line Manager of Project Director for these tasks instead of assigning new people for the job.

To make sure that lessons learned are found quickly, a suggested addition to the lessons learned system is to specify in which phase of a project the lesson learned can be used. Otherwise it remains hard to find specific lessons learned for a project to use (v1). It is suggested that the lessons learned session should literally be tuned to the phases of the project, because people come and go in a project and this might lead to the loss of valuable lessons learned (in line with previous findings on switching project teams). One expert panel member already conducts evaluations after each meeting with the client to identify lessons learned (v4), which is an example of constructively identifying lessons learned.

A concern is given by v1 about the privacy of the lessons learned. They should not be open to the public and need to be aligned with other documentations of projects. But as these documents are private, it might be hard to find a suitable balance between public and private content in a lesson learned. In the project Health Check certain tasks are mandatory, this can include whether a project team has conducted one or more lessons learned sessions (v1).

Another suggestion is to discuss the approach of a project with an experienced project manager before the project starts, to retrieve their lessons learned on project aspects and to actively use them in the next one (v3). With the support of specific standards and guidelines for larger client accounts, it is more likely that the lessons learned can be properly used in future projects (v2, v3).

Positive reactions were given to the credibility suggestions of this research, to make an active document which gets updated every time it is used. In line with this, the proposed Root Cause Analysis (RCA) as the structure for a lesson learned is validated by the participants as well. Not only does this method show what the origin of a certain challenge was, but it also gives possible solutions to prevent them from happening again. By using RCA as a method, the content will focus on the process knowledge of a lesson learned instead of the product knowledge; answering the question to how and why instead of what.

The validation session provided some helpful and interesting insights into the practical engagement of using lessons learned. Suggestions regarding privacy, aligning the lessons learned with project phases and discussing the project with an experienced project manager before the project starts are contributing to this research. It becomes clear that not all the findings and suggestions were validated by the validation panel, assigning a new 'lessons learned team' is one of them. A reason for these deviations could be found in the set-up of the validation session as described earlier this section. The validation panel members were first asked to give their personal insights into what is needed to ensure the use of lessons learned, and only afterwards the comparison is made between both the panel's insights and the conclusions of this research.

Appendix H provides an overview of the validation session, displaying all the results that derived from the validation session. The next chapter will look deeper into deviations derived from the validation session, the implications of this research and discussing the results.

9. DISCUSSION

This chapter discusses the findings derived out of this research in three sections. Section 9.1 discusses the results yielded from this research and relates back to the findings in literature. Section 9.2 elaborates on the implications during the research and section 9.3 focusses on the learnings for each different level within the organizational structure.

9.1 Discussing the results

This research produced a lot of findings, and can be considered too much. At the start of writing the thesis it aimed to not produce an extensive report with a lot of text, but along the way it became clear that this was inevitable. The results of this research show a lot of similarities with the findings in literature and previous researches about (using) lessons learned. This research confirms that the current practice remains to have difficulties with properly transfer and implement lessons learned (Bakker et al., 2011; Bartsch et al., 2013; Bresnen et al., 2003).

As an extension of the research conducted by Buttler (2016), this research has explored the lessons learned practice after the lessons already have been identified. Within the research company, it appeared that the identification of the lessons learned was done quite well. However, the paper trail also ends at this phase. During the in-depth interviews with the corresponding project managers of the case study projects, it became clear that certain project managers do claim to have transferred several lessons learned to fellow project managers and practitioners by face-to-face interaction. But during this research no documentation could support these statements and the project managers could not pinpoint which lessons were supposedly disseminated. Although the lack of documentation does make these statements somewhat questionable, the fact that fellow practitioners share their experiences through verbal communication streams is in line with an enabling factor found in literature stating that person-to-person knowledge sharing is perceived to be most effective (Boh, 2007; Bresnen et al., 2003; Almeida & Soares, 2014).

Both the enabling factors and hampering factors (respectively chapter 4 and 5) contribute to the long list of findings derived from this research. Although all the findings contribute to completing the whole picture around “what to do” and “what not to do” when aiming to use lessons learned, it is debatable whether all findings are contributing on an equal scale. When looking at the overview of all findings presented in table 7, some of the findings could be clustered or placed into a hierarchical underneath other findings. For example, the second finding stating to create standards and structure for the lessons learned practice. By creating these standards (finding 2) in such a way that the consistency is guaranteed (finding 3), the content focusses on process knowledge (finding 4) and that there is a possibility to make visualizations (finding 7), multiple findings are tackled at once.

In addition, deviations could be found regarding the level within an organization that the findings relate to. Later in this chapter learnings are presented regarding different levels within an organization; the boardroom, staff, the project and the client. As already found in chapter 7, both a top-down as a bottom-up approach is required when embedding the use of lessons learned into an organization. Not only does the boardroom and higher management have responsibility in facilitating and stimulating the use of lessons learned, also the employees, staff and the client need play an important role in ensuring the use of lessons learned.

Considering the validation session presented in chapter 8, the question can be raised to which extend the conclusions and recommendations of this research will be futureproof. Apparently, lessons learned, and thus in some way the conclusions of this research, are not properly used in future projects. And can we thereby conclude that the same future lies ahead for the results of this research? It remains hard to state whether this will be or not be the case, it depends on how the results of this research are brought into action within the research company and future research. The validation of this research has been done based on the experience of the members part of the validation panel, and no results are generated which involves the conclusions of this research being used in real-life cases. One of the validation panel members, who is currently working on making improvements to the Project Management Handbook of Royal HaskoningDHV, will take incorporate the results of this research in the revisions (v4).

As described in the beginning of this research report (section 1.5), this research aimed *“to contribute to the knowledge of using lessons learned in project-based organizations by identifying the enabling and hampering factors and, based on the identified desired characteristics, develop a recommended conceptual framework to enable the use of lessons learned”*. This research did identify the enabling and hampering factors, the desired characteristics and developed a recommended conceptual framework to enable the use of lessons learned. Based on the proposed research goal, this research does have contributed to the knowledge of using lessons learned in project-based organizations. However, it can be argued to what extend it contributed as for example the conclusions have not been brought to the test yet.

In addition, the suggestions made in this research will only be beneficial if multiple findings are implemented at once. In a way, the lessons learned practice is as weak as its weakest link. For example: the suggested centralized structure can only function when awareness is created, the organizational infrastructure is facilitated and project team members are contributing to the lessons learned knowledge as a collective due to the created sense of urgency, usefulness and belief by higher management (leadership). This is one of the reasons why a prioritization was needed with the use of a MoSCoW analysis, to identify what *must* be implemented when desiring to use lessons learned.

9.2 Discussing the implications

As became clear in this thesis, the available literature on the usage of lessons learned is scarce. Although the subject 'lessons learned' is discussed in a broad variety of literature, the focus on the desired usage of these lessons learned is not discussed that often. In relation to this research gap, the actual practice of using lessons learned is also found to be minimal. For organizations, it remains difficult to use lessons learned, derived from other projects and project members. This research aimed to contribute to the knowledge of using lessons learned in project-based organizations, with the ambition to provide a solution or framework which organizations can incorporate into their organizational structure.

The limited amount of information available in two incomplete and contradicting sources also created implications for this research. All three case study project folders, each containing around 3,000 documents in which no clear structure was maintained, made it hard to find valuable information which was suitable for this research. Using keywords like 'lessons learned', 'Monthly Progress Report' and 'evaluation' helped in retrieving required documentation. However, this research did not investigate all 9,000 documents in total. In combination with the contradicting and incomplete sources, it was even harder to yield valuable information for this research.

Another implication for this research concerns the tacit knowledge of the interviewees and experts. The selected projects for the case studies have already been finished and the interviewees have already continued with other projects, making it harder for them to recall case specific events. Furthermore, in one of the case studies (c2) the project manager was no longer working at RHDHV. Instead, the account manager was interviewed and asked the general and case specific questions. All these features together made it harder to retrieve data and information regarding the subject of this research.

9.3 Learnings on different levels

This research produced learnings which are addressed to different levels within the organization. These levels include the boardroom, staff, the project and the client. This section strives to differentiate the learnings for each level within the organization, with the goal to clearly present responsibilities and tasks for each level within the organization. As already presented earlier in this research, both a bottom-up and a top-down approach is required for lessons learned to be properly used in future projects.

The boardroom

The first learnings derived from this research are aimed at the level of the boardroom. One of the most important learnings for the boardroom relates to leadership and creating a sense of urgency, usefulness and belief. Higher management has a large responsibility in creating a culture of honesty, respect and acceptance towards cultural differences. Higher management must support the use of lessons learned by monitoring, mentoring and rewarding. Creating awareness for the lessons learned practice is key, which amongst other things can be stimulated by assigning a central 'lessons learned team'. The influence of this top-down approach alone is perceived to be not enough as the use of lessons learned also requires to be driven through a bottom-up approach.

Staff

Through this bottom-up approach, the learnings are divided between staff, the project and the client. A large part of the findings is addressed towards the staff of the organization. With assigning a “lessons learned team” the lessons learned practice is centralized. A lot of work lies in the standardization and structuring of documentation and project practices (concise lessons learned content, active use of the lessons learned content and effectively transfer lessons learned during the project management intervention sessions). When looking back at table 7 (page 69 of this report), the first 16 findings all relate to the staff within an organization. In addition, finding 18 regarding the standardized processes in which lessons learned practice is conducted is a learning for staff.

A lot of learnings ask for one single initiation and only require iterations over time, while a small number of learnings need to be monitored on a constant basis. For example, ensuring the possibility of visualizations in a lesson learned document or the creation of standards and structure for the lessons learned practice require a single initiation with periodical iterations over time. On the other hand, making the lessons learned credible and actionable is something that will require a more intensive way of monitoring and improvement.

Project

Looking at the level of each individual project, a lot of similarities can be found with the learnings discussed in the level of staff. However, this research does have identified some specific learnings for each individual project. Projects should always organize internal lessons learned meetings on a fixed, regular basis. Furthermore, the lessons learned should be used actively instead of reactively and time (and money) should be created to properly execute the lessons learned practice. Lastly, project teams need to make sure that the lessons learned cycle presented in chapter 1 (figure 1) has been completed before the project (or project phase) closes. Because the project team members often switch between project phases and because of this knowledge could be lost.

Although the learning on creating time (and money) for the lessons learned practice might be considered a learning for the boardroom, it is just as much a responsibility for the project manager to ensure time reserved for the lessons learned practice.

Client

On the other side of the project spectrum lies the client, probably the most important stakeholder within a project. Learnings for the client consist of a mixture between learnings for the staff and the project levels. The case results of this research identified several specific findings which are client-related; a difficult relationship with the clients’ project manager, the dissatisfaction by the client regarding safety and quality standards and (more positive) the partnership between the client and Royal HaskoningDHV. Which aims to increase the efficiency and productivity of future projects.

Regarding the learnings for the client it is most important to align the lessons learned practices accordingly. For example, one of the recommendations derived from the partnership session (Appendix B) stated to align project phasing to prevent misunderstandings and stimulate working towards the same milestones. Another learning for the client level is the standardization of documentation and practices per client account. Each client has his or her preferences and it is important to create a context in which both parties (client and organization) can perform lessons learned practices without too much of a hassle.

10. CONCLUSIONS, RECOMMENDATIONS & REFLECTION

In this final chapter, the main research question is answered with the support of the already answered sub-questions in chapters 3 up to and including chapter 7. Section 10.1 presents a short recap of the different answers on the SQ's which is followed by answering the main research question as presented at the beginning of this report;

“How can lessons learned, retrieved from previous projects, be shared and used by other projects and managers?”

In support of this research questions, the following sub-questions (SQ) were formulated:

1. How are lessons learned currently shared and used?
2. What are the enabling factors for using lessons learned, retrieved from different projects and managers?
3. What are the hampering factors for using lessons learned, retrieved from different projects and managers?
4. What are the characteristics that are needed to use lessons learned, retrieved from different projects and managers?
5. Which requirements are needed to embed the usage of lessons learned into the organization and its culture?

After the conclusions on the research questions are presented, the following section elaborates more on the embedment of the conclusions into the organization (10.2). The limitations to this research will be discussed in section 10.3, followed by the recommendations and suggestions for further research (section 10.4). This graduation report will close of with a personal reflection on the personal lessons learned of the researcher and the practicability of the suggestions made (section 10.5).

10.1 Answering the research question

Currently a lesson learned is shared and used in the most minimal way. Although the interviewees of this research ensure the dissemination and implementation of lessons learned in other projects, none of these lessons could be pinpointed or be found in the project documentation of the case studies. The use of lessons learned is amongst other things enabled by “person-to-person” knowledge transfer, by using the lessons learned actively assigning a central “lessons learned team” that is responsible for the whole lessons learned practice.

On the other hand, the use of lessons learned is amongst other things hampered by the overload of information, by the structure and organization of information, by time and client pressure and by the lack of support, stimulation and monitoring by higher management. To cope with all of this, lessons learned need to be actionable, be focused on process knowledge, be able to be used in other project contexts and be incorporated into already existing (digital) tooling.

To embed the use of lessons learned, both a top-down and a bottom-up approach is needed. From a top-down perspective leaders must step up and create a sense of urgency, usefulness and belief, and stimulate the culture with monitoring and rewarding. Bottom-up, a clear “lessons learned infrastructure” is required, showcases and best practices need to be available and the intrinsic motivation of employees should be encouraged as well.

RQ: How can lessons learned, retrieved from previous projects, be shared and used by other projects and managers?

Currently the interest and priority of the lessons learned practice is too low. Higher management believes that new methods, like for example the Health Check, seem to function properly. But this research shows that this is not the case. As the literature review, case studies and interviews show, a lot can still be learned from prior mistakes and best practices, saving a lot of time and money. But as long as higher management does not invest in the required conditions for lessons learned to be used in other projects, lessons learned practice will not function properly.

People within an organization do not believe that investing time and effort in lessons learned practice will be beneficial, they remain pessimistic on the returns of lessons learned practices and are more likely to directly contact someone within their own company network. However, this is one of the pitfalls in the usage of lessons learned; the reactive use instead of *the active use of lessons learned*. Most of the time a solution to a certain problem in a lesson learned is most effective at the beginning of a project, and when using a lesson learned as a reactive measure it is often too late.

Based on the findings of this research an answer can be given on how lessons learned can be shared and used by other projects and managers. The lessons learned practice is a process (Buttler, 2016) which can be divided into three phases; identification, dissemination and implementation (Duffield & Whitty, 2014).

This research identified that *'people-to-people' knowledge transfer is perceived to be most effective* in using lessons learned. By stimulating the conversation, a more deepened and scenario-based version of the lesson learned can be transferred and used by other projects and managers.

For lessons learned to be shared and used by other projects and managers, this research emphasizes on *the alignment and completion of lessons learned processes*. This research found several cases which indicated the incompleteness and lack of alignment in the processes of lessons learned practices. MPRs were lacking, in one case the Project Plan was not constructed, the correlation between project management tools is perceived to be minimal and there is an information overload in contradicting sources. These issues need to be solved for lessons learned to be used in a proper way.

This research stresses that *a central "lessons learned team" should be assigned* who is responsible for the lessons learned practices within an organization. By making the lessons learned practices centralized and structured for all projects, the lessons learned can be shared and used in the most optimal way.

Aside from inserting a central "lessons learned team" who hosts several lessons learned sessions within the project lifetime: *the intrinsic motivation of all employees must be stimulated accordingly*. A company should *create a comfortable culture in which the lessons learned are actively shared and used* without feeling ashamed or guilty. Higher management needs to be stimulating people to share their challenges and best practices so that the company as a whole can benefit from it. Rewarding and monitoring the lessons learned practices can be used as a stimulant, but first *project managers and department directors need to fulfil the role of a leader and be the example*. These leaders should create awareness, a sense of urgency and belief in order to stimulate the usage of lessons learned by other projects and managers.

Concluding conceptual framework

Figure 10 illustrates the conceptual framework in which the lessons learned, retrieved from previous projects, can be shared and used by other projects and managers. It shows how lessons learned sessions are hosted throughout the lifetime of a project and how these are aligned with the Project Health Checks and project phases. This research suggests including at least a 'lessons learned' section within the Project Health Check documentation that indicates whether the lessons learned sessions took place. Depending where in the lifetime of the project these lessons learned sessions are conducted, lessons learned can be suggested and/or retrieved with/by the lessons learned team, project team and experts. These experts could include the authors of previous identified lessons learned, project managers from other projects, a project soundboard, but also experts from outside the company (for example academics). All these different experts could generate valuable information, and can give extra stimulation to the 'person-to-person' knowledge transfer. An important notion to this suggestion is that adding a 'lessons learned' section within the HCs will not automatically result in the actual use of lessons learned. It will only create awareness and supports monitoring the lessons learned practice in projects. Nevertheless, both are very important for the eventual use of lessons learned.

The lessons learned sessions displayed in figure 10 can be considered as project team workshops in which lessons learned are disseminated and discussed by conversation. As "people-to-people" knowledge transfer is most effective to the eventual use of lessons learned, this should be the preferred mechanism in which lessons learned are transferred. Mentioned in figure 10 is the so-called 'lessons learned team', which can be considered as a group of people who are responsible for the full lessons learned practice within the organization. The lessons learned team will prepare, host and document the sessions, while the project team and experts discuss the content of the lessons learned and how they can be used in the project of themselves and others. The task of the lessons learned team during such a "lessons learned session" is simple: [1] monitor the pace of the discussion, [2] keep the focus on the use of the lessons learned and [3] retrieve or capture new lessons learned when the previous lessons learned is discussed. Aside from the lessons learned sessions, the lessons learned team functions as the centralized place (both digital as physical) where people can go to for all lessons learned related content. This can be for example retrieving lessons learned from the database or disseminating the captured lessons learned through the infrastructure of the lessons learned practice. The structure in which the lessons learned are discussed is in line with the Root Cause Analysis (RCA) method, aiming to answer 'why' or 'how' something has happened instead of 'what'. This results in lessons learned content which focuses on the process knowledge instead of the product knowledge.

Aside from the project-based lessons learned sessions, the Project Management Intervention sessions are also incorporated into the conceptual framework. These lessons learned sessions are an overarching medium of the projects in which all project managers can share and retrieve knowledge and lessons learned. In addition, the conceptual framework also shows both the top-down and the bottom-up approach which is needed for lessons learned to be used. As section 9.3 already mentioned, there are different learnings for different levels within the organization; the boardroom, staff, the project and the client. These different levels are also displayed in the conceptual framework.

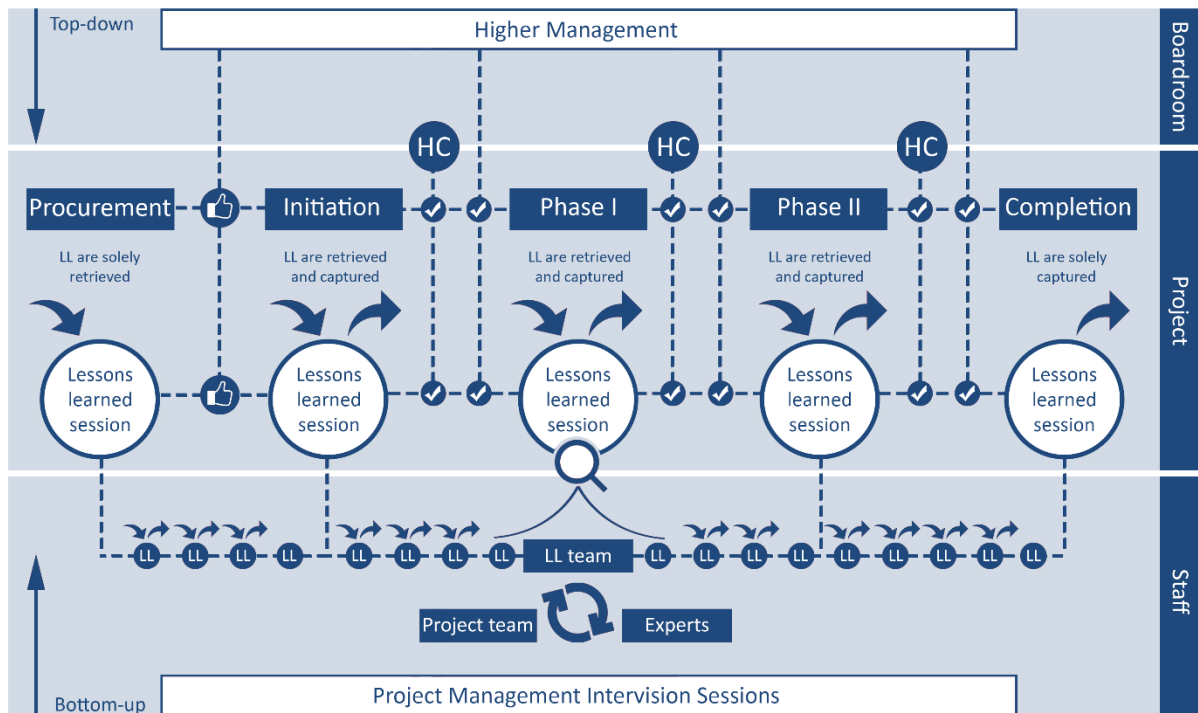


Figure 10 – Conceptual framework for the use of lessons learned

10.2 How to embed in the organization

The conceptual framework presented in figure 10 will not satisfy all requirements necessary for lessons learned to be used for other projects and by other managers. Although this framework includes a control moment after each “lessons learned session”, the content of these sessions needs to be disseminated amongst other project teams properly and the eventual use of lessons learned should be monitored as well. This research stresses that *leadership has the utmost responsibility* in assuring the lessons learned to be used properly. From a *top-down perspective*, leaders should monitor the execution of the lessons learned sessions through the Health Checks and regularly check the outcomes of a lessons learned session. From a *bottom-up perspective* the needs and means for the use of lessons learned in other project environments should be facilitated by leadership as well. The lessons learned team is responsible for [1] enforcing the means and requirements to monitor and improve the conceptual framework when necessary and [2] create awareness of the available lessons learned at all times.

Higher management must invest in [1] time for all employees to execute the steps in the conceptual framework displayed in figure 10, [2] the investment of people who will be responsible for the lessons learned practice within the organization (lessons learned team), [3] the organizational infrastructure in which all lessons learned can be identified, disseminated and implemented and [4] rewarding employees who have took the time for the lessons learned practice and its benefits. As this organizational infrastructure needs to be created from nothing, *this research suggests starting at a single department within the organization and monitor its progress*. Afterwards this can be expanded to other departments using showcases and best practices.

10.3 Limitations of this research

As already described in the research scope, this research focused solely on greenfield brewery projects from one client account. Although the participants of the validation sessions were not only from the client account, and confirmed the current practice in other industries to be the same, still this research has not investigated other industries. If this research would have been conducted on a broader selection of industries, the results of this research could have been different.

This research maintained a qualitative character and interviewed only one project member per case. This brings up the discussion that the findings derived from the in-depth interviews are only based on the perspective of one project member. However, all the interviewees were the project managers or the account manager of these projects and thus should have had the best overview of how lessons learned were identified, disseminated and implemented. Still it must be noted that only interviewing one project team member could generate a bias to the results in this research.

As the literature appeared to be scarce to the subject of 'using lessons learned', often the literature review deviated to the subject of knowledge management (KM) and information management (IM). Researchers regularly use the terms lessons learned, KM and IM within the same context, often with the same meaning. This makes it debatable whether the results presented in this research are fully in line with the lessons learned practice, or that some findings might not have been used for this research.

In addition, the interviewees were not specifically asked what their prioritization of the different findings was. And the MoSCoW prioritization was solely based on the results of the validation session and the answers during the interviews. Again, this generates the limitation that only a select group of individuals have had influence on the prioritization of the results.

Another limitation to this research is that no distinction is made between different project phases. As project are often divided in phases, an interesting topic for research could be to see in what phases of a project the lessons learned practice comes to play. Although the results suggest organizing several lessons learned session within a project, structured per project phase, no research has been conducted on what phases will profit most of these sessions.

Also, the eventual composition of the validation panel did not meet the requirements prescribed at the beginning of this research. In the end, only one of the validation members was working outside the research scope (v4). Not only does this limit the validity of the research, it can also be questioned to which extend the results are applicable outside the research scope.

A final notion must be made regarding the similarity between the conceptual framework presented earlier this chapter (figure 10) and a framework developed at the oil and gas company Royal Dutch Shell. In 2003 a similar model was developed at the project management department of Shell, also striving to make optimal use of the available knowledge (and lessons learned) within the company (Bakker, 2018). However, 15 years later, still the same features are included into a conceptual model. It appears that in practice, it remains to be hard to implement and use the framework as prescribed at Shell and in this research. Although this research did focus on the embedment of the conceptual framework (section 10.2), this does not guarantee a different future for the conceptual framework presented in this research compared to the framework designed within Shell.

10.4 Recommendations

Now that all the results, discussion, conclusions and limitations are discussed, this section presents the recommendations derived from this research. First suggestions for future research will be discussed (section 10.4.1), and this will be followed by recommendations for practice (section 10.4.2).

10.4.1 Suggestions for future research

- Dive deeper into the lessons learned practice performed in HROs. Industries like aviation and healthcare can function as a proof of concept, which might be valuable to the current knowledge of lessons learned practices in the civil sector. A suggested reason why these industries appear to make better use of their lessons learned is because of the strict associated regulations in these industries. However, this has not been scientifically researched and could be of great value for future practice.
- Conduct research on the actual practice of the proposed conceptual framework. Figure 10 presents the conclusive conceptual framework derived from this research, but up to now it has not been tested in a practical environment. The only reference on how it could function is investigating the functionality of the model designed within Shell in 2003. Adjustments to the current framework are probably inevitable, but the framework can function as a basis which can be further improved over time.
- Conduct a MoSCoW analysis with the input of broader project management perspective. Already discussed in chapter 8, this research conducted a MoSCoW analysis based on the perceptions, opinions and viewpoints yielded from both literature and the interviews. However, as this only concerns a relative small diversity of people, it is suggested to investigate whether the results are prioritized differently when a MoSCoW analysis is performed for a large group of people. This research proposes two ways in which this can be done: [1] send out a survey to people within and outside an organization and/or [2] conduct several MoSCoW sessions with different project teams and compare the results.
- Conduct research on a broader field of type of projects, because this research only researched three greenfield brewery projects. Other industries or types of projects could lead to other results and conclusions.
- Research the Root Cause Analysis (RCA) as a structure to support the usage of lessons learned. As discussed in this graduation report, this research suggests structuring the lessons learned sessions by using the '5 Why's' method, but other RCA methods might suffice as well. These RCA structures might eliminate a lot of the current hampering factors to the usage of lessons learned: too detailed descriptions of the lessons learned content, describing product knowledge instead of process knowledge in the lessons learned content, and so on.
- Almost in line with the suggestion on a broader field of type of projects, this research suggests investigating whether the same results are yielded when another group of case study projects are researched belonging to the same client account. As the cross-case analysis showed, a lot of similarities were found in all case studies. It would be interesting to investigate if the amount of similarities found is dependent when it concerns solely case study projects from the same client account.

10.4.2 Recommendations for practice

- Pilot the proposed conceptual framework in a project-based environment incorporating the lessons learned of several projects. As already mentioned in the previous section, the conclusive conceptual framework has not yet been assessed. Monitor, evaluate and adjust the framework when necessary.
- Make someone responsible and invest in them. This research recommends assigning a “lessons learned team” which is fully responsible for the lessons learned practice within an organization. Facilitate the organizational infrastructure in which employees can capture and retrieve lessons learned from their projects. In addition to this, make sure that the people within the project team reserve time for the lessons learned practice as well, by creating a sense of urgency, usefulness and belief.
- In line with the previous recommendation, an organization should allocate a central point of (digital) lessons learned practice. This will not only create awareness amongst the people within the organization, but will also partially facilitate the organizational infrastructure required for the lessons learned practice.
- Start framing and standardizing common project management practices. For example: by means of the RCA, project management practices could be including specifically lessons learned practices into their tasks. In line with this it is recommended to facilitate in the tooling currently used for all sorts of lessons learned practices. For example, this research recommends including a ‘lessons learned’ section within the Project Health Check documentation. Although this will not guarantee the actual usage of lessons learned, it still creates awareness and gives higher management the opportunity to monitor the lessons learned practice simultaneously.
- Outside the research scope it is suggested to take a good look at the current form of the project Health Check. Along the way it was noticed that there are sceptics to the current way the Health Check is used. The HC provides insight for higher management and the project manager on how healthy the project is at that moment. Project drivers like time and budget are assessed and roughly show whether a project is healthy (green), is having some issues (orange) or is in critical conditions (red). It appears that higher management is giving more support to projects which are off track, meaning that higher management is not focusing enough on the projects which are ‘healthy’. Because of this, HC authors are tended to assess their projects towards a lower health to make sure that they get sufficient support of higher management. Although this recommendation does not directly apply to the usage of lessons learned, it remains an issue very much worth mentioning for the practice of HCs.

10.5 Personal reflection

Looking back on the research, I can say it was a bumpy ride. At my first midterm, I had to make a drastic switch in the research subject, my second supervisor had to leave my committee due to personal circumstances and my research needed some extra insights at the end. The initial research yielded results that were way more interesting for the current subject: using lessons learned. At first, I was not aware of the difficulties the industry was facing in making good use of the lessons learned retrieved from previous projects. A bit naïve I thought that especially the larger companies in the sector would have mastered this practice, but the findings in the beginning of my research proved me wrong.

Already half way in the graduation process, the graduation committee requested me to dive into this new subject and dedicate my research to the use of lessons learned. In the beginning of my graduation process I struggled to make the subject of my thesis to the point, but with this turning point at my first midterm meeting I gained motivation and joy as I finally had the feeling I could contribute to science. Because of this I am very thankful to my committee, who has shown me a way in which I could really make a difference to the current field of practice.

Within RHDHV I had a great time meeting a lot of new and interesting people. Although I believe that the knowledge I gained during the courses within the master program will help me in my future career, the experience you get when working in a professional environment makes a valuable and indispensable addition to me as future manager. The first day I walked in the office of RHDHV in Rotterdam, I knew that this journey would provide me with a lot of new inspiration, knowledge and friends. And the more I started talking to people about my research, the more excited I got because of all the positive reactions and acknowledgements.

During the case studies and interviews I experienced a lot of ‘oh my’, ‘oh really?’ and ‘aha’ moments, as the findings of my research indicated some bigger issues than I had expected upfront. This gave me even more motivation to conduct a high-quality research, as it could really make a difference and improve the current practice.

During my research, I captured multiple, personal lessons learned. This was the first time I have positioned myself as a true researcher, conducting case studies, interviews and a validation session with the responsibility to keep the results worthy to the academic standard. It was harder than I expected, especially because I am quite a creative thinker. I often already see a possible solution before it is even researched, but as a researcher you should always be impartial and open to the suggestions by others.

Another lesson I learned is that the only person stopping me from progressing is myself. A beautiful analogy states ‘the harder you push forward, the harder others will push with you’. I noticed this when I was actively talking to people about difficulties and doubts. It would almost always lead to someone who supported me or helped me in my decision-making. Just do it!

Last, but certainly not least, a lesson that I learned during my graduation research was that no matter how many times and how hard you fail, just get up and face it again. As I already said, the graduation process was not as smooth as I hoped for in the beginning. But here I am, proud to have delivered this graduation thesis and glad that I finally have finished this personal journey and milestone.

I want to close this personal reflection with an anecdote. I was walking at the campus, staring at the different faculty buildings which have been part of my life for the past 8 years. I felt proud for the fact that I have been studying at the TU Delft, I felt sentimental for all the memories I have created at a lot of these buildings and I feel sad because it is almost time to leave this place behind.

REFERENCES

- Ajmal, M. M., Kekäle, T., Takala, J. (2009). Cultural impacts on knowledge management and learning in project-based firms. *Journal of Information Knowledge Management Systems*, 39(4), 339–352.
- Ajmal, M. M., Takala, J., & Kekäle, T. (2008). Role of organizational culture for knowledge sharing in projects. In *PICMET 2008 proceedings* Cape Town, South Africa, 27–31 July.
- Almeida, M., & Soares, A. (2014). Knowledge sharing in project-based organizations: Overcoming the informational limbo. *International Journal of Information Management*, 34(6), 770–779.
<http://dx.doi.org/10.1016/j.ijinfomgt.2014.07.003>
- Andriessen, J.H.E. & Fahlbruch, B. (2004). *How to Manage Experience Sharing: From Organisational Surprises to Organisational Knowledge*, 1st ed. Elsevier, Amsterdam; Boston.
- Atkinson, R., Crawford, L., & Ward, S. (2006). Fundamental uncertainties in projects and the scope of project management. *International Journal of Project Management*, 24(1), 687–698.
- Bakker, R. M., Cambré, B., Korlaar, L., & Raab, J. (2011). Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer. *International Journal of Project Management*, 29(5), 494–503. <http://dx.doi.org/10.1016/j.ijproman.2010.06.002>
- Bakker, H.L.M. (2018) Graduation process meeting on the 5th of July 2018
- Barach, P., & Small, S.D. (2000). Reporting and preventing medical mishaps: lessons from nonmedical near miss reporting systems. *British Medical Journal*, 320(7237), 759–763.
- Barnes, S. (2011). Aligning people, process and technology in knowledge management, *Serventie (Ed.)*, Ark Group in Association with Inside Knowledge.
- Bartsch, V., Ebers, M., & Maurer, I. (2013). Learning in project-based organizations: The role of project teams' social capital for overcoming barriers to learning. *International Journal of Project Management*, 31(2), 239–251. <http://dx.doi.org/10.1016/j.ijproman.2012.6.009>
- Birk, A., Dingsøyer, T., & Stålhane, T. (2002) Postmortem: Never leave a project without it. *Software, IEEE*, 19(3), 43–45.
- Boh, W. F. (2007). Mechanisms for sharing knowledge in project-based organizations. *Information and Organization*, 17(1), 27–58. <http://dx.doi.org/10.1016/j.infoandorg.2006.10.001>
- Bouthillier, F., & Shearer, K. (2002). Understanding knowledge management and information management: The need for an empirical perspective. *Information Research*, 8(1).
- BP. (2010). *Deepwater Horizon Accident Investigation Report*.

- Bresnen, M., Edelman, L., Newell, S., Scarbrough, H., & Swan, J. (2003). Social practices and the management of knowledge in project environments. *International Journal of Project Management*, 21(3), 157–166. [http://dx.doi.org/10.1016/S0263-7863\(02\)00090-X](http://dx.doi.org/10.1016/S0263-7863(02)00090-X)
- Buttler, T. (2016). Collecting Lessons Learned: How project-based organizations in the oil and gas industry learn from projects. doi: 10.4233/uuid:b3333087-029e-4927-901b-3eb4b96b08ca
- Buttler, T., & Lukosch, S. (2012). Rethinking lessons learned capturing. *Proceedings of the 12th International Conference on Knowledge Management and Knowledge Technologies - i-Know 12*. doi:10.1145/2362456.2362460
- Buttler, T., & Lukosch, S. (2013). On the Implications of Lessons Learned Use for Lessons Learned Content. *Proceedings of the 13th International Conference on Knowledge Management and Knowledge Technologies - i-Know 13*. doi:10.1145/2494188.2494229
- Carrillo, P. (2005). Lessons learned practices in the engineering, procurement and construction sector. *Engineering, Construction and Architectural Management*, 12(3), 236-250. doi:10.1108/09699980510600107
- Carrillo, P., Ruikar, K., & Fuller, P. (2013). When will we learn? Improving lessons learned practice in construction. *International Journal of Project Management*, 31(4), 567-578. doi: 10.1016/j.ijproman.2012.10.005
- Casey, J.J. (2008). *Leveraging Five Whys* – Get the most of your effort. Retrieved on June 2018 <https://www.qualitydigest.com/inside/quality-insider-article/leveraging-five-whys.html>
- Cicmil, S., & Hodgson, D. (2006). Are projects real? The PMBOK and the legitimization of project management knowledge. *Making Projects Real*. Palgrave MacMillan.
- Cleveland, C. (2011). *Macondo: the gulf oil disaster*. Encyclopedia of Earth.
- Coakes, E. W., Coakes, J. M., & Rosenberg, D. (2008). Co-operative work practices and knowledge sharing issues: A comparison of view-points. *International Journal of Information Management*, 28(1), 12–25. <http://dx.doi.org/10.1016/j.ijinfomgt.2007.10.004>
- Cooke-Davies, T. (2002). The real success factors on projects. *International Journal of Project Management*, 20(3), 185-190.
- Craddock, A. Fazackerley, B., Messenger, S., Roberts, B. & Stapleton, J. (2008). *DSDM Atern: The Handbook, Volume 2*. DSDM Consortium.
- Detlor, B. (2010). Information management. *International Journal of Information Management*, 30(2), 103–108. <http://dx.doi.org/10.1016/j.ijinfomgt.2009.12.001>

- Disterer, G. (2002). Management of project knowledge and experiences. *Journal of Knowledge Management*, 6 (1), 512–520.
- Duffield, S., & Whitty, S. J. (2014). Developing a systemic lessons learned knowledge model for organisational learning through projects. *International Journal of Project Management*, 33(2), 311-324. doi:10.1016/j.ijproman.2014.07.004
- Duhon, H., & Elias, J. (2008). Why it is difficult to learn lessons: insights from decision theory and cognitive science. *SPE Project Facility Construction* 3(1), 1–7.
- Eken, G., Bilgin, G., Dikem, I. & Birgonul, M. (2015). A Lessons Learned Database Structure for Construction Companies. *Procedia Engineering* 123 (2015), 135-144. doi:10.1016/j.proeng.2015.10.070
- Eskerod, P., & Skriver, H.J. (2007). Organizational culture restraining in-house knowledge transfer between project managers—a case study. *Project Management Journal*, 38(1), 110–122.
- Fernie, S., Green, S.D., Weller, S.J., & Newcombe, R. (2003). Knowledge sharing: context, confusion and controversy. *International Journal of Project Management*, 21(1), 177–187.
- Frechtling, J., Frierson, H. (2002). The 2002 user friendly handbook of project evaluation. Arlington, VA: National Science Foundation, Directorate for Education & Human Resources, Division of Research, Evaluation and Communication
- Gann, D.M., & Salter, A. (1998). Learning and innovation management in project based, service-enhanced firms. *International Journal of Innovation Management*, 2(1), 431–454.
- Gibson, E. G. J., Caldas, C. H., Yohe, A. M. & Weerasooriya, R. (2007). An analysis of lessons learned programs in the construction industry (2nd ed.). Technical report, Construction Industry Institute, Austin, TX
- Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review*, 77(2), 106–116, 187. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10387767>
- Hislop, D. (2005). *Knowledge Management in Organizations: A Critical Introduction*. Oxford University Press, Oxford; New York.
- Holzmann, V. (2013). A meta-analysis of brokering knowledge in project management. *International Journal of Project Management*, 31(1), 2–13. <http://dx.doi.org/10.1016/j.ijproman.2012.05.002>
- Hopkins, A. (2009). *Learning from High Reliability Organisations*. CCH Australia Limited, Sydney.
- Huang, J.C., & Newell, S. (2003). Knowledge integration processes and dynamics within the context of cross-functional projects. *International Journal of Project Management*, 21(1), 167–176.

- Insight (2018). Project Health Check. Retrieved from <https://insight.rhkonnections.com/projects-knowledge-and-expertise/projects-knowledge-expertise-project-support/project-health-check.html> on the 24th of April 2018.
- Jackson, P., & Klobas, J. (2008). Building knowledge in projects: A practical application of social constructivism to information systems development. *International Journal of Project Management*, 26(4), 329–337. <http://dx.doi.org/10.1016/j.ijproman.2007.05.011>
- Karim, N. S. A., & Hussein, R. (2008). Managers' perception of information management and the role of information and knowledge managers: The Malaysian perspectives. *International Journal of Information Management*, 28(2), 114–127. <http://dx.doi.org/10.1016/j.ijinfomgt.2007.08.003>
- Kasi, V., Keil, M., Mathiassen, L., & Pedersen, K. (2008). The post mortem paradox: a Delphi study of IT specialist perceptions. *European Journal of Information Systems*, 17(1), 62-78.
- Keegan, A., & Turner, J. R. (2001). Quantity versus Quality in Project-Based Learning Practices. *Management Learning*, 32(1), 77-98
- Kerzner, H. (2009). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 10th ed. John Wiley & Sons, Hoboken, N.J.
- Klakegg, O., Williams, T., Walker, D., Andersen, B., & Magnussen, O. (2010). *Early Warning Signs in Complex Projects*. Project Management Institute Inc., Newtown Square, Pennsylvania.
- Kotter, J. (2008). *A sense of urgency*. Boston, Mass.: Harvard Business Press.
- Kululanga, G., Edum-Fotwe, F., & McCaffer, R. (2001). Measuring construction contractors organizational learning. *Building Research & Information*, 29(1), 21-29. doi:10.1080/09613210150208769
- Leistner, F. (2010). *Mastering Organizational Knowledge Flow: How to Make Knowledge Sharing Work*. John Wiley & Sons, Hoboken, N.J.
- Liebowitz, J. (2008). Two forgotten elements of a knowledge management strategy. *Knowledge Management Research & Practice*, 6(3), 239-244.
- Mahroeian, M., Forozia, A. (2012). Challenges in Managing Tacit Knowledge: A Study on Difficulties in Diffusion of Tacit Knowledge in Organizations. *International Journal of Business and Social Science*, 19(3), 303-308
- Maqsood, T. (2006). *The Role of Knowledge Management in Supporting Innovation and Learning in Construction*, School of Business Information Technology. RMIT University.

- McKenna, T., & Whitty, S.J. (2012). Reconceptualising project management methodologies for a post-postmodern era. *9th Annual Project Management Australia Conference Incorporating the PMI Australia National Conference (PMOz)*, Melbourne, Australia, pp. 34–54.
- Milton, N. J. (2010). *The lessons learned handbook practical approaches to learning from experience*. Oxford: Chandos Publishing.
- Neef, D. (2005). Managing corporate risk through better knowledge management. *Learning Organizations*, 12(1), 112–124.
- Newell, S. M., Bresnen, M., Edelman, L. F., Scarbrough, H., & Swan, J. (2006). Sharing knowledge across projects: Limits to ICT-led project review practices. *Management Learning*, 37(2), 167-185.
- O'Dell, C., & Hubert, C. (2011). *The New Edge in Knowledge: How Knowledge Management is Changing the Way We Do Business*. John Wiley & Sons, New Jersey.
- Orlikowski, W.J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies*, 28(1), 1435–1448.
- Päivärinta, T., & Munkvold, B. E. (2005). Enterprise content management: An integrated perspective on information management. In *Proceedings of the 38th Hawaii international conference on system sciences*.
- Pemsel, S., & Wiewiora, A. (2013). Project management office a knowledge broker in project-based organisations. *International Journal of Project Management*, 31(1), 31-42.
<http://dx.doi.org/10.1016/j.ijproman.2012.03.004>
- Prencipe, A., & Tell, F. (2001). Inter-project learning: Processes and outcomes of knowledge codification in project-based firms. *Research Policy*, 30(9), 1373–1394.
[http://dx.doi.org/10.1016/S0048-7333\(01\)00157-3](http://dx.doi.org/10.1016/S0048-7333(01)00157-3)
- Reason, J. T. (1997). *Managing the Risks of Organizational Accidents*. Ashgate, Aldershot, Hants, England; Brookfield, Vt., USA.
- Reason, J. T. (2000). *Human error: models and management*. Br. Med. J. 320, 768.
- Reich, B. H. (2007). Managing knowledge and learning in IT projects: A conceptual framework and guidelines for practice. *Project Management Journal*, 38(2).
- Rooney, J., & van den Heuvel, L. (2004). *Root Cause Analysis For Beginners* Quality Basics, July.
- Schindler, M., & Eppler, M. J. (2003). Harvesting project knowledge: a review of project learning methods and success factors. *International Journal of Project Management*, 21(3), 219-228.
[doi:10.1016/s0263-7863\(02\)00096-0](https://doi.org/10.1016/s0263-7863(02)00096-0)

- Sense, A.J. (2007). Learning within project practice: cognitive styles exposed. *International Journal of Project Management*, 25(1), 33–40.
- Sense, A.J. (2009). The social learning character of projects and project teams. *International Journal of Knowledge Management*, 3(1), 195–208.
- Sherif, K., 2006. An adaptive strategy for managing knowledge in organizations. *International Journal of Knowledge Management*, 10(1), 72–80.
- Smulders, F.E., Kiers M.H. and Van Engelen, J.M.L. (1998). Thema 2: Productinnovatie, 180 pp., in: J.M.L.van Engelen, H.W.C. van der Hart, S. Seikes (Eds.), *Handboek voor Commercieel Technici*, Alphen aan de Rijn: Samsom. (in Dutch)
- Smulders, F.E., Lousberg, L., & Dorst, K (2008). Towards different communication in collaborative design, *International Journal of Managing Projects in Business*, 1(3), 352-367.
- Sondalini, M. (n.d.). *Understanding How to Use The 5-Whys for Root Cause Analysis*. Lifetime Reliability Solutions. Retrieved on June 2018 at http://www.lifetime-reliability.com/tutorials/lean-management-methods/How_to_Use_the_5-Whys_for_Root_Cause_Analysis.pdf
- Tan, H. C., Anumba, C., Carrillo, P. M., Bouchlaghem, N., Kamara, J. M., & Udeaja, C. (2010). *Capture and reuse of project knowledge in construction*. Wiley –Blackwell, Oxford.
- Tan, H. C., Carrillo, P. M., Anumba, C., Kamara, J. M., Bouchlaghem, N., & Udeaja, C. (2006). Live capture and reuse of project knowledge in construction organizations. *Knowledge Management Research & Practice*, 4(2), 149-161.
- Verschuren, P., & Doorewaard, H. (2010). *Designing a Research Project* (2nd edition). The Hague: Eleven international publishing.
- Vestola, M. (2010). A Comparison of Nine Basic Techniques for Requirements Prioritization. Helsinki University of Technology. Retrieved June 7, 2018 from http://www.mvnet.fi/publications/software_development_seminar.pdf.
- Vogus, T.J., & Sutcliffe, K.M. (2007). The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. *Med Care*, 45(10), 997–1002.
- Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review*, 20(2), 115–131.
<http://dx.doi.org/10.1016/j.hrmr.2009.10.001>
- Weber, R., Aha, D., & Becerra-Fernandez, I. (2001). Intelligent lessons learned systems. *Expert Systems with Applications*, 20(1), 17-34. [https://doi.org/10.1016/S0957-4174\(00\)00046-4](https://doi.org/10.1016/S0957-4174(00)00046-4)
- Williams, T. (2004). Identifying the hard lessons from projects – easily. *International Journal of Project Management*, 22(4), 273-279. doi: 10.1016/j.ijproman.2003.11.001

- Williams, T. (2007). *Post-Project Reviews to Gain Effective Lessons Learned*. Project Management Institute, Newtown Square, USA.
- Williams, T. (2008). How do organisations learn lessons from projects—and do they? *IEEE Transport Engineering Management* 55(1), 248–266.
- Weick, K. E., & Sutcliffe, K.M. (2001). *Managing the Unexpected: Assuring High Performance in an Age of Complexity*. Jossey-Bass, San Francisco.
- Wysocki, R.K. (2004). *Project Management Process Improvement*. Artech House, Boston.
- Yin, R. K. (1981). The case study as a serious research strategy. *Science Communication*, 3(1), 97–114. <https://doi.org/10.1177/107554708100300106>

This page is intentionally left blank