INTER PROJECT LEARNING

KEY STEPS AND ACTIONS TO EFFECTIVELY REUSE LESSONS-LEARNED BY MANAGERS IN NEW PROJECTS

R.R. HUISMAN
TU Delft
DATE: 13/03/2017

MASTER TRACK
CONSTRUCTION MANAGEMENT & ENGINEERING

"IF ONLY I KNEW THEN WHAT I KNOW NOW..."
COLOPHON

REPORT

TITLE
INTER PROJECT LEARNING
KEY STEPS AND ACTIONS TO EFFECTIVELY REUSE LESSONS-LEARNED BY MANAGERS IN NEW PROJECTS

LOCATION
HOOFDDORP

DATE
18/03/2017

PAGES
54 / 75 (APPENDIX)

KEYWORDS
INTER-PROJECT LEARNING, KNOWLEDGE MANAGEMENT, LESSONS-LEARNED REUSE, PROJECT-BASED ORGANIZATIONS, PROJECT MANAGERS

AUTHOR

NAME
RICKWIN ROBERT HUISMAN

STUDENT NUMBER
4022513

EMAIL
RRHUisman@gmail.com
RICKWIN.HUISMAN@FLUOR.COM

UNIVERSITY
DELT UNIVERSITY OF TECHNOLOGY

FACULTY
CIVIL ENGINEERING & GEOSCIENCES

MSc PROGRAM
CONSTRUCTION MANAGEMENT & ENGINEERING

GRADUATION COMMITTEE

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SUPERVISOR
PHD CANDIDATE Y. LIU
TU DELFT, FACULTY OF CIVIL ENGINEERING AND GEOSCIENCES

COMPANY SUPERVISORS
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FLUOR, QUALITY AND CPI DEPARTMENT MANAGER CENTRAL EUROPE

K. DE WIT
FLUOR, MANAGER PROPOSALS
"If only I knew then what I know now..."
Fluor project manager, 2016

We have all had this thought. It is evidence that you have learnt something, whether your experience was positive or painful. While you might not realise it, your experience has a price tag attached to it.

Think about it for a moment... if you could travel back in time with all of your current knowledge, acquired by working on projects, what effect would that have on the outcome? No doubt it would increase quality, save time or costs – or even someone’s life. If you begin to think in these terms, you realise that the knowledge you gain has value for others, even if they do not realise it yet. Similarly, the experiences of others are worth something to you, even if you do not realise it yet. This simple but often underappreciated concept of sharing and learning from experience is the focal point of this research.

A personal note
The submission of this report is my final act with respect to fulfilling all the requirements necessary to obtain a master’s degree in Construction Management and Engineering at the faculty of Civil Engineering and Geosciences. Since beginning this study in November, conducting this research has been marked by a rollercoaster of experiences that were both intense and interesting.

This thesis would never have flourished without the help, support and wisdom of others. I would therefore like to express gratitude to the following people: first of all, I would like to thank my committee members from the TU Delft, namely Hans Bakker, for his critical perspective on my research and his ability to give constructive feedback; Yan Liu, for his weekly support while I was conducting my scientific research and his consistently polite attitude; Stephan Lukosch, for his outstanding knowledge, constructive feedback and pleasant style of communication; and my Committee member Merlijn Lojenga from Fluor, for her steady constructive and welcoming feedback and support while I tackled a complex research topic. Furthermore, I would like to thank all the project managers at Fluor for their valuable input and open attitudes during the interviews. Finally, I would like to thank Fluor for the opportunity they provided to connect the theory with practice.

Finally, the time spent researching and writing this thesis was a tough period, characterised by ups and downs. For this reason I would like to thank my family, friends and girlfriend for their unconditional support and confidence through good and bad times, which enabled me to finish my research.

Rickwin Huisman
April 2017
**SUMMARY**

The project environment is currently undergoing rapid change due to the tremendous growth in the use of informatics, information in general and knowledge. As a consequence, organisations are subjected to ongoing change at all levels of the business environment. This has led to the development of the theoretical-organization model of a “learning organisation”. The focus of this model is on the production and distribution of knowledge to stimulate innovation and stay ahead of ongoing developments. Especially, for contemporary international project-based organisations that are working on temporary, challenging, gigantic and complex projects, this development has led them to recognise the potential in the growing amount of knowledge. Due to the increasing complexity and size of projects, as well as available knowledge, an increasing amount of attention is paid to knowledge transfer between projects so that teams can learn from each other.

In large scale project in the engineering, procurement and construction management industries, projects are executed by temporary teams. There is therefore the risk that newly acquired knowledge will be lost when project teams are disbanded. Commonly, these project-based organisations adopt the ‘lessons-learned’ approach to maintain the knowledge acquired during one project and transferring it to new or ongoing projects. Often the lessons-learned are defined as failures or successes from previous projects that can be of value to new projects. The lessons-learned can cross functional boundaries and prevent other teams from making the same mistakes or reinventing the wheel, and also build on previous successes. It appears that the “lessons-learned” approach is an efficient way to preserve knowledge acquired from previous projects. However, the literature also indicates that project teams have little interest in learning from previous projects and that, consequently, project-based organisations face fundamental challenges in the effective reuse of these learned lessons. Specifically, the behaviour of the project managers, as heads of projects, are crucial to the reuse of lessons-learned. Or, as an old saying puts it: “if the boss takes it seriously, the project team will as well.”

Consequently, the focus of this research was on recommendations for stimulating project managers to effectively reuse lessons-learned in project based organizations. It was expected that by investigating stimulating factors for the project managers’ intentions and behaviours, the fundamental challenges could be solved. Hence, the following research question was posed:

**How can managers of new projects be stimulated to effectively reuse lessons-learned?**

In order to answer the research question, both literature and practice were studied. In the literature study a thorough understanding of the concept of lessons-learned, the reuse process and the behaviour of the project managers were detailed. It was found that seven activities were indicated for the process of reusing lessons-learned, namely: intention; definition of the search question; search for expertise; assess and select from among the search results; endorsement and tasking; implementation and monitoring; and validation. For the behavioural framework the dimensions of Wang et.al. (2010) were used, being environmental, individual and motivational. These dimensions influence the behaviour of the project managers in the effective reuse of lessons-learned. In the environmental dimensions, motivational factors of the organisational environment, interpersonal and team characteristic, as well as cultural elements were investigated, while research into the individual dimension involved factors such as work experience, personalities and self-efficacy. The motivational dimension included factors such as perceived benefits and costs, trust and belief in knowledge ownership.

In order to identify the factors influencing the behaviour of project managers in the current reuse of lessons-learned in Fluor, a qualitative study was conducted by means of semi-structured interviews with the project managers. Afterwards, the interviews were transcribed, checked and analysed on the priori codes based on the behavioural factors framework defined by Wang et.al. (2010).
As a result of the practical study, the interrelated factors were clustered. For these clusters the following trends were discussed: stimulate the comprehension; facilitate constructive continuous communication; create a critical mass; define responsibility; develop strategy; and active monitoring and feedback. To specify, comprehension was the result of experience and education, personalities, accurate perception of self-efficacy and environmental factors such as interactive context and culture.

Recommendations were developed based on these trends in the form of key steps and actions to stimulate the reuse of lessons-learned, combining the results of the literature and practical studies. The key steps and actions were validated with the head of the project management department and a senior to enhance the practical value. The strength of these key steps and actions is that it takes into account the characteristics of the temporary, challenging, gigantic and complex characteristics in project environment in relation to the intention and behaviour framework of the project managers. Therefore,

The managers of new projects can be stimulated to reuse lessons-learned by the application of the recommended key steps and actions.

Finally, two observations; this answer to the research question shows that, as with many forms of cooperation, people and their behaviour are key in achieving maximum results. The systems and procedures can be designed efficiently, but without the collaborative effort of people, it will not lead to the effective reuse of lessons-learned. Or as Dale Carnegie once said:

"Knowledge is not power until it is applied"
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ABBREVIATIONS

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<td>ECPM</td>
<td>Engineering, construction, procurement management</td>
</tr>
<tr>
<td>PBO</td>
<td>Project-based Organization</td>
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<td>FEED</td>
<td>Front End Engineering Design</td>
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“Learning how to learn is life’s most important skill”

Tony Buzan

1.1. INTRODUCTION

In the last two decades, many important phenomena have occurred that challenge both organizational sciences and businesses. This is due, first, to the tremendous growth in the use of informatics, information and knowledge. Second, it is due to the fact that the business environment is changing on all levels (Hoekstra, 2006). This has led to the development of the concept of a “learning organization”. The focus of this concept is on the production and distribution of knowledge to stimulate innovation and to stay ahead of on-going developments.

In project-based organizations (PBO), the focus is on maintaining the acquired knowhow from one project and transferring it to another project or raising it to an organizational level. The process of creating, sharing and using of knowledge is entitled as knowledge management. A common procedure that is used for this is the lessons-learned approach (Argote and Ingram, 2000). The lessons-learned cycle consists of collection, verification, storing and dissemination (Newell, Bresnen, Edelman, Scarbrough & Swan, 2006). Besides the lessons-learned collection process, audit and client feedback reports are used as input for the knowledge management systems. Ideally, in these systems, experience based and tacit knowledge flows in the form of knowledge acquired into explicit knowledge, and, when necessary, back into explicit and tacit knowledge. However, this information flow is associated with difficulties for storing and retrieving of tacit knowledge and losses of crucial context information. This is because professionals find it difficult to reuse core experts’ knowledge for highly knowledge-intensive activities (Woo, Clayton, Johnson, Flores, and Ellis, 2004).

PBO’s have demonstrated that explicit information can be efficiently be collected and stored in databases. However, in practice, it appears that these computer-based approaches are poor at knowledge retrieval and exchange for effective reuse. Nevertheless, the typical process of organizations is completely focused on computer-based approaches.
1.2. RESEARCH MOTIVATION

1.2.1. INTER PROJECT LEARNING IN AN PROJECT ENVIRONMENT

Contemporary international EPCM organisations are working on mega, complex and otherwise challenging projects. Therefore, increased attention is given to knowledge transfer between projects or so-called inter/cross-project learning. In 1990, Peter Senge first introduced the concept of the learning organisation. From that moment, businesses started to recognize the benefits of their learning potential. The benefits of knowledge sharing contribute to the corporate aims, such as higher turnover, reduced cost, unique services, and securing core values. To secure these aims, organizations need to incorporate the aims in the knowledge activities of development, storage, sharing, application and evaluation (MOT, 2006). These are supported by a knowledge infrastructure consisting of an ICT- and organizational-environment. If applied systematically, the importance and value of inter-project learning can result in a cumulative and systematic improvement in both the process and the deliverables of the project (Antoni, Nilsson-Witell, and Dahlgaard, 2005).

1.2.2. THE CHALLENGING LEARNING ASPECT IN PROJECT-BASED ORGANIZATIONS

According to Argote and Ingram (2000) and Argyris (1991) the learning component becomes increasingly important in the harsh competition of the engineering industry. Currently, learning from past projects is still associated with great challenges (Hertogh, 2008; Newell et.al., 2006). To specify, large projects are often developed by temporary, international project teams. There is a risk that the newly acquired knowledge will be lost when the temporary project teams decompose. On the long term and at large scales this could lead to a reduction in the learning potential of an entire organization (Man, 2015). Yet research (Hertogh, 2008) suggests that project teams in organizations have little interest in learning from projects at a more advanced state of completion. This study considers the possibility that this is due to a tendency for inward-looking project teams to relish the challenge of tackling problems that are new to their experience rather than searching solutions elsewhere (Hertogh, 2011). For the successful use of external solutions, it is important to not automatically copy a best practice from elsewhere without understanding why it was applied at a certain place and time to particular circumstances. In other words, this means that it is of great importance to react adaptively to the contextual differences. This calls for an effective knowledge reuse process for coming up with solutions that can better fit the purpose of the project. To support this process, a learning organization promotes the education and development of all employees so that they can adapt themselves to a continuously changing environment. This continuous transformation requires besides the ability to learn new skills also to unlearn old habits. In a learning organization, new ideas and collective ambitions are encouraged and continuously compared to organizational goals and client needs (Senge, 2006).

Commonly, PBOs focus on maintaining knowledge acquired from previous projects and on transferring it to new or ongoing projects. Furthermore, an organization can raise it to the organizational level by changing procedures, for example. For these processes, PBOs use the lessons-learned approach (Argote et.al., 2000). As described by PMP (2008), the lessons-learned cycle crosses functional boundaries and helps organizations learn from their failures and successes. It has been claimed that an effective lessons-learned reuse process should prevent project team members from making the same mistakes again, reinventing the wheel and should stimulate the repetition of successes. It should be an instrumental part of any organization that strives for continuous improvement.

1.2.3. BEHAVIOURAL UTILIZATION OF LESSONS-LEARNED

According to Milton (2010), learning across projects is achieved only if the lessons of past projects are applied in new projects or in the organizational processes. Therefore, multiple authors state that the application of lessons-learned entails a change in personal or organizational behaviour (Milton, 2010; Disterer, 2002; Chung and Galetta, 2012). This action-based use of knowledge focuses current research on the behavioural utilization of lessons-learned. In this thesis, behaviour denotes the range of actions and mannerisms
demonstrated by project managers (Harcourt, 2017). Relative to the large number of responsibilities they manage, the role of project managers in lessons-learned reuse seems to be rather small. However, the involvement of project managers is crucial. According to Milton (2010), the commitment and leadership of project managers is a cornerstone for the success of the reuse of knowledge. This is supported by Bell DeTienne, Dyer, Hoopes, and Harris (2004), who remark that it is important for the head of a project and/or organization to be involved in knowledge-related practices. They describe it as follows: “if the boss takes it seriously, the project team will as well”. Also, Zyngier, Burstein and Mckay (2006) support this claim by identifying the essential roles of leadership in managing the reuse of lessons-learned. However, the implementation of lessons-learned is rarely a completely individual act, as all changes in the execution of a project influence other people and are mostly a team effort. Therefore, project managers are also expected to motivate the behaviour of the project team towards the reuse of lessons-learned.

1.2.4. Research gap, practical relevance and objective

As described in the former paragraphs, project managers and their project teams show little interest in learning from former projects. Milton (2010) claims that this is a consequence of individuals or organisational behaviour. In addition, it has been found that previous research focuses on efficiently storing and dissemination the lessons-learned via procedures or computer-based approaches, while less attention is paid to the actual reuse. However, emphasis should be placed on effective personalized knowledge reuse processes and on using computer-based approaches in a supporting role. Knowledge bases do not only reside in computerized repositories; they also reside in human brains (Woo et al., 2004). Hence, a research gap is found in the lack of an effective process for reusing of lessons-learned in new projects. Or as Dale Carnegie once said:

"Knowledge is not power until it is applied"

The knowledge flow in Figure 1 illustrates the green area as the gap identified in the body of science.

The practical challenge for project-based international organizations is to stimulate effective lessons-learned reuse and to thereby improve the performance of projects and the learning potential of organizations. The scientific challenge can be expressed as a clear scientific mapping of the factors that stimulate reuse of lessons-learned by project managers. With the aim to address the practical and scientific challenges identified above, the research objective can be formulated as follows:

The aim of this study is to give recommendations for stimulating project managers to effectively reuse lessons-learned from the execution phase of finished or on-going projects and to apply these lessons in current or future projects. This requires mapping the factors that influence the behaviour of project managers to reuse lessons-learned and developing keys steps and actions to foster the reuse of lessons-learned.
1.3. Research Question and sub-questions

The research challenge of this thesis is formulated in the form of a research question. Based on the research objective stated above, this thesis aims to answer the following research question:

‘How can managers of new projects be stimulated to effectively reuse lessons-learned?’

To answer the research question, two phases of study are defined (Hevner, March, Park, and Ram, 2004). These phases will give more insight into specific topics and will together enable the researcher to answer the main research question. Second, the phases have a steering function: they are intended to keep the research on track and to serve as support for the methodology and planning of the study. The first phase is a literature study undertaken on the concept of lessons-learned reuse in new projects and the second phase is an assessment on the specific case of Fluor.

The first phase is explored by literature study to identify factors that influence project managers to reuse lessons-learned. The second phase in the study focuses on assessment within Fluor. This phase can be divided into two elements:

- Defining the system: A qualitative analysis is conducted of the current process within the Fluor organization to determine underlying factors and trends for lessons-learned reuse by project managers.
- Development: Recommendations for keys steps and actions to stimulate effective reuse of lessons-learned.

Considering the phases defined above the following sub-research questions are defined:

**Literature study: Project-based organizations in the engineering domain**
1. What factors influence managers of new projects to reuse lessons-learned?

**Business case: Fluor**
2. What factors and underlying trends influence the behaviour of Fluor project managers in the current reuse of lessons-learned?
3. What key steps and actions are recommended for effectively reusing lessons-learned by Fluor project managers?

1.4. Research strategy

To answer the research question, the research strategy is developed, and shown in Figure 2. Both literature and practice are studied. To elaborate, the literature study is divided into two parts: first, the context (Chapter 2) or the concept of lessons-learned is explained; second (Chapter 3), the knowledge re-user and his or her corresponding behaviour are defined. Next, (chapter 4) the methodology for the case study is explained. Afterwards, the assessment of Fluor (Chapter 5) focuses on the current situation in the application of lessons-learned by project managers. The results of the assessment are then analysed for major underlying trends and discussed (Chapter 6). Recommendations for key steps and actions are then developed (Chapter 7). To validate the recommendations, an evaluation by means of semi-structured discussions is completed. The suggested alterations are included in the revised final version (Chapter 7). Finally, an answer to the main research question is given in the form of a conclusion (Chapter 8). Furthermore, it should be mentioned that the internal and external dynamics that can influence the research are identified in Appendix A.
1.4.1. Research Scope

1.4.1.1. Effective reuse of lessons-learned
This study focuses on the effective reuse of lessons-learned by project managers in engineering, procurement, and construction management for mega projects. The reuse of lessons-learned can also be referred to as the application or implementation of lessons-learned. An elaborated description of the concept of the reuse of lessons-learned can be found in Chapter 2.

1.4.1.2. Engineering, procurement, construction management organizations
The organization's name shows that it is contracted to provide engineering, procurement and construction-management (EPCM) services. The organization typically executes projects in teams of engineers and managers who work on a taskforce basis to design and build the projects for the client. In this study, the execution phases are the phases of engineering, procurement and construction.

1.4.1.3. The project managers
In this study, the concept of a project manager refers to all the managers who hold leading roles in a project. For example, project managers can also be called project leads or engineering managers. The project managers take care of the daily management of a project. The project managers are traditionally responsible for executing projects within agreed cost, quality and schedule targets. In addition, it should be safe, should produce a happy client, and should lead to flawless start-up (Bakker, Arkestijn, Bosch-Rekveldt, & Mooi 2010). Further, the project managers are in charge of unique projects that have tangible results. Implementing the lessons-learned is one of their tasks to increase the success of a project.

1.4.2. Deliverables
The main scientific deliverable of this study is to contribute to the knowledge base on the topic of stimulating the reuse of lessons-learned by project managers in new projects. The contribution consists of a blueprint of what effective lessons-learned reuse should entail. The practical deliverable of this study is twofold. The first deliverable is an assessment of the current situation of Fluor; the second are key steps and actions for the effective reuse.
“Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow”

William Pollard

LITERATUR STUDY: CONTEXT OF LESSONS-LEARNED

2.1. CONTEXT: FROM THE PERSPECTIVE OF LESSONS-LEARNED
   2.1.1. INTRODUCTION
   2.1.2. THE CONCEPT OF LESSONS-LEARNED
   2.1.3. A PERSPECTIVE ON THE LESSONS-LEARNED CYCLE
   2.1.4. THE USAGE OF LESSONS-LEARNED

2.2. SUMMARY
2.1. CONTEXT: A PERSPECTIVE ON LESSONS-LEARNED

2.1.1. INTRODUCTION

This chapter investigates the concept and purpose of reusing lessons-learned. It must be noticed that, although the study is focused on the reuse, this chapter also provides more insight into the overall lessons-learned cycle. This insight may help the reader place the study into context and thereby achieve a more in-depth understanding of what these topics support in achieving effective reuse.

2.1.2. THE CONCEPT OF LESSONS-LEARNED

To help the reader understand the concept of lessons-learned, a clear definition of lessons-learned is given and the success criteria for the lessons-learned usage process are identified. Buttler (2016) defines a lessons-learned as follows: “A lessons-learned is a text or (multi-media) document that is based on experiences made in a project that has the potential to provide value for future projects”. In her analysis of multiple definitions, Buttler states that, in general, lessons-learned are documents, cognitive entities or behaviours that may be based on knowledge, experiences or learning. Lessons-learned can be either positive or negative and are specific to organizational values and goals.

In light of Buttler’s research, additional definitions are mentioned that help to define the goal for reuse. According to the definition by Bickford (as cited by Weber, Aha & Becerra, 2001) the final goal in usage of lessons-learned is working safer, more efficiently and with higher quality. These contributions are in line with the responsibilities of the project managers (as described in the section on research motivation). Further, as explained before, Milton (2010) stated that the application of lessons-learned entails a change in personal and organizational behaviour. This behavioural, action-based use of lessons-learned enables this study to specify the goal of reusing. Therefore the definition by Harrison (as cited by Gibson, Caldas, & Yohe, 2007) emphasizes three criteria and Buttler (2016) emphasizes another criteria for only small projects. These are as follows:

- **Repeat application of innovative approach.** This can be seen as the implementation of a positive lessons-learned.
- **Prevent adverse work practice.** To prevent an adverse standard procedure or work process.
- **Avoid recurrence of experience.** That an incidental situation outlined in a lessons-learned does not occur in new projects due the application of the lessons-learned.
- **Create awareness** (small projects). To invest time in lessons-learned, it could be enough to get the focal point of lessons-learned on the agenda.

2.1.3. A PERSPECTIVE ON THE LESSONS-LEARNED CYCLE

In this part, the lessons-learned cycle is described to gain some understanding of where lessons-learned come from. In general, according to the literature, the lessons-learned cycle consists of the following four generic activities: capture, verification, storing and dissemination (Weber et. al. 2001; Barney 2011). Although, as identified by Milton (2010), the fifth step should be the reuse of lessons-learned.

To specify, examples of methods used for capturing lessons-learned are project reviews, audits and after-action reviews or sessions (Schindler and Eppler 2003; Stanleigh 2008; Newell, Edelman, Scarborough, & Swan, 2006). These capturing sessions can be held individually or, preferably, within a group setting (Baaz, Holmberg, & Nilsson, 2010; Buttler 2016). A group setting increases credibility and creates wider support. After the lessons-learned are captured, they must be verified to ensure that they are of adequate quality (GAO, 2002). Once verified, the lessons-learned can be directly implemented in new projects or stored in a
central database and disseminated through the knowledge-management system for future application (Newell et. al. 2006). If it is decided that lessons-learned are of value to new projects, projects should reuse the lessons in their strategies and plans and set up a process that can monitor this implementation (Milton, 2010; Zedtwitz, 2002).

It is found that most of the literature focuses on the capturing of lessons-learned and on the organizational dissemination. However, literature does not specify how to effectively reuse lessons-learned.

2.1.3.1. **ALTERNATIVE PROCESS: LESSONS-LEARNED CYCLE BY NATO**

For identifying activities important for lessons-learned reuse, the cycle of NATO (2016) is described. The NATO cycle differs from the general lessons-learned cycle. It recognizes that lessons-learned can be discovered during project execution and that, therefore, potential remedial actions can be taken.

The NATO (2016) consists of three main phases: analysis, remedial action and dissemination (Figure 3). In the analysis phase, the steps of observation and analysis of the situation are executed. Subsequently, if the lessons are identified during the project, there is the possibility for taking remedial action within it. The remedial-action phase consists of three steps: *Endorsement and tasking; Implementation and monitoring; Validation.* To specify, the process step of endorsement and tasking leads to a real commitment. Implementing and monitoring defines the actions that should be carried out. The validation step is to determine the effect and to boost morale. In the final dissemination phase, the lessons-learned are disseminated throughout the organization. It must be noticed that the remedial-action phase includes activities for the application of lessons-learned. Therefore, these can be seen as the direct application of lessons-learned.

![Diagram of the NATO Lessons-Learned Cycle](image)

**Figure 3 lessons-learned cycle (simplified representation of NATO 2016)**

2.1.4. **THE USAGE OF LESSONS-LEARNED**

First, lessons-learned are either used to evoke changes on an organizational level or are used directly in new projects (Buttler, 2016; Milton, 2010). On an organizational level, lessons-learned are used to change procedures, work processes or other structural knowledge assets or to modify employee training (Gibson et al., 2007, Birk, Dingsøyr, & Stalhane, 2002). Consequently, new projects benefit the implementation of these new procedures. This is so-called double-loop learning (Hoekstra, 2006). Furthermore, lessons-learned can be used as inputs for new projects or for so-called single-loop learning (Hoekstra, 2006). For this study double-loop learning is understood as changing how an organization does things (procedures, work processes). Single-loop learning is understood as directly learning from a situation (other projects).

Second, Newell et al. (2006) report that project team members mostly use a central knowledge database after encountering issues that they cannot solve themselves. In other words, they are re-actively solving issues. Buttler (2016) shows that lessons-learned are also used pro-actively.
Third, lessons-learned serve as input for decision-making or problem-solving, including the identification framing (Buttler, 2016). They can be implemented in the FEED phase, the design phase and the implementation phase. In the FEED phase, lessons-learned are used to identify potential issues and/or to increase problem understanding. In the design phase, lessons-learned are used to design a solution, to move from an initial idea to a potential solution, and to adapt or analyse a potential solution. In the implementation phase, lessons-learned are used to implement a solution without modification. Single lessons-learned can be used in more than one phase.

2.2. **SUMMARY**

To conclude, lessons-learned are experiences that can be of value to future projects by; *repeat application of innovative approach; prevent adverse work practice; avoid recurrence of single experience; create awareness (small projects).* Further, the lessons-learned cycle consist of five activities, including capturing, verification, storing, dissemination and reuse. Although, for the fifth activity ‘reuse’ it not specified how to effectively reuse lessons-learned. The NATO remedial phase offers direct application activities that could potentially fill in this gap.
“Know where to find the information and how to use it - that is the secret of success”

Albert Einstein

LITERATURE STUDY: REUSE OF KNOWLEDGE

3.1. FROM THE PERSPECTIVE OF THE INDIVIDUAL KNOWLEDGE RE-USER
   3.1.1. A PERSPECTIVE ON THE REUSE ACTIVITIES
   3.1.2. AN IDENTIFICATION OF INFLUENTIAL ASPECTS
   3.1.3. SYNTHESIS OF LESSONS-LEARNED AND KNOWLEDGE USE

3.2. BEHAVIOURAL CHANGE
   3.2.1. A PERSPECTIVE ON FACTORS THAT INFLUENCE BEHAVIOUR
   3.2.2. CATEGORIZATION ON FACTORS THAT INFLUENCE BEHAVIOURS

3.3. SUMMARY OF THE LITERATURE STUDY
LITERATURE STUDY: REUSE OF KNOWLEDGE

INTRODUCTION
Focus in this study is on the ‘effective’ reuse. This is only possible if project managers truly apply the lessons-learned in new projects. For this reason, this chapter focuses on behaviours shown by project managers in new projects. This means investigating why and how project managers reuse lessons-learned. Further, for this research, both the perspective gained on the context of lessons-learned and the perspective on the project managers are essential. Alignment between these two perspectives contributes to a better underpinned research. Hence, the elaboration of the concepts is guided by the following sub-research question:

What factors influence managers of new projects to reuse lessons-learned?

3.1. FROM THE PERSPECTIVE OF THE KNOWLEDGE RE-USER
This part of the chapter examines process steps for the re-users of lessons-learned. For reference, the concept of lessons-learned belongs to (explicit) knowledge (Gibson et al. 2007; Cacciatori, Tamoschus, & Grabher, 2011) in this chapter. For this reason, this chapter includes activities for knowledge reuse and of aspects that influence these activities.

3.1.1. A PERSPECTIVE ON THE REUSE ACTIVITIES
The reuse of knowledge by an individual starts with his or her intention to reuse learnings from the past (So and Bolloju, 2005). This intention ensures that the knowledge recipient decides to reuse lessons-learned or at least to start the process for knowledge reuse. Markus (2001) defined four sequential activities for the knowledge-reuse process. The first activity is the definition of the search question, or in other words, the determination of what to search for. This is considered crucial to the success of knowledge reuse. The second activity involves the process of searching for expertise. The third activity involves assessment of and selection from the search results. The final (fourth) activity is the re-contextualization of knowledge, or in other words, the application of knowledge. Altogether, the intentions and activities that make up the reuse process (Markus, 2001; Anninos, 2012) are illustrated in Figure 4.

3.1.2. AN IDENTIFICATION OF INFLUENTIAL ASPECTS
The literature identifies key aspects that influence (support/hinder) the reuse activities. However, based on literature review, other activities related to reuse are also found. These are monitoring and performance feedback, however, these activities are not defined in the process by Markus (2001).
So, based on previous studies, aspects that influence these reuse activities are explained. First, the aspects for reuse activities of Markus (2001) are explained. Second, aspects that influence monitoring and performance feedback activities are explained, based on Franco et al. (2005), Milton (2010) and Zyngier (2006). These results are described in the next paragraphs on the basis of the process illustrated in Figure 4 and the new activities of intention; definition; search; asses and select; apply knowledge; monitoring and feedback.
3.1.2.1. **Reuse activity: Intention to reuse**

First, the intentions of an individual can be influenced by the values and norms he/she has concerning knowledge reuse. Negative or positive beliefs about the reuse, or the so-called attitude of the individual concerning knowledge reuse, influences his or her intention to show such behaviour (Markus, 2001).

Second, the perceptions of individuals or teams concerning knowledge reuse facilitates the reuse (So and Bolloju, 2005). So and Bolloju mention that an increased perception of effort required to find and apply lessons-learned influences the intention negatively. Furthermore, perception of the existence of a performance gap can play a role (Majchrzak, Cooper, & Neece, 2004; Markus, 2001). The feeling of limited experience and/or of being bound to time constraints positively influences the intention to engage. Likewise, perceptions of individual project managers or team members concerning required risk reduction in the project supports the decision to engage in knowledge reuse.

Third, trust in the knowledge that resides in the knowledge repositories (Watson and Hewett, 2006) influence the intention. Watson and Hewett (2006) mention that this is a matter of the extent of the recipient’s trust in whether the lessons-learned are correct and timely. In other words, the greater the individual’s belief that the results will repay the effort and time spent, the more likely he or she will reuse lessons-learned.

Fourth, the added value of the (explicit) knowledge is a significant factor. Emphasis is on the personal added value (Watson and Hewett, 2006; Damodaran and Olphert, 2000). In other words, the more clearly the perceived personal value of engaging in the reuse process, the more motivated the individual is to engage in the reuse of knowledge.

Finally, the retentive capacity of the knowledge recipient has an important influence on the intention to reuse (Szulanski, 2000). By retentive capacity is meant the ability of recipients to routinize practices, or in this case, to routinize the practice of reusing lessons-learned (Ajmal, Kekäle, & Takala, 2009; Markus, 2001).

3.1.2.2. **Reuse activities: Definition of the search question and search for expertise**

The definition of the search question depends on the recipient’s ability to know what question to ask. The task of defining the search question is one of the key aspects for the reuse of knowledge (Markus, 2001). It separates the experts from the novices. Furthermore, it depends on the familiarity of the project managers with the knowledge-management system (KMS). The authors (Majchrzak et al., 2004; Watson et al., 2006) suggest that the searching process is easier the more familiar the recipients are with the searching tools. Additionally, they suggested that an increasing motivation is positively dependent on the awareness of knowledge available.

3.1.2.3. **Reuse activities: Assess and select among the search results and apply knowledge**

Values and norms do not merely influence the intentions; they also influence the process of assessing and selecting from among the search results. An important value is the personal openness to examine both direct solutions and indirect analogies from a broad set of knowledge sources to obtain appropriate knowledge (Majchrzak, Neece, and Cooper, 2001).

In the same way, trust is an important factor in both the intention and the assessment of the search results. According to Szulanski (2000) and Ajmal et al. (2009), this is the recipients’ trust in the reliability of the author of the lessons-learned.

Furthermore, it depends on the user’s ability to identify the usefulness of the lessons-learned in assessing and selecting from among the search results (Majchrzak et al. (2001); Chua, Lam, and Majid, 2006). This is the concept of the absorptive capacity of the recipient. It refers to the stickiness of knowledge (Szulanski, 2000). The absorptive capacity is also an important value for the application of knowledge. Further, the ability of an individual to apply lessons-learned is critical.
3.1.2.4. **Reuse activities: Monitoring and performance feedback**

According to Milton (2010), the monitoring and measurement of the used knowledge are imperative to stimulating the awareness of the knowledge user. If monitoring and measurement are absent, then the managers do not know whether the initiatives have been applied and are functioning effectively. Measurement is also indicated by other authors, such as Zyngier et al. (2006). The added value of measurement for project managers is encapsulated in an old adage: “What you can measure, you can manage” (Skyrme, 2011). Further, Orange, Onions, Burke, and Colledge, (2005) mention that the provision of feedback on the performance of the individual or project team can stimulate performance improvement and motivation. A case study by Franco et. al. (2004) concerning the relationship between project-management services and project performance shows that learning from regular performance feedback is imperative to performance improvement (Wong Cheung, & Leung, 2008; Tirado-rives, 2008).

3.1.3. **Synthesis of lessons-learned and knowledge use**

Although the activities described by Markus (2001) and Anninos (2012) are valuable to this study, the list is not yet complete. This means that aspects for the activities monitoring and feedback are missing. Therefore, monitoring and performance feedback should be included into process design. Hence, the synthesis below describes an adapted process for the reuse of lessons-learned by specifying activities for “applying knowledge”

3.1.3.1. **Specifying process steps for “applying knowledge”**

The basis is formed by the process (Chapter 3.1) of Markus (2001) and So and Bolloju (2005), which consists of the following activities: intending; defining; searching for expertise; assessing and selecting; and applying knowledge. This process defines the first activities of the knowledge-reuse process at a sufficient level. However, Markus (2001) does not define in detail what activities the application entails. As is described in the goal description in Chapter 2.1, application means the effective execution and successful completion of the reuse. First, this means that project managers should not only implement but also monitor and evaluate the success. As explained by Orange et.al. (2005), project managers are stimulated by performance feedback. Second, upon finishing the complete reuse process by monitoring and evaluating, it is possible to close the loop between the lessons-learned collection and reuse phases. Therefore, we must redefine the “apply-knowledge” process step of Markus (2001).

To determine what phases to include in the application phase of Markus (2001), it is appropriate to recall the NATO lessons-learned cycle (2016)(Chapter 2.2, figure 3). In this cycle, the remedial actions are seen as the direct application of the lessons-learned. Further exploration shows that the starting point of the application phase in both processes is similar. Ideally, the project managers in new projects that are ready to apply lessons-learned are aware of the former situation, the root cause and the most likely solution. This is comparable to the project managers in previous projects who have just finished the analysis phase of the lessons-learned and who are ready to apply the proposed solution directly in a current project via remedial actions. It should be noted, however, that there is one significant difference: the owner of the lessons-learned differs. In NATO (2016), the owner of the lessons-learned is also the user in the remedial phase. However, in new projects, this ownership changes to new project managers. This influences the project managers trust and belief of knowledge ownership.
3.1.3.2. **MERGING THE ADAPTED LESSONS-LEARNED REUSE PROCESS**

To sum up, the author of this study has adapted the knowledge-reuse activity, “applying knowledge” (Markus, 2001), because it does not specify activities for successful application. Based on literature, it was found that strategy development and monitoring (Milton 2010; Zedtwitz, 2002) and validation (Milton 2010; Orange et al., 2005; Skyrme, 2011; Zygier et al. 2006) should be added to the knowledge reuse process. First, these are equal to the remedial activities in the NATO (2016) process and second, as explained, the remedial actions from NATO (2016) can be seen as the direct application of lessons-learned. Therefore, the remedial action phases from the NATO (2016) process are used to fill in this gap. Consequently, based on the knowledge-reuse activities of Markus (2001) and the activities defined within the remedial-actions phase of NATO (2016), the author has adapted the reuse process of lessons-learned. To specify, the application of knowledge from Markus (2001) (figure 5a) is redefined into three phases from the NATO (2016) (figure 5b): endorsement and tasking; implementation and monitoring; and validation. Figure 5c depicts this adapted process. The execution of the activities defined in the adapted process (figure 6) can be seen as desired behaviour. As defined by Milton (2010), to successfully reuse lessons-learned, it is important that a project manager, together with his or her team, is actively involved in the reuse cycle by finishing all activities. Therefore, the next part describes the behavioural aspects required by the project managers.
3.2. **BEHAVIOURAL CHANGE**

This part of the chapter further investigates the behaviour of individuals. On the basis of the study of behaviour, a framework is examined for categorizing factors that influence project managers in the environmental, individual and motivational dimensions. Or as Einstein introduces:

*One cannot alter a condition with the same mind-set that created it in the first place*

The desired behaviour of project managers is the result of the various factors, as explained in the next section.

### 3.2.1. **A PERSPECTIVE ON FACTORS THAT INFLUENCE BEHAVIOUR**

In broad spectrum, the behaviour of a person is subject to personal and professional factors and psychological processes (Nolting and Paulus, 2011).

Personal factors are comprised of the following psychological concepts:

- **Memories** (e.g., relating to the project from which lessons-learned are collected)
- **Skills and abilities** (e.g., to analyse experiences)
- **Attitudes** (here defined as “a general feeling or evaluation - positive or negative - about some person, object, or issue” (Hogg and Vaughan, 2009)
- **Personality** (Nijstad, 2009; Nolting and Paulus, 2011)
- **Other stable attributes of a person such as gender**

Professional factors comprise the professional expertise of the project managers and their role in an organization. The environment forms the basis in which personal and professional factors are generally formed; however, these can be influenced and therefore changed by direct experiences (Buttler, 2016).

Psychological processes include motivation, emotion and thought processes. The thought processes of project managers can further be explained as comprehension of and reaction to a certain situation at hand (Nolting and Paulus, 2011), decision-making and counterfactual thinking (Kahneman and Tversky, 1982; Morris and Moore, 2000; Roese, 1997). In comparison to personal factors, psychological processes are less stable and, therefore, can be influenced by the situation at hand (Nolting and Paulus, 2011). During the lessons-learned reuse process, the situation at hand will change multiple times. Furthermore, the psychological processes influence each other and are subject to personal and professional factors. For example, the expertise of project managers can influence problem categorization (Chi, Feltovich, & Glaser, 1981) and strategies for problem solving (Larkin McDermott, Simon, & Simon, 1980).

Furthermore, project managers work in collaboration with their teams. In such group contexts, individuals contribute to the communication and interaction of the group. In turn, other group members influence the individuals (Nijstad, 2009). Group interactions can lead to process gains that an individual would never be able to make alone. On the other hand, they can also lead to losses if a group adopts the wrong solutions.

For better understanding of the factors that influence behaviour, they are categorized in the next section.

### 3.2.2. **CATEGORIZATION ON FACTORS THAT INFLUENCE BEHAVIOURS**

In exploring the literature, the following knowledge-sharing framework is described for structuring the factors that influence behaviour. Wang and Noe (2010) defined this framework on the basis of a narrative
review of the literature. The factors in the framework are structured on the basis of environmental, individual and motivational dimensions. The environmental and individual dimensions influence the knowledge sharing behavior both directly and indirectly. The indirect influence is categorized as motivational factors. Figure 7 gives an overview of the dimensions identified in the framework by Wang et al. (2010). The authors indicate that the grey boxes have been examined in the existing literature, and the area surrounded by dotted lines requires further attention.

The framework has certain benefits. It shows the factors of motivation, the individuals and the project environment. It also connects all the important factors and indicates the interrelations of these dimensions. The next paragraphs explain the factors.

![Figure 7 A Framework for identifying influential factors (Wang et al., 2010)](image)

3.2.2.1. ENVIRONMENTAL DIMENSION

The environmental dimension is divided into three sub-areas including organization context, interpersonal and team characteristics, and cultural characteristics (Wang et al. 2010). Each sub-area consists of factors influencing the intention and behaviour.

ORGANIZATIONAL ENVIRONMENT

As identified by Wang et al. (2010), the organizational environment consists of six factors: culture and climate; management support and leadership characteristics; rewards/incentives; organizational structure and context.

Research (Damodaran et al., 2000; Majchrzak et al., 2001) shows that the most motivational factor in the environment for project managers and their teams is a supporting culture. Therefore, management should cultivate a knowledge-reuse culture by transmitting regularly appropriate values and beliefs to the project team members (M. M. Ajmal et al., 2009). According to Chiu, Hsu, and Wang (2006) and Willemad Scarbrough (2006),
the benefits of a culture and climate of trust and a focus on innovation (Bock, Zmud, Kim, and Lee, 2005) are positively associated with knowledge sharing. Further, the perceived commitment of organization’s management and leadership towards knowledge reuse is considered important (Argyris, 1991; Yeung and Holden, 2007). The project managers or top management should, therefore, regularly communicate its commitment and lead by example. This influences the individuals in their decision to engage and positively affects culture and willingness (Connelly and Kelloway, 2003; Lin, 2007d), exchange efforts, and the perceived usefulness of knowledge (Cabrera, Collings, & Salgado, 2006).

Also, it can be argued that the recognition and rewards of reusing lessons-learned encourage engagement (Damodaran et al., 2000). Similarly, communicating business drivers such as client pressure are contributing for creating understanding of the team members. However, the utility of extrinsic rewards is disputed, as they do not always result in the desired behaviour (Wang et al., 2010). Therefore, different types of incentives have different effects: individual and competition-based incentives are less effective than cooperative and group-based incentives for knowledge sharing (Ferrin and Dirks, 2003; Locke and Barol, 2007). Finally, based on the ideas of Jones (2005), it is suggested that the organizational and team structure should create opportunities for employee interactions to occur and that employee rank and seniority should be de-emphasized to facilitate knowledge sharing (Kim and Lee, 2006).

**INTERPERSONAL AND TEAM CHARACTERISTICS**

Traditionally, the structure of project teams differs from that of normal business entities as they do not have a permanently defined structure with well-established working routines that allow individuals to naturally absorb new knowledge (M. M. Ajmal et al., 2009; Liebowitz, 1999). Therefore, the lack of organizational memory should be compensated by the standardization of knowledge reuse at the beginning of projects. Furthermore, interpersonal and team characteristic can be described by the following four factors: team characteristics and processes; social networks; diversity; and team development stage.

As explained by Wang (2010), team characteristics and processes influence knowledge sharing among team members. Positive influences include cohesiveness, team duration, communication styles and empowering leadership (Bakker, Smith, and Leenders, 2006; Sawng, Kim, and Han, 2006; De Vries, van den Hooff, and de Riddler, 2006). In the same way, the strength of personal ties among individuals within social networks facilitates knowledge transfer and quality (Cross and Cummings, 2004). This suggests that the existence of network connections and related social capital can facilitate knowledge sharing (Kankanhalli et al., 2005). Further, a perceived minority of socially-isolated individuals are less likely to share knowledge. Therefore, a better-functioning, diverse team stimulates knowledge sharing (Ojha, 2005; Sawng et al., 2006).

**CULTURAL CHARACTERISTICS**

As explained by Wang et al. (2010), cultural characteristics include collectivism; in-group and out-group; and cross-cultural differences. The authors state that national cultures and languages can pose challenges for knowledge sharing for international organizations (Ford and Chan, 2003; Minbaeva, 2007). Further was found that collectivism and in-group behaviour positively contributes to knowledge sharing (Hwang and Kim, 2007). One’s feeling of collectivism is related with a positive attitude towards using knowledge.

**3.2.2.2. INDIVIDUAL DIMENSION**

According to Wang et al. (2010), an individuals’ intention and motivation for knowledge reuse is based on education; work experience; personality; self-efficacy; evaluation apprehension; impression management; and his or her perceptions.

As explained by Cabrera et al. (2006), the personality of openness to experience is positively related to knowledge reuse. Similarly, Jarvenpaa and Staple (2000) identify education and work experience as influential. Also important is the individual’s comfort level and ability to use computer-based approaches in
a collaborative, electronic, media-sharing setting. In other words, the individual project managers are more likely to reuse lessons-learned if they have had sufficient training and practice (Watson and Hewett, 2006). This is based on the principle that people are less likely to perform a practice that they do not know. In the same way, a low self-efficacy—in other words, the perception of limited skill—is found to stimulate the search of knowledge. On the other side, the confidence that one has a lot of knowledge stimulates knowledge dissemination (Cabrera et al., 2006; Lin, 2007). Furthermore, individuals with a higher level of education and work experience have positive attitudes towards using lessons-learned and are more likely to share their expertise (Cabrera et al., 2006; Lin, 2007). Nevertheless, according to Bordia, Irmer, and Abusah (2006), evaluation apprehension could be a barrier for knowledge reuse. This means that anxiety based on fear of negative evaluations negatively influence knowledge sharing.

3.2.2.3. Motivational dimension

Environmental and individual characteristics influence the motivation of project managers. According to Wang et al. (2010), the motivational dimension includes belief of knowledge ownership; perceived benefits and (social) costs; (team-level) trust, justice and cohesiveness; leader member exchange; and positive attitudes.

As explained by Jarvenpaa et al. (2000), if individuals believe that they rather than the organization own the knowledge, they are more likely to engage in reuse activities due to internal satisfaction. This belief of ownership is stimulated by cultural factors such as solidarity and a need for achievement. Moreover, a perceived high responsibility to execute the lessons-learned within the scope of work stimulates the intention of the individual to engage. Furthermore, Lin (2007) and Hew and Hara (2007) state that individuals evaluate the perceived ratio of benefits to costs and base their actions on the expectation that it will lead to rewards like respect, reputation and tangible incentives. Similarly, project managers or team members are influenced by social pressure to exhibit correct behaviour. The more social pressure the project managers apply, the more people are likely to engage in the reuse of lessons-learned. In computer-based systems, time, unfamiliarity with the subject and a weak trust in peers are perceived as high costs (Hew et al., 2007).

Similarly, interpersonal and team trust and justice stimulates project managers. They have been used as antecedents or mediators (Lin, 2007b). Affect-based and cognition-based trust have a positive influence on teams trust and sharing (Wu et al., 2007). Further, someone is trustworthy based on capability, integrity and benevolence (Bakker et al., 2006). However, unconditional trust in the authors of the knowledge could lead to misapplication or misuse of knowledge (Sondergaard, Kerr, and Clegg, 2007). Finally, individuals need positive attitudes towards expectations of usefulness and perceive possibilities of improving relationships (Bock and Kim, 2002). Additionally, senior managers’ encouragement lead to positive attitudes (Lin and Lee, 2004), job satisfaction and commitment (Lin, 2007).

3.3 Summary

The literature study investigated elements for effective reuse. Based on literature (Milton 2010; Orang et al., 2005), the adapted lessons-learned reuse process specifies the process activity ‘Applying Knowledge’ offered by Markus (2001), into endorsement and tasking; implementation and monitoring; and validation activities offered by the NATO (2016) lessons-learned cycle. The processes would not meet the goal defined, per se, but by adaption of the processes it could.

Furthermore, the factors that influence the behaviour of the project managers contribute to effective reuse. Therefore these factors are the answers to the first sub-research question: What factors influence project managers to effectively reuse lessons-learned in the execution phases of new projects? The factors are categorized in the dimensions defined in the framework by Wang et al. (2010). The framework takes into account the characteristics of the project environment in relation to the intention and behaviour of the individual. This distinction assists in the case study to define underlying trends, as perceived by the project managers.
“Research is to see what everybody else has seen, and to think what nobody else has thought”

Szent-Györgyi

**FLUOR: research methodology**

4.1. ORGANIZATION SELECTION
   4.1.1. INTRODUCTION TO THE ASSESSMENT
   4.1.2. ORGANIZATION SELECTION
   4.1.3. RESEARCH METHODOLOGY
4.1. RESEARCH METHODOLOGY

4.1.1. INTRODUCTION TO THE ASSESSMENT

This chapter elaborates the research methodology for the assessment of lessons-learned in practice. However, a description of the selected organisation is given first. The methodology services the purpose of finding factors and trends that lead to effective reuse.

4.1.2. ORGANIZATION SELECTION

For the data collection, a from origin North American engineering, procurement, and construction management organization named Fluor is selected. Fluor is a project matrix organization with an international reputation that executes mega projects worldwide. The Amsterdam office mainly executes projects for the energy and chemicals industry in Europe, the Middle East, Africa and Russia. Its other business lines include infrastructure, life sciences and advanced manufacturing. In collaboration with various Fluor offices located around the world, Fluor provides the engineering, procurement and construction-management services for operators such as Shell and Exxon in the energy and chemicals industry. For example, an average of 30 percent of the engineering is executed at Fluor Amsterdam, and the other 70 percent in India. To make the collaboration increasingly complex, multiple disciplines within Fluor collaborate from various Fluor locations around the world.

Most employees work on a task-force basis, which means that they work via large, multidisciplinary project teams. Also, the matrix organization has two reporting lines: namely, the departmental manager and the project manager. During the EPC phases, employees are expected to use procedures set by the organization. Eventually, only several project team members will go to the construction site. During the project execution, the experiences gained during the EPCM phases should be shared within the organization. For this process, Fluor uses the lessons-learned cycle, audits and client feedback reports. However, Fluor indicates that they encounter challenges concerning the reuse of lessons-learned in new projects.

4.1.3. RESEARCH METHODOLOGY

The methodology describes the process to assess factors that influence managers in new projects to reuse lessons-learned. First, the research design and second, the study participants are explained. Third, the measurement instruments are described. Fourth, the data-collection process and fifth, the data analysis are explained. Finally, the validation method is described.

4.1.3.1. RESEARCH DESIGN

The oddities of the engineering and construction industry, which are unique compared to other industries, required a qualitative research method (du Toit and Mouton, 2012). Besides, as the reuse of lessons-learned is a relative new topic in the industry, the choice of a qualitative method is supported, as is argued by Amaratunga, Baldry, Sarshar, & Newton (2002). This is further defensible given that the objective of this study is to explore the drivers as perceived by project managers, which entails a rigorous exploration of their intentions. Therefore, as proposed by du Toit et.al. (2012), semi-structured interviews with project managers form the basis of this study: This is considered to be the most effective method for assessing the needs and aspirations of the project managers in a natural context.
4.1.3.2. **Study Participants**
The interviewees selected are Fluor project managers from the Amsterdam office. It is expected that conducting this study within such a context will provide a wealth of knowledge due to the experience and role of these project managers. A “purposive sampling” approach was used to identify interviewees in Fluor who have adequate knowledge of and experience with lessons-learned reuse. Purposive sampling made it possible for the researcher to meet the goals defined by the research aim and to control the level of variation among the interviewees (Bazeley, 2013). Seven project managers were identified with help from the quality department manager at Fluor. Though seven interviews may seem a small sample, the size of the sample in qualitative research is irrelevant because the value of the study is based on the quality of data (Mason, 2010). To identify influencing factors, the project managers selected, deliberately, ranged from those known for showing real motivation in reusing lessons-learned to project managers that only do this if required by the organization. All interviewees were interested in the subject and willing to discuss it as one of their responsibilities. According to Simms and Rogers (2006), implementing such an approach enhances the richness of data due to the commitment of the interviewees.

4.1.3.3. **Measurement Instruments**
The semi-structured interviews were structured on the lessons-learned reuse process (Chapter 3.1). As explained in the literature review, this process consists of seven activities: **intention; definition of the search-question; search for expertise; assessment and selection; endorsement and tasking; implementation and monitoring; and validation.** Questions were derived based on this process and the related factors identified. Therefore, the execution of the interviews follows the logic of the process while addressing all important factors. This setup increases the interviewees’ understanding of the questions, and, as a consequence, it increases the overall speed of the interview and leaves as much time as possible for answering the questions. The comprehensive, semi-structured interview can be found in Appendix B.

The setup of the interview is as follows:
- **CONTEXT:** Background questions (function, age, career, background, international, on-site)
- **INTRO:** General questions (situation, opportunities, challenges, environmental)
- **MAIN:** Process-based questions (intention, definition, search, assessment and selection, monitoring, results)
- **END:** Future use and trends questions

In addition to the interviews, the author attended three sessions of the project management department on sharing lessons-learned. In these sessions, the author took notes and identified the attitudes, the knowledge-sharing culture and the communication in project management group.

4.1.3.4. **Data Collection**
Data collection and analysis were executed in two steps. The first step involved the semi-structured interviews in Fluor and were arranged through a pre-notification email. Each interview lasted approximately one hour and was recorded with the consent of the interviewee. In order to keep the interviewees focused, the study adopted a semi-structured approach. The recordings were written out in electronic documents, and the information in the interviews was handled with confidentiality to ensure that the interviewees could speak freely. The second step involved “data analysis”. Between these two steps, the procedures of “confirmation” and “checking” were undertaken (Ardichvili, Page, & Wentling, 2003).

4.1.3.5. **Data Analysis**
As suggested by Lewins and Silver (2014), in the analysis of interview transcripts, qualitative studies should reflect the manner in which decisions are made about coding themes. Recent studies such as Bazeley (2013) recommend to focus on comparison with and contrast to a theoretical foundation. This approach directs the current study to use “a priori codes” to code the interview transcripts. Implementing such a technique safeguards the link between the research questions and the data while producing fresh ideas (Bazeley, 2013).
The list of *a priori* codes for this study was based on factors that were previously identified in the literature-review section and shown in Framework ‘identifying influential factors’ (Chapter 3.2, Figure 7). This framework classifies the factors into the following three dimensions: environmental, individual and motivational.

Next, it is the task of the researcher to systematically analyse the results (Bazeley and Jackson, 2013). For this reason, to analyse the interview transcripts, the approach by Dransfield, Morrot, Martin, & Ngapo (2004) is used. This process involves two steps: first, coding and categorization of the interview transcripts into the *priori codes* in the qualitative data software Atlas.ti. Atlas.ti (version 7) software enhances the rigour of qualitative data analysis (Lewins et al., 2014; Bazeley, 2013). Second, running word-frequency tests in that same order on the codes. As explained by Ryan and Bernard (2003), using the frequency of words is the most efficient way to discover concepts and themes that are embedded in the interviews. So, it will identify the factors perceived as most relevant by the project managers.

Finally, reflecting on the factors that were found to be conceptually similar in the characteristics or interrelated in meaning were grouped under more abstract clusters. (Marle and Videl, 2011)

4.1.1.4. **Validation**

It was decided to select Fluor project managers who were not involved in the assessment of the current situation to evaluate the recommendations. This contributes to the aim of an objective evaluation. Further, the evaluators had to meet the following two requirements: he or she must be knowledgeable about the current lessons-learned process, and he or she must have acted previously as a project manager. Based on these requirements, the head of the project management department and a senior project manager at Fluor were selected as evaluators. The choice of the project management department head implies that he is not only knowledgeable about the current reuse of lessons-learned, but that he also has increased responsibility for the success of it. The evaluative discussion ensures more commitment from the top project management to reuse lessons-learned (De Bruijn, Ten Heuvelhof, 2010), and it therefore gives more practical value to the research.

With regard to the evaluation method, a semi-structured discussion was chosen. The discussion was set up to evaluate the recommendations on the principles of “efficacy, quality and usability” (Hevner et al., 2004). To be more specific, the semi-structured evaluative discussion comprised a presentation of the draft “success criteria” framework (figure 18) and the recommendations in the form of key steps and actions to effectively reuse lessons-learned (figure 19). Between each phase within the process, a discussion was held for each reuse activity. The efficacy is sufficient if it stimulates project managers (and their project team) to effectively reuse lessons-learned. Quality is expressed in the thoroughness of the recommendations and in the amount it contributes to the goal. The usability is sufficient if the actions within the framework can be executed relatively easily within Fluor. The alterations were incorporated into the final recommendations. The discussion took place in the Fluor premises in Hoofddorp on the 21st of March 2017 and lasted approximately one hour.
Chapter 5

“That will never happen to me..”
Project manager Fluor, 2016

Fluor: Assessment of the current situation

5.1. Fluor: Assessment of the current situation
   5.1.1. Introduction
   5.1.2. Desk research: context
   5.1.3. Interview results

5.2. Summary
5.1. **Fluor: Assessment of the Current Situation**

5.1.1. **Introduction**

This chapter presents the results of the current situation in Fluor. The results offer insight into the intentions and behaviour of the project managers. This will help to define factors and trends for effective reuse of lessons-learned. The research question that guides this assessment is the following:

*What factors and underlying trends influence the behaviour of Fluor project managers in the current reuse of lessons-learned?*

In order to provide a well-substantiated answer to this question, the first part of this chapter explains the current lessons-learned cycle. In what follows, the results of the interviews are provided.

5.1.2. **Desk Research: Context**

The description of the lessons-learned cycle within Fluor includes activities for capturing, verification, storage, dissemination and reuse. Furthermore, a description is given on current developments that are related to this research.

5.1.2.4. **Capturing Process**

The lessons-learned in Fluor are documented in a common team session at the end of the various project phases (FEED, Engineering and Construction). The project team collects the lessons and discusses causes and recommendations for improvement. From the key lessons, root cause analyses are identified in small teams. Afterwards, the project quality manager captures all lessons-learned in an electronic document. The document describes the situation at hand, the root cause, and the recommended solution. In addition to the common team sessions, lessons-learned are also supposed to be captured during the project execution.

Information to be captured includes the following:

- Problem / event description / results of innovative approach
- Why did it happen? (Apparent / contributing causes)
- Solution / action taken
- Cost / schedule / quality / health, safety and environmental (HSE) impacts
- Actions taken to develop long-term solution
- Suggestion for updating knowledge (practices, specifications, etc.)
- Responsible key persons familiar with the lesson

5.1.2.5. **Storing, Verification and Dissemination**

The electronic documents are submitted to the quality department manager for verification of the type of lessons-learned and the quality level. The quality department manager determines whether it is a lessons-learned; therefore, an existing procedure must be updated, or a project experience. Furthermore, it is determined whether any patterns can be identified that require systemic changes. The difference between lessons-learned and project experiences is that project experiences are seen as incidental and as not requiring a change in the procedures. The lessons-learned are seen as a crucial update to the existing work processes and entail a change of the Fluor operating system (procedures or systems). The differentiation between lessons-learned and project experiences is only a year ago introduced within the organization Fluor (Appendix C). Consequently, the project experience database is still developing and completely new for the project managers. However, project managers are familiar with the (old) concept of lessons-learned.
Therefore, to reduce the effect of this internal dynamic there has been chosen to define lessons-learned and project experiences as equal and all called lessons-learned. After the quality review, the office quality manager uploads the lessons-learned to the global knowledge database called Connections. When uploaded, the lessons-learned are reviewed by a global review team, and, if selected they are shared in a “project experience community” and made available to all employees within Fluor. In case a lessons-learned document requires an update of the Fluor operating system, the lessons-learned will be shared with the relevant key process owner (KPO), who will update the relevant procedure(s) or system. Users are expected to read the documents in the online communities. The project-experience work process is documented in a mandatory practice. When the practice was updated recently, the updates were shared with all employees in the organization via townhalls, department presentations and webinars.

5.1.2.6. Reuse Process

Ideally, at the start of a project, the project manager will request that the project quality manager or any other representative(s) of the project team to collect lessons-learned from the global database. During a kick-off session with the project leadership team, the first assessment and selection of the lessons-learned is executed. As a result of the meeting, the selected lessons-learned are assigned to an individual team member to integrate into the project-execution baseline or project work processes. The project manager, often with the support of the project quality manager, is supposed to monitor the implementation of lessons-learned in the project execution. However, it is indicated that this process is not effective yet.

5.1.2.7. Current developments within Fluor

Currently, Fluor is focusing on so-called “continuous collecting” to facilitate faster and better reactions to information. Furthermore, they like to focus on the “on-time delivery” of lessons-learned in the application of lessons-learned. However, first results of small pilots encounter reduced benefits. Apparently, team members still do not want to focus on applying lessons-learned. Therefore, it is suggested that a real change in intention and behaviour is needed.

5.1.3. Interview Results

As explained in the methodology, interviews were conducted to examine the underlying factors for intention and behaviour. Therefore, the interview results examined the environmental, individual and motivational dimensions influencing the intention and behaviour (framework for identifying influential factors (Chapter 3.2, Figure 7)). As a consequence, by distinguishing any “environmental” or “individual” factors for project managers that make the difference in stimulating project managers to effectively implement lessons-learned, the results of the qualitative data analysis can yield interesting views of the most important motivational concepts. An extensive elaboration of the results can be found in Appendix D.

Results: Environmental versus Individual Dimension

The first results are based on comparing the frequency of coded factors for the environmental (external motivation) and individual (internal motivation) dimensions that influence the motivation. These first results indicate that the environmental factors have, in general, a slightly higher impact: they influence around 60/40 percent of the motivation of project managers (figure 8). A second result is that the variance between project managers related to the reuse of lessons-learned is negligible in all situations.

![Figure 8 Ratio environmental versus individual dimension](image)
5.1.3.4. RESULTS IN THE ENVIRONMENTAL DIMENSION

This part examines the results for the environmental dimensions. First, an examination of the sub-area of organizational environment. Second, a consideration of the interpersonal and team characteristics. Third, an examination of the cultural characteristics.

**ORGANIZATIONAL ENVIRONMENT**

Within the organizational environment, a total of nine factors were mentioned (Figure 9). Of these nine factors, the context was mentioned the most (grounded 14 times). To specify, project managers prefer face-to-face and continuous communication in the form of a constructive dialogue. This context should allow a discussion for nuance, consensus and background information. As a result of these requirements, the project managers prefer to search and communicate via the team or social network (grounded 8 times); other forms of context, such as ICT and procedures, were mentioned less often (grounded 4 and 3 times, respectively).

To illustrate why project managers are not eager to use procedures, one of the project managers said:

"The problem with, for example, the project management procedure is that it is 1100 pages. You're not going to address this every time. Therefore, just an update is not sufficient."

In addition, most project managers are not familiar with the systems. But they nevertheless say that it is valuable to examine a broad set of knowledge sources such that a potential issue is not overlooked. Therefore, the central system could benefit project managers especially at the beginning of the project. As the project progresses, their focus shifts completely toward the social network. In the words of a project manager:

"The central system works especially early in the project. At that moment you create something, but once you are engaged in the project and you feel that it is known within your team or network, you're going to call first."

Furthermore, the incentives—including the rewards, recognition and accountability—are mentioned many times (grounded 12 times). On the one hand, project managers (would like to) see the gains of lessons back in the project result indicators. On the other hand, they do not monitor and assess the lessons-learned, which makes it impossible to identify the effect. The positive effects of lessons-learned are therefore not fully recognized and are consequently not a priority. Further, several project managers stress external factors such as client recognition and incentives for personal, team and relation development.

Further, in the perception of some project managers, there is no knowledge-sharing culture (grounded 11 times) between the project managers. For example, one of the project managers said the following:

“I know something what you don’t know, but I am not eager to share that’ or ‘people are hesitant to ask questions’.”

Furthermore, it was mentioned that giving informal recognition and compliments are not a common practice within the organization.
While this is the case, many project managers indicated that the management support (grounded 6 times) accelerates the teams and their motivation. Though they currently perceive management support, the project managers indicated there is a lack of enforcement in action and control mechanisms. Finally, some project managers’ indicated that good leadership leads the team to recognize the importance of knowledge-sharing culture. However, it must include that severe negative feedback and assigning consequences could negatively influence the motivation.

**INTERPERSONAL AND TEAM CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Name</th>
<th>Grounded</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITC: Process/ characteristics: Role responsibility &amp; team consensus &amp; team effort</td>
<td>16</td>
</tr>
<tr>
<td>ITC: Process/ characteristics: communication of lesson learned</td>
<td>15</td>
</tr>
<tr>
<td>ITC: Social networks</td>
<td>9</td>
</tr>
<tr>
<td>ITC: Team development stage</td>
<td>8</td>
</tr>
<tr>
<td>ITC: Diversity</td>
<td>3</td>
</tr>
</tbody>
</table>

*Figure 10: factors of the interpersonal and team characteristics*

Based on the ideas of the project managers, five factors were identified for interpersonal and team characteristics (Figure 10). Of these five factors, role responsibility, team consensus, and effort were mentioned most often (grounded 16 times). Notice that almost all project managers assign responsibility to the individual for applying lessons-learned. However, this contradicts their perception that the reuse of lessons-learned should be a team effort and a team consensus. The following reasons were given by the project managers for creating team consensus and effort:

- Most mistakes are made because of an individual’s mistake.
- Personal bias influences the problem-understanding and the solution development.
- Team politics and trust influences the ability to get lessons-learned on the agenda
- Team consensus and effort must be created to prevent future problems in the execution of lessons-learned by different disciplines, phases and layers.

To illustrate, a project manager described the need for consensus in the reuse by the following:

"You notice that there is sometimes resistance against the reuse of lessons-learned. This resistance is not always well-founded and based on security for their responsibilities, on assumptions and fear to try something new. Thus, there is a tension to the reuse of lessons-learned. For this reason, there is a mix of views needed, before you come to a decision, and this mix is important”

Furthermore, constructive and continuous communication (grounded 15 times) is an effective way to align the intended results, to create trust and consensus, and finally to stimulate the comprehension. One project manager said the following:

"If you improve communication than the team works so much better. Too many people think that documents are communication and this is a fundamental problem, also for lessons-learned”

In the same way, due to the absence of a threshold and high trust in the quality of the knowledge and the person, all project managers start the search question for lessons-learned with people in the social network (grounded 9 times) with whom they have strong ties.

Another interesting point to take account of is the team-development stage (grounded 8 times). Although this is a demanding and challenging phase, it is described by multiple project managers as an opportunity to infuse lessons-learned. This is because the project team and the project plans have not yet been settled.
Finally, the diversity of project teams (grounded 3 times) is mentioned by only a few. In their perception, a diverse project team will help to overcome the issue that one discipline is overshadowing the others.

**Cultural characteristics**

According to multiple project managers (Figure 11), a real knowledge-sharing culture (grounded 11 times) and cultural collectivism (grounded 4 times) is hard to achieve in Fluor due to the individual based incentives in Fluor. Though, at organization level they are committed to increase knowledge sharing. For example, there are multitude of knowledge sharing activities that serve employee interaction. However, this has not yet found its way to the individual level. For example, one of the project managers said the following:

“I share my ideas and I am always open to other ideas of project managers. Please, complete it and say what I’m doing wrong. But I have, unfortunately, seldom experienced that I got something back.”

These results are supported by observation of the project-management meetings. In these meetings, notable interest was exhibited by the group of project managers, although the meetings were somewhat intense and could not be identified as a constructive discussion. More one person presented, and the others challenged the presented information. The group is made up of individuals with strong personalities and a lot of experience who are not afraid of confrontation. Finally, the project managers perceive in-group behaviour within the disciplines but perceive room for interdisciplinary improvement.

**Results for the individual dimension**

Based on the ideas of the project managers, a total of eight personal factors have been defined (Figure 12). Most project managers perceive self-efficacy (grounded 18 times) as a reason to search for lessons-learned. Preferably, a low self-efficacy on the project task and high self-efficacy on the procedures and systems. Therefore, they also mention that they were eager to search for lessons-learned in the database because they perceived it to be difficult. In the words of a project manager,

“I’m not a computer enthusiast, who is going to find lessons-learned on connections (database) in the evening!”

Nevertheless, many project managers experienced that certain types of work (grounded 17 times)—such as working on-site, extensive functional exposure and client encounters—lead to an increased comprehension for reuse. It is indicated that working on site, gives the project managers an understanding of the issues on construction site, but, which are caused in engineering. For example, in the words of one the project managers,

‘Most people are focussed on the engineering design and do not have sufficient notion of the real finish and issues in construction (understanding).’
In the same way, the project managers’ education (grounded 13 times) is a way to become familiar with the lessons-learned processes, procedures, systems, project team and themselves. However, currently, the project managers have limited experience with the systems and lessons-learned database. They believe that it is too much effort, that there are too many lessons-learned and that they cannot find the right lessons-learned.

Furthermore, the project managers defined four personalities. In order of most mentioned, the personalities are as follows: result driven; open; confident and persevering (respectively grounded 11, 7 and 3 times). Most project managers stressed that these characteristics develop positively with increased experience.

5.1.3.6. RESULTS IN THE MOTIVATIONAL DIMENSION

RESULTS ON PERCEIVED BENEFITS AND COSTS
The project managers identified a total of 14 significant factors (Figure 13). The project managers perceived most benefit for the project results. These were mentioned two or three times as often as the other perceived benefits for the team (personal) development and client satisfaction (grounded 8 and 3 times).

The following benefits are defined by the project managers:
- Prevent issues during execution to facilitate a smoother process
- Use the lessons-learned as point of attention
- Mostly easy to execute

And the following perceived costs are mentioned
- Result show up late or not at all
- Difficult to identify the effect of lessons-learned in the project results.
- Initial effort in the already challenging team-development phase
- Extensive effort for communication and persuasion of other team members
- Risk/fear of losing time and effort due to failed reuse intention

It should be noticed that some truly motivated project managers perceived personal and team development as crucial (grounded 8 times). Therefore, they differ from other project managers in identifying areas for improvement for the team and the individual. Further, the degree to which project managers can identify the effect of lessons-learned depends on understanding of the process, importance and results. For this reason, they specifically mentioned that this degree is increased by work-site experience and client encounters. For example, the importance of client encounter in the words of one the project managers,

‘Most people do not have to take responsibility for the issues that arise (client encounter)’
RESULTS ON ATTITUDES
Most project managers desire three attitudes—comprehension (grounded 13 times), feeling responsibility (grounded 13 times), and commitment (grounded 6 times). Crucial to the success of lessons-learned reuse, is the stimulation of comprehension on (importance of) the intended results in the early phases. Due to the comprehension, the project managers know what to search for and where to search. Or as one of the project managers said,

“For modular design was it relatively easy to find the lessons-learned, since I could just search on modular design (question easy to define) and because I could easily approach colleagues who have done it (so I knew where was the knowledge).”

In the same way, most project managers feel responsibility on basis of their perceived scope of work, job duration, perceived management support and feedback, and client satisfaction. Finally, a genuine commitment is created by focus on a reduced number of lessons-learned, constructive communication, and (visually) sharing the lessons-learned on the (in)formal agenda.

BELIEF OF KNOWLEDGE OWNERSHIP
Multiple project managers perceive that an increased feeling of knowledge ownership (grounded 9 times) positively influences intention, implementation and results. Specifically, a feeling of reduced knowledge ownership over someone else’s lessons-learned in comparison to one’s own lessons-learned negatively influences intention. Or in the words of the project managers,

“When, unconsciously, someone’s own lessons-learned play a major role than they might push others away.”

In the implementation phase, the belief of knowledge ownership on lessons-learned reuse is linked to their performance and responsible duration. This means that they are held accountable or that success is celebrated. Furthermore, all project managers indicate that they can only focus on three to five lessons-learned each.

TRUST, COHESIVENESS AND CREDITS
Several project managers stressed the importance of a cohesive team with a high level of team-level trust. This trust helps to overcome interpersonal trust barriers. Although team-level trust and cohesiveness is hard to measure, it is perceived as a vital part of their job description. Furthermore, trust is based on reputation, on the capability of the authors and on the identified usability of the lessons-learned. In addition, all project managers mention that direct interaction with author of the lessons-learned document stimulates trust. The systems lack this possibility for interaction and, therefore, they have a low trust in the central database. In the words of a project manager,

“For decades we have filled systems, but it is not effective yet”.

KNOWLEDGE SHARING INTENTION AND BEHAVIOUR

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Grounded</th>
</tr>
</thead>
<tbody>
<tr>
<td>strategy development</td>
<td>11</td>
</tr>
<tr>
<td>routines and habits</td>
<td>4</td>
</tr>
<tr>
<td>active monitoring</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 14 factors on knowledge sharing intention and behaviour

The results (Figure 14) show factors of the intention and the behaviour. To specify, behaviours that correspond with the reuse of lessons-learned are strategy development, avoiding routines and habits, active monitoring.
and decision-making. According to several project managers, the goal of strategy development is to successfully reuse. Specifically, they mention the following success criteria:

- Stimulate the comprehension
- Create an early alignment,
- Establish constructive and continuous communication
- Create sufficient support in decision-making
- Reduce number of lessons-learned (commitment)
- Deal with task uncertainties
- Take account for falling back in routines (people)
- Use active monitoring and feedback

It became apparent that falling back in routines and habits was an important reason for strategy development. On the one hand, routines are valuable to effortlessly execute most tasks and therefore provides opportunity for infusing lessons-learned. On the other hand, routines are the reason for obstructive behaviour in the lessons-learned reuse process. They also said that to change routines a lot of effort is needed. Based on these arguments, it can be argued that lessons-learned reuse should be routinized. This can best be illustrated by the following quote:

“I think I'm inclined to do things on the automatic pilot in the old way.”

5.2. Summary

The results of the interviews show that around 60 percent of motivation is due to environmental factors and that around 40 percent is due to individual factors. Subsequently, within the sub-area of organizational environment, it was found that the context, recognition and culture are major contributors. Examination of interpersonal and team characteristics revealed the importance of communication, responsibility, team consensus and effort. The cultural characteristics indicate that knowledge-sharing culture and collectivism are challenging factors within the group of project managers. The analysis of the individual dimension shows that the perception of reduced self-efficacy, work-on-site experience and education are motivating. In addition, personality traits like being result-driven, open, confident and persevering are identified as supreme. Further, the motivation of project managers is mainly the result of perceived benefits for project results. Although, several project managers also focus on personal and team gain. Other important factors are trust, belief of knowledge ownership and attitudes of comprehension, commitment and feeling responsibility. Finally, the intentions and behaviour include strategy development, active monitoring and decision-making. Although indicated as valuable for efficiently executing normal day-to-day tasks, the routines of the individual were identified as behavioural barriers to reusing lessons-learned. The above identified factors are key to effectively reusing lessons-learned. Or as one of the project managers said about the issue:

“I think it's because lessons-learned reuse is people's work.”
“Insanity is doing the same thing, over and over again, but expecting different results”

Albert Einstein

DISCUSSION

6.1. DISCUSSION
   6.1.1. INTRODUCTION
   6.1.2. CLUSTERING OF RELATED RESULTS
   6.1.3. DISCUSSION OF THE CLUSTERS OF RESULTS
   6.1.4. PERSPECTIVE OF TRENDS
   6.1.5. BEHAVIOURAL REUSE FACTORS FRAMEWORK
6.1. DISCUSSION

6.1.1. INTRODUCTION

In order to find underlying factors and trends for effective lessons-learned reuse, this discussion is structured in four parts. First, the factors from the results are clustered and visualized in a factor-identification model to show the impact. Second, the clusters are discussed and, third, a perspective on trends is elaborated. Finally, a framework of “success criteria” is presented that takes the behavioural factors into account in relation with the lessons-learned reuse process. This framework forms the basis for developing recommendations for the effective lessons-learned reuse.

6.1.2. CLUSTERING OF RELATED RESULTS

To identify the trends, the factors are grouped into the most important clusters. 19 clusters are defined within the dimensions environmental (7), individual (4), motivational (4), and intention and behaviour (4). The clustering is based on the results of the assessment (Chapter 5), and the interrelated factors or factors similar in characteristics are clustered together. To specify, in the environmental dimension the management support and leadership; as well as culture and incentives; and team development stage and diversity are clustered. For the individual dimension, the personalities, as well as experience and education are clustered. For the motivational dimension, justice, social costs and interpersonal- and team- level trust are clustered. The clusters are presented in Figure 15. The size of the circles is related to the importance of the cluster relative to the other clusters. The structure is equal to the framework for identifying influential factors, as defined in Chapter 3.2 (Figure 7). Furthermore, the underlying excel chart can be found in the Appendix E.

6.1.3. DISCUSSION OF THE CLUSTERS OF RESULTS

To understand the characteristics of the different dimensions, the clusters of results will be discussed. The individual dimension is discussed first and, afterwards, the environmental dimension.

6.1.1.1. DISCUSSION INDIVIDUAL DIMENSION

According to the project managers, experience and education is the most important underlying cluster that shapes the basis for the motivation. Hence, without experience on site, extensive functional exposure, client encounters, and proper training, a project manager will never show the right behaviour for reusing lessons-learned. Furthermore, personalities are also indicated to be quite important foundations, but less so, as they

![Figure 15 factor-identification model](image-url)
are also partly perceived as a consequence of experiences and education. As one of the project managers described it,

_Without seeing the working site it is almost impossible to be result-driven and open to certain lessons-learned._

In essence, personalities and the experiences are a major influence on the perception of self-efficacy. It is argued that it is essential that the project managers have an accurate self-image. However, as explained by the quality department, the trainings within Fluor are not focused on a better self-image. Further, a low self-efficacy in executing a project task is seen as a driver to start searching for lessons-learned. This outcome supports the findings of Cabrera et al. (2006). However, in addition, all project managers claimed that the individual should also have high self-efficacy for handling the systems and processes to start exploring for lessons-learned. However, most researchers in literature have hitherto ignored this phenomenon. To conclude, the three findings suggest that an individual is more inclined to focus on something that he/she knows and is aware of.

Only one project manager mentioned evaluation apprehension, though it is indicated in the literature as negatively influence factor (Bordia et.al. 2006). This could be because project managers do not yet relate the reuse of lessons-learned with evaluation, as this is not current practice within Fluor.

The summary that follows is from the above-mentioned clusters:

<table>
<thead>
<tr>
<th>Experience and education</th>
<th>The underlying basis for self-efficacy and attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalities</td>
<td>Partly stimulated (and deliverables of) by the experience and education</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>An accurate self-image</td>
</tr>
<tr>
<td></td>
<td>Result of experience, education, and personalities</td>
</tr>
<tr>
<td></td>
<td>Low SE on project task, High SE on LL systems and processes</td>
</tr>
<tr>
<td>Evaluation apprehension</td>
<td>Not yet connected by project managers with LL process</td>
</tr>
</tbody>
</table>

6.1.1.2. DISCUSSION ENVIRONMENTAL DIMENSION

ORGANIZATIONAL ENVIRONMENT

Based on the findings, the cluster of context is indicated as crucial for influencing project managers’ intentions and for the searching and assessing of lessons-learned. Most project managers indicate that transferring knowledge via document (lessons-learned) is a struggle concerning the context, the possibilities for interaction and the trust in the author. Hence, all project managers prefer face-to-face and continuous communication in a constructive dialogue. This finding is in line with the finding that almost all project managers use an inside-out approach, starting with the team/social network for searching of lessons-learned. Furthermore, it was found that project managers are willing to use the system in the beginning of the project, but as the project progresses, they shift to a social network. From this it can be concluded that project managers are willing to use the central system to pro-actively solve issues, and that, when they encounter issues, they prefer the social network. Notwithstanding, most project managers are potentially willing to use the documents and system in a supporting role, which is different from the current central role of the system. At the moment, however, the trust in the central system is low. This is problematic as the literature indicates that a low trust in the system is one of the barriers to knowledge reuse (Hew et.al., 2007). For this reason, it is suggested to increase trust in the lessons-learned database, with respect to interaction, traceability, feedback and transparency, and that project managers familiarize themselves with the process and the system.

Furthermore, several project managers strongly emphasize the lack of a knowledge-sharing culture and the corresponding lack of recognition and incentives. First, they do not perceive real incentives to take ownership. This is because the results of lessons-learned are not monitored and recognized, though these
are identified in the literature as important motivational factors by Milton (2010) and Wong et al. (2008). Second, they do not perceive stimulation of inter-personal sharing, which is in line with the perception that knowledge is power. To effectively influence the knowledge-sharing culture and to give proper incentives and recognition, the project managers indicated that good leadership and management support accelerates reuse. As also described in a literature study by Zygier et. al (2006), the role of the project managers is therefore crucial. They should lead by example, supporting the team instead of the enforcement of procedures, and setting strategy, vision and identifying bottlenecks. Figure 16 illustrates how these current issues are perceived by the project managers.

Furthermore, several project managers indicated client recognition and incentives for personal, team and relation development as important external factors. Therefore, as suggested by Damodaran et. al. (2000), the client’s pressure should be clearly communicated.

The concepts can be summarized as follows:
- Face-to-face and continuous communication in a constructive dialogue
- Inside-out approach by team / social network
- Supporting role for the systems
- Trust in and familiarity with systems
- Result driven and interpersonal sharing incentives
- Monitoring and recognition mechanism
- Leadership and management support

**INTERPERSONAL AND TEAM CHARACTERISTICS**

Based on the ideas of the project managers, the role of communication and social networks is emphasized as crucial facilitators of the reuse of lessons-learned. Specifically, communication is seen as a way to align the intended results, to increase comprehension and to create a consensus. According to several project managers, communication should be continuous to keep topics on the agenda in the informal circuit. In the same way, most project managers rely on social networks with people with whom they have strong ties. This type of communication via social networks is due to ease (no threshold), interaction and trust in quality. The importance of these social networks is in line with the research of Kankanahalli et al. (2005). The results also show that communication within the team is important to stimulate peer pressure, as also described by Wang et.al. (2010).

Another crucial factor is the misalignment indicated in responsibilities and team effort. Specifically, the majority of project managers clearly define the responsibility to the individual project manager, engineer, or lead. However, an individual will often not be able to get lessons-learned on the agenda. Furthermore, they mention that it should be a multi-discipline wide consensus early in the project, to overcome personal bias,
and to prevent issues in later stages. Likewise, most mistakes in the execution of lessons-learned are assignable to individual actions. Therefore, to increase the feasibility of the reuse, it is suggested by most project managers that it should be a team consensus and effort to create a critical mass. This phenomenon is currently not emphasized in the literature.

Furthermore, numerous project managers identified the team-development phase as a demanding and challenging period. However, because not everything is settled yet, this is also the period to infuse lessons-learned. In addition, multiple stakeholders are involved in the various phases during the reuse process of lessons-learned. Often, these involvements lead to diffusion in task responsibility, dependency and alignment. Also, although less recognized issue, is the dominance of one discipline/type of character over the others. Therefore, to stimulate a wide field of view, it is preferable to have diversity in the team and in the assessment and selection of lessons-learned, as is also pointed out by Sawng et al. (2006).

The findings of these clusters can be summarized as follows:

- Communication within social networks (strong ties, trust, threshold, peer pressure)
- Effort and consensus of the team / reduces bias, mistakes and increases feasibility
- Challenging team development phase, but potential for lessons-learned.
- Diversity in teams / reduce dominance of the majority
- Align intended results, responsibilities and dependencies

**6.1.4. PERSPECTIVE OF TRENDS**

Based on most important clusters in previous paragraphs, the major underlying trends are discussed. The following six trends are identified: stimulate the comprehension; facilitate constructive continuous communication; create a critical mass; define responsibility; develop strategy; and active monitoring and feedback.

**6.1.1.3. INGREDIENTS FOR COMPREHENSION**

The understanding attitudes of project managers are key to the reuse of lessons-learned. Do the project managers understand why the reuse of lessons-learned is important and what its impact is? Or as Albert Einstein quoted:

“Insanity is doing the same thing, over and over again, but expecting different results”

First, as explained by Nolting et al. (2011), these thought processes of individual project managers are influenced by professional and personal factors. This study finds that the comprehension is fundamentally an effect of professional factors of work experience and of the education and personal factors of specific personalities and accurate self-efficacy. Second, Nijstad (2009) and Kankanhalli et al. (2005) indicated that recognition, interactive context and knowledge sharing culture within the team or organization stimulate individuals. These concepts underlying the comprehension are elaborated in the following paragraphs. The relations are visualized in Figure 17.

![Figure 17 Concepts underlying the comprehension](image)
THE DYNAMICS OF WORK EXPERIENCE

The types of experience that increase comprehension are working on site, functional exposure, and client encounters. To specify, working on site and client encounters provide project managers with the ability to understand the impact of lessons-learned, because the project managers have seen the effect of implementation. This enables managers to be result-driven. This means that they have the ability to foresee the intended results and to achieve these results.

Furthermore, it was argued by several project managers that functional exposure ensures that the project managers have sufficient understanding and an ability to easily perform the routine tasks. On the one hand, current leaders are not sufficiently experienced in the field of project management. They explain that, in the development of the new leaders, the employees are assigned to job rotations. In these years, the future leads and project managers learn the essentials of the job, but when the individual has deep understanding to improve the process/project with lessons-learned, they are assigned to a new job function or a bigger project. So, it is difficult to achieve a balance between (fast) learning for future leaders and a deep understanding of the job description and its pitfalls. On the other hand, other project managers indicate the opposite by arguing that, if project managers/future leaders are at a job function too long, they can become stuck in their habits and routines and reluctant to change when necessary. Despite the fact that a behavioural change is crucial for effective lessons-learned reuse (Milton, 2010). This balance between new fresh energy, and experienced project managers is something that should be taken into account in the environmental part. As it is impossible to have both characteristics, it is suggested that people start working together. To sum up, it is beneficial for the development of project managers to go to the site, to work with the client and to create a diverse team.

THE EFFECT OF EDUCATION

It is perceived from the results that the project managers do not have experience/training with the central database system in Fluor, and that there is no formal process defined for reusing lessons-learned. Based on the ideas of Jarvenpaa et.al. (2000), it was found in the literature that the individuals’ comfort with and ability to use computer-based approaches influences knowledge use. Therefore, to stimulate comfort level and to improve the ability of the individuals, Fluor should invest in a mentoring approach toward new-systems implementation.

Underlying these findings is the fact that, in Fluor, it is expected that changing/updating a work practice, procedure, lessons-learned, or any other document is sufficient to transfer knowledge. However, this is not the case for documents used in projects, which is characterized by uniqueness with high time pressure and an overload of paperwork. Consequently, the group of project managers all apply a variety of work practices for the same task or situation. Therefore, it is suggested that, with every change in the organization, the management plan should be set up to ensure behavioural change. Thus, a vast effort should be made by the organization to ensure effective use, especially if, in the perception of the project managers, the work practice or manner they apply is already sufficient. For the implementation of most lessons-learned the change is mostly less significant and is therefore often ignored; this makes the issue not less valid. This means that the reuse of lessons-learned denotes a behavioural change, and that to effectively implement lessons-learned, extra attention should be planned to the prevention of potential behavioural hiccups. Further, it was found that perception of own education in comparison to peers is reason to be open for other solutions. To sum up, the project managers’ education provides them with the ability to work with the systems and the process. A mentoring approach should help overcome behavioural hiccups. Furthermore, the perception of the education of the project managers relative to that of their peers influences their openness.
THE CONCEPT OF SELF-EFFICACY

For a proper understanding for reusing lessons-learned, an individual’s self-efficacy should be accurate. First, an accurate self-efficacy at certain project tasks is crucial. If the project managers are doubtful that they can execute a project task in a sufficient way, they have more intention to search for other solutions and vice versa. This part of self-efficacy is also mentioned in the literature (Cabrera et al., 2006; Lin, 2007); however, most researchers ignore the second part of self-efficacy.

Second, an accurate or high self-efficacy with respect to the systems and processes that correspond with the reuse of lessons-learned is essential. This is explained by the fact that the project managers should have the feeling that the lessons-learned process is in their fundamental understanding and routines. In demanding periods, such as during project start-up, they fall back on these routines. The changes of routines are especially challenging. These require more than handing them procedures or online computer courses. The education should be designed to be more interactive and repetitious. Ideally, to learn a new habit, someone must perform an action between 18 to 254 times. (Lally, Van Jaarsveld, Potts, and Wardle, 2010). Also, assessments on self-image for the purpose of a more accurate self-efficacy are not common. This phenomenon is not yet recognized in the literature, though several project managers have indicated its importance. To sum up, it is the combination of an accurate self-efficacy of limited experience on the project tasks and accurate or high self-efficacy on the systems and procedures that makes this concept really valuable.

UNDERLYING PERSONALITIES

As indicated by Cabrera et al. (2006) and the project managers, comprehension is stimulated by the degree to which a person is open and being result-driven (goal-oriented). These can be seen to be fundamental characteristics of a person, though they are also partly a consequence of many years of experience in the Fluor environment, as also described by (Buttler, 2016). Thus, it is challenging to directly change the personalities of individuals. Therefore, the indirect development of personalities could be incorporated into human research management practices of Fluor. For directly stimulating personalities, Fluor could create an open environment and a supporting result-driven process that stimulates the ideal personalities temporarily.

THE ROLE OF CONTEXT

The transferring context largely influences the comprehension. As explained, transfer by documents is the current practise within Fluor. For the context two main issues are indicated; It was found that the project managers understand the outlined content, but they do not fully understand the implications. The lessons-learned should be generic enough to identify benefit the new project, but also be detailed enough to make it alive. This is also one of the reasons why project managers prefer their own lessons-learned above others. To illustrate, for his or her own lessons-learned, the project manager has the knowhow and understands the need to use it in new projects. Lessons-learned from others are just documents with information. They are often understandable, but it is difficult to identify usefulness in the new project. Cabrera et al. (2006) also stated this issue. The second issue, is that project managers are not able to properly judge the lessons-learned and surrounding context in which it is collected. This could lead to the perception of ambiguousness (Buttler, 2016). The project managers anticipate on this ambiguity. Generalizing the lessons-learned to a person independent document does not solve this issue; it is only ignored.

For overcoming the first issue, it could helpful to increase comprehension and reduce ambiguousness by visualizing the intended results, to involve the owners of the lessons-learned, to reduce the number of lessons-learned and to define by success stories. For the second issue, it suggested to make the documents more appealing with background information for the purpose interaction. Therefore, as also confirmed by Woo et.al. (2004), the lessons-learned database should be used in a supporting role, instead of playing the central role. This means that the systems facilitate effortless interaction with the owners.
**Culture, Communication and Recognition**

Finally, the comprehension of the individual is influenced by the perception of recognition, communication and culture. Recognition leads to engagement. This engagement is a key element in creating an extensive comprehension of the lessons-learned reuse. Furthermore, communication between people stimulates awareness of lessons-learned and innovative solutions, and creates a better understanding of the lessons-learned. A culture that focuses on trust, team cohesiveness and knowledge sharing helps to overcome the interpersonal sharing barriers. These are also recognized by Ajmal et.al. (2009) and Schepers et.al. (2007).

6.1.1.4. **Constructive Continuous Communication**

Constructive and continuous face-to-face communication aligns the intended results, creates trust and stimulates knowledge transfer. A “constructive” dialogue is essential to ensure that the communication contributes to a higher goal instead of fighting arguments and ambiguities. The importance of communication styles is also mentioned in previous research (Bakker et al., 2006; Sawng et.al., 2006; De Vries et.al., 2006). Contributing actions are active involvement of owners of lessons-learned, as well as creating a facilitated and structured kick-off for reusing lessons-learned and making the lessons-learned prospects visual. “Continuous” communication should ensure that lessons-learned are kept on the agenda to prevent falling back into routines and habits. Therefore, this occurs multiple times during the project on pre-determined, strategic milestones.

6.1.1.5. **Critical Mass**

It is found that, ideally, for the reuse of lessons-learned, it is important to establish, as early as possible in the project the critical mass of people for alignment of goals and selection of lessons-learned. According to the results, the critical mass should be defined as a multi-disciplinary and -layer diverse consensus in the group with sufficient authority to ensure the feasibility of implementing lessons-learned. This prevents the bias of individual perception and action (a major contributing factor for failing to reuse lessons-learned). Further, a widespread awareness and alignment within the project team avoids island forming and future problems and stimulates the early effort for taking chances when they arise.

The project managers also indicated that it is a political process. Many project managers indicated that the execution of the content within lessons-learned is not the difficult part; the challenge is in the process of getting the lessons-learned on the agenda. They indicated that it is because all the project managers and team members are willing to get their own lessons-learned on the agenda that it is important to ensure that, in the challenging team-development phase, the dominance of the majority is prevented. This is also confirmed by Sawng et al. (2006).

6.1.1.6. **Responsibility**

Currently, the responsibility is at the individual level and the project managers determine which lessons-learned are reused. The first issue is that the team and the individual should believe that they own the knowledge of the lessons-learned. The project managers indicated that the top-down approach of forcing people to execute lessons-learned is not effective and leads to rebellious behaviours. They indicated that individuals should be personally attachment to lessons-learned and should, therefore, bring in own lessons-learned—i.e., the bottom-up approach. In the literature, this finding is described as empowering leadership (Bakker et al., 2006; Sawng et.al., 2006; De Vries et.al., 2006). It is suggested to let people choose three or four lessons-learned and to let them bring these forward in a kick-off session. An independent facilitator facilitate these sessions, which are structured in various phases of inputs, priority, content discussion, and that they are limited in time and outcome (number of lessons-learned). In addition, criteria are defined to assess the lessons-learned and evaluate the results. Similar initiatives have been applied in the past for construction- or maintenance-driven design criteria.

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The second issue occurs after a repetitive failure to implement changes (lessons-learned) under an individual’s responsibility. In this situation, the re-user of lessons-learned develops a feeling of impotence and frustration, leading to a lack of motivation. As previously determined, this is due to the fact that it is challenging for the individual to effectively execute the lessons-learned without the critical mass.

The third issue is that project managers, often, only feel responsibility for their own scope of work. This is explained by that they are typically not involved from the start to the end of a project and take ownership for monitoring and evaluation. Consequently, they only determine strategy for their own part. Watson et al. (2006) also stated this. It is suggested, that the perception on scope of work is extended to successful completion. This ensures that they do not focus merely on delivering a document.

6.1.1.7. **Strategy Development**

As described in the previous part, strategy development (endorsement and tasking) is an important activity within the reuse of lessons-learned. It is argued that it is crucial to take the complete horizon into account, including monitoring and evaluation. It is also important to determine strategic moments for monitoring the progress and to prevent falling back into routines. Furthermore, it is crucial to keep the project on the informal and formal agendas by making it visual when possible and thereby stimulating continuous constructive communication. It is indicated that a kick-off session is valuable, but not the whole story, because it is just a moment in time. Finally project managers’ should be able to make a difficult (team) decision that can receive sufficient support to effectively execute the lessons-learned. This is confirmed in the literature on good leadership (Yeung et al., 2007)

6.1.1.8. **Monitoring and Result Feedback**

Finally, according to the study, the activities of monitoring the lessons-learned results and process feedback are missing. First, currently in Fluor, the goals and gains for the intended results of lessons-learned reuse are not clear. Therefore, the criteria are not defined for individual- and team-project/process evaluation. Although, in the literature (Milton, 2010; Orange et al., 2005; Wong et al., 2009), monitoring and feedback have often been defined as critical activities that stimulate intention, awareness and performance improvement. This is because the feedback and related incentives influence the personalities, self-efficacy and comprehension of the individual. As a consequence, project managers have a better understanding of what they are capable of and give more attention and importance to the lessons-learned reuse process. However, caution should prevail to avoid finger pointing, which negatively influences the knowledge-sharing culture and the reuse process. Bordia et al. (2006) also confirms this. Therefore, define feedback measures, which stimulate a higher evaluation apprehension.

6.1.5. **Behavioural Reuse Factors Framework**

Based on the research findings the following framework (figure 18) has been developed. This framework shows the critical success criteria for stimulating effective re-use of lessons-learned. The success criteria are defined as the factors that stimulate effective reuse. These success criteria are structured within the individual, environmental and motivational dimensions as defined by the behavioural framework of Wang et.al (2010) (Chapter 3.2.2, figure 7) and along the activities of the lessons-learned reuse process (Chapter 3.1.3, figure 6). These seven lessons-learned reuse activities were: intention; definition of the search-question; search for expertise; assessment and selection; endorsement and tasking; implementation and monitoring; and validation. The framework (figure 18) illustrates the lessons-learned reuse activities along the vertical axes and the three dimensions on the horizontal axes. This framework forms the basis for defining the key steps that need to be taken into account in the re-use process, to increase the effectiveness of implementation.
Figure 18: A framework for critical success criteria
“The world we have created is a product of our thinking. It cannot be changed without changing our thinking”

Albert Einstein

RECOMMENDATIONS

7.1. RECOMMENDATIONS FOR EFFECTIVE RE-USE OF LESSONS-LEARNED
    7.1.1. INTRODUCTION TO THE FRAMEWORK
    7.1.2. RECOMMENDED KEY STEPS AND ACTIONS
    7.1.3. RECOMMENDED RESPONSIBILITIES
    7.1.4. VALIDATION
7.1. Recommendations for effective re-use of lessons-learned

In order to maximize the effective application in practise, these final recommendations include key steps and actions for the individual, environmental and motivational dimensions for each of the activities within the lessons-learned reuse process. This aligns with the third sub-question that was raised at the beginning of this study is:

*What key steps and actions are recommended for effectively reusing lessons-learned by Fluor project managers?*

Initial recommendations were validated with key representatives of the project management department, leading to the final recommendations. The alterations on the initial recommendations are presented in the last part of this chapter.

7.1.1. Introduction to the framework

The recommendations to Fluor for effectively reusing lessons-learned focuses on the fifth step (re-use) of the total lessons-learned cycle. This cycle consists of: collection; verification; storing; dissemination; and reuse (Newell, et al., 2006; Milton, 2010). By defining recommendations for the fifth step, the reuse, it is possible to close the loop of the lessons-learned cycle. As explained in the literature review, this fifth step, the reuse process consists of seven activities: intention; definition of the search-question; search for expertise; assessment and selection; endorsement and tasking; implementation and monitoring; and validation. (fig 19 vertical axes). However, from literature and interviews, it appeared that this process is not effective yet. On top of the seven activities, a change in individual and organisational behaviour is required. Or as Einstein explains:

“*The world we have created is a product of our thinking. It cannot be changed without changing our thinking*”

These factors were earlier defined as the behavioural framework which consists of three dimensions: exploiting the motivational factors, stimulating the individual and creating the correct environment (fig 19, horizontal axis).

The success criteria as identified in the framework ‘success criteria’ (Figure 18, Chapter 6.1.5) are translated in key steps and actions, and plotted along two axis of a practical framework (figure 19):

- along the earlier mentioned seven activities of the reuse process (fig. 19, vertical axis)
- within the behavioural framework (fig 19, horizontal axis); specifying key steps in the motivational dimension and actions in the individual and environmental dimensions

The next paragraphs elaborate the recommendations to make the reuse process more effective.

7.1.2. Recommended key steps and actions

In this chapter the key steps and actions of the lessons-learned reuse process are defined (figure 19). If this process is conducted systematically for each project in a standardized way, the value of inter-project learning will result in cumulative and systematic improvement in both the process and the deliverables. This is based on literature (Antoni et al., 2005), supported by the interviews within the Fluor organisation and finally underlined in the validation process.
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<tr>
<th>LESSONS LEARNED</th>
<th>INDIVIDUAL ACTIONS</th>
<th>MOTIVATIONAL KEY STEPS</th>
<th>ENVIRONMENTAL ACTIONS</th>
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<td>RE-USE PROCESS ACTIVITIES</td>
<td>Long-term</td>
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<td>Client encounters</td>
<td>Gain knowledge</td>
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<td>Develop Learning organization &amp; culture</td>
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<td>Routine/training with re-use</td>
<td>Stimulate action-oriented and open</td>
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<td>Re-use Lessons learned criteria template</td>
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<td>DEFINITION OF SEARCH QUESTION</td>
<td>Past experience for the</td>
<td>Brainstorm: Let them define potential</td>
<td>Create interaction plan for interaction</td>
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<td>ability to identify</td>
<td>success stories/elements to reach these</td>
<td>Communicate plans for interaction</td>
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<td>impact (otherwise involve)</td>
<td>goals and gains</td>
<td>Communicate plans for interaction</td>
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<td>Systemize peer pressure</td>
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<td>SEARCH OF EXPERTISE</td>
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<td>Openness: Experience with multi-disciplinary</td>
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<td>ASSESS &amp; SELECT AMONG SEARCH RESULTS</td>
<td>On-job practice/</td>
<td>Share and communicate the potential success/</td>
<td>Create interaction plan (Integrate physical &amp; online)</td>
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<td>success stories/elements, criteria and impact</td>
<td>Improve user-friendliness systems</td>
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<td>around the involved disciplines &amp; project managers,</td>
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<td>Systemize: collecting own &amp; others lessons learned</td>
<td>Collaborative collecting phase</td>
<td>Visual templates</td>
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<td>Self-image assessments</td>
<td>- Input/collaborate lessons learned &amp; new trends</td>
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**Recommendations for the Reuse Activity: Intention**

The comprehension, awareness, justice and trust are identified as crucial to successful intention. For this reason, it is recommended to form a multi-disciplinary team and use the technique of brainstorming to identify suitable re-use information (step 1). It is recommended, that this team consist of the project manager, the leads and a facilitating independent project quality manager.

In the second step, it is important that in the brainstorm session, the perceived benefits for each individual and the organization will be aligned to commonly shared project goals and team gains. To stimulate the perceived benefits, the organization clearly communicates the value of implementing lessons-learned and the goals of the client and the organisation project specifically. In parallel (for the long term) it is important that the organization defines mechanisms for recognition and incentives to stimulate a knowledge sharing culture. Additionally, it is recommended that the organisation focuses on developing open and action oriented leaders with an accurate perception on his or her experience and education. This can be gained, for example by increasing the experiences of potential leaders by working on site and involving in client encounters. Further, it is important that the organisation routinizes the lessons-learned reuse process and supporting tools.

**Recommendation for the Reuse Activity: Definition of Search Question**

In the third step of the brainstorm, it is recommended that during the brainstorm session the team has to translate the goals and related high level perceived benefits and team gains into potential “success stories” that visualize the positive end result of implementing the lessons (Top-down approach). Next, for these opportunities, detailed areas of improvement and corresponding criteria, efforts and potential impacts need to be defined (step four). In the organisational environmental dimension, the higher management supports these steps by communicating the performance gap, facilitating the interaction in the brainstorm session, and agrees upon the criteria for reuse. The individuals in this step, for successfully defining the success stories, need to have the ability to identify opportunities and understand impacts. Further they require an open attitude for other opinions. Both can be stimulated by exposure to the work site and to multi-disciplinary solutions and/or roles.

**Recommendations for the Reuse Activity: Search of Expertise**

The fifth step includes sharing the potential success stories within the involved disciplines, project management group, higher management and the Fluor community. It is advised to communicate the success stories in the project management meetings, the project online communities, social networks (if any) and by the project coffee corners. Further, it is recommended that the project quality managers, sets up a special central interaction room (online and offline) created on the project floor where the success stories are shared on the walls. This room facilitates an interactive setting and visual representation to stimulate the trust, face-to-face communication and reduces the threshold for interaction.

For stimulating the exchange of knowledge, it is recommended, that the organization support the project team with guidelines and resources for a communication plan. The organization should also improve the user-friendliness of the database systems on interaction, traceability and feedback. Further, to effectively use the systems it is advised that the project leadership team members are mentored on familiarity with the systems and application in real projects.

In step six the team maps the people, projects and locations for knowledge. Step seven establishes collaboration with the owners of the lessons-learned to exchange context information. Preferably, this collaboration is established in the interaction room for context exchange, to reduce ambiguousness and stimulates the sense of urgency.
RECOMMENDATIONS FOR THE REUSE ACTIVITY: ASSES AND SELECT AMONG THE SEARCH RESULTS
Step eight includes phase, for example a week, of collecting the lessons-learned from the different disciplines into the central interaction room. The various disciplines hang their lessons-learned, or in other words, their contributions to the potential success stories in this room. Every engineer, lead or anyone else can contribute to the input of lessons to this room (bottom-up approach). The quality project managers facilitate that online and offline the rooms are equal and up to date. This process stimulates the success criteria commitment, belief of knowledge ownership, consensus, and constructive interaction. Furthermore, it stimulates the individual’s openness and confidence to engage.

In step nine, the quality manager facilitates a decision-making workshop with the multi-disciplinary project team. The team prioritizes the lessons-learned and involve the owners of these lessons-learned. Afterwards, in a content and context discussion the group select the final lessons-learned applicable to the project.

RECOMMENDATIONS FOR THE REUSE ACTIVITY: ENDOREMENT AND TASKING
Step 10 includes the facilitation (by the project quality manager) of strategy workshops with the multi-disciplinary team on the application of lessons-learned; starting with an adaptation of the lessons to the context and a result-driven approach. Followed by specifying the responsibilities, critical points and behavioural hiccups, risks, stakeholder analysis and a pro-active monitoring plan. Finally, they empower an execution team and also make them responsible for knowledge transfer. The strategy is visualized in the interactive room. These actions meet the success criteria “feeling responsibility, taking ownership, creating commitment and a result driven strategy”. It is recommended that the organization support this by providing incentives for taking ownership and enforcing the change needed.

RECOMMENDATIONS FOR THE REUSE ACTIVITY: IMPLEMENTATION AND MONITORING
In step 11 the execution team implements and actively monitors the lessons-learned. The lessons-learned are incorporated into the project-execution baseline and / or project work processes. The project manager and assigned individuals, with support of the project quality manager, pro-actively monitor (monthly) the progress. When necessary, the execution team re-assesses the solutions of the lesson-learned with the strategy team (step 12). To stimulate this process the quality department enforces monitoring, measures progress, collect insights from internal and external parties, gives (informal) feedback to employees involved and share status updates in the interaction room. For effective implementation it is crucial that the project manager stays involved and regularly discusses the implementation with the Project Quality Manager and team.

RECOMMENDATIONS FOR THE REUSE ACTIVITY: VALIDATION
In step 13 the facilitator holds an evaluation session with the team to assess the process and project gains of the lessons-learned. This is often at the end of the project.
Afterwards, step 14, feedback and credits are given to people involved and owners of lessons-learned. The quality department transform the project and process evaluation into a formal standardized document for sharing and comparing in the organization and shares the results in the interactive room with the project team. Furthermore, it is recommended that the organization in parallel develops a recognition and praise mechanism, collects client credits and routinize individuals' assessments on self-reflection and corresponding action plans.

Finally, the successes or failures of the applied lessons-learned implementation plans should be added to the lessons-learned collection session. The feedback has to be sent to the quality department for verification.
7.1.3. **Recommended responsibilities**

As described the recommendations are based on three main guiding dimensions: stimulating the individual, exploiting the motivational success criteria, and creating the correct environment. The office management team is primarily responsible, but for each of these dimensions a department is made owner for realizing the key steps and actions. In figure 20 the structure for responsibility is shown.

For the dimension ‘stimulating the individuals’, the department managers are responsible. They have to understand personalities and based on that need to develop skills, trigger perceptions and accurate self-efficacy. Also, they need to make sure their employees are familiar with the processes and systems. Further, it is recommended that the Department Managers select and/or stimulate personalities (openness, action- and result-driven, confident and persevering) for the lead functions in the lessons-learned reuse team. Next, they need to make sure that in the career path of potential (future) project managers, work-site experience, client encounters, and exposure to various functions in multiple disciplines is included. Also, incorporate the leadership development in the ‘Leadership development program’ of Fluor. Next, they need to provide on-the-job mentoring to emphasize importance of applying the process and systems. Also, improve openness to examining both direct solutions and indirect analogies from a broad set of knowledge sources. Finally, make them familiar with the process of setting personal goals, execution of self-reflection and successive actions (personal career development plan).

For exploiting the motivational key steps, the project manager and leads are responsible for the execution of the process steps and the project quality manager for the facilitation of the brainstorm session, the strategy workshop and evaluation sessions and setting up the interaction room. The project quality manager is supported by a team of junior engineers from various disciplines to ensure involvement and herewith commitment and awareness on the junior levels.

For creating the correct organisational environment, the management team is responsible. A stimulating environment is characterized by management support, encouraging peer pressure, facilitation of verbal and visual communication, physical interaction, monitoring and recognition. Organizational culture, incentives and recognition programs and communication protocols are key responsibilities of an office management team. The improvement of the systems and procedures could be delegated to respectively knowledge management and the so-called Key process owners within Fluor. The monitoring and evaluation could be delegated to the quality department.

![Figure 20 Responsibility breakdown structure](image-url)
7.1.4. Validation

This section elaborates the alterations to the initial key steps and actions. The alterations are incorporated into the final recommendations, as described in the previous paragraphs (chapter 7.1.2.)

7.1.1.1. Alterations of the recommendations

Overall, it was found that the evaluation discussions positively contributed to the refinement of the recommendations. More specifically, the evaluative discussion comprised only positive comments regarding the efficacy, mainly positive comments on the quality, although, some minor comments on the clarity of the process stages and definitions, and few comments on the usability. The alterations will be discussed on the basis of these three principles efficacy, quality and utility. In appendix F the completed ‘Validation’ form can be found.

Alterations to improve the efficacy

Concerning the efficacy, it was positively commented that the actions would lead to the desired intention and behaviour of the project managers. It was especially appreciated that a people focus was applied to the re-use of lessons-learned. Nevertheless, some recommendations for improvement for the efficacy were made: First and the far most important recommendation, was to magnify the importance of the collaborative collecting phase of lessons-learned in the interactive room. This will improve the motivation and the alignment of the lessons-learned on all levels within the project team. Further, the comments suggested adding new trends in the collecting phase besides, solely, the collection of lessons-learned from previous projects. Another suggestion, was to try to increasingly involve the junior level disciplines to the process. Therefore, it was advised to facilitate and monitor the process by the project quality manager together with the support of several juniors. Further, it was indicated that the organization stresses the importance of a learning culture.

Alterations to improve the quality

Concerning the quality the evaluators appreciated the top-down approach of setting goals and a bottom up approach of collaboratively collecting lessons-learned in the interaction room. A few additional comments were made: first, defining team responsibility is difficult and disputed and leads to a major change of the organization. Second, to make the process more robust, it was suggested to have an alignment session on lessons-learned when a new key leader is assigned half way the reuse process.

Alterations to improve the usability

The main comment on usability was to add responsibilities to the process. It was advised that the individual development is managed by department manager, the process by the project management department and the environment by the organization. Further, it was advised that the whole process would be facilitated by the quality team. In this way it is possible for the quality team to pro-actively stimulate improvement of projects.
"Knowledge is not power until it is applied"

Dale Carnegie

CHAPTER 8

CONCLUSION, LIMITATIONS, FUTURE RESEARCH

8.1. CONCLUSION
8.2. LIMITATIONS
8.3. FUTURE RESEARCH / FUTURE WORK FLUOR
8.4. REFLECTION
8.1 CONCLUSION

Although lessons-learned cycle presents an efficient way to maintain knowledge acquired from former projects, organizations face fundamental challenges in effectively reusing this knowledge in new projects. It can be concluded that this is due to the fact that the reuse of lessons-learned requires a change in the intention and behaviour of the project managers. Of course this also requires acknowledgement and active support in these areas of the environment, being the organisation. For this reason, this study investigated the possibility of improving the effectiveness of the lessons-learned reuse process and developed and validated key steps and actions that can help to stimulate the intention and behaviour of project managers in this process. Hence, the following research question has been established:

“How can managers of new projects be stimulated to effectively re-use lessons-learned?”

Sub-questions were raised and answered prior to addressing the main research question. Furthermore, the researcher discovered that there are multiple definitions of lessons-learned. In order to clear the area, consensus on what is referred to as lessons-learned reuse was required. In general, lessons-learned are documents, cognitive entities, or behaviours that may be based on knowledge, experience or learning. They can be either positive or negative and are specific to organizational values and goals. For the purpose of this research, it was discovered that lessons-learned should be of value for future project by virtue of four main criteria: application of innovative approach, prevention of an adverse work practice, avoidance of a reoccurrence of negative experience and creation of awareness.

Further, the lessons-learned cycle consists of five generic activities: capture, verification, storing, dissemination and reuse. The fifth activity—the reuse of the lessons-learned—is frequently neglected in the current research field. Besides this, Fluor indicated that this area of reuse was their main concern in increasing the effectiveness of the overall lessons-learned cycle. This study focuses on connecting the future user with the lessons-learned. Therefore, the reuse process of the lessons-learned cycle from the perspective of the project managers was assessed. It was found in literature that the process of reusing knowledge consists of five steps: intention, definition of the search question, search for expertise, assessment and selection and application of knowledge. Juxtaposition of the activities within the lessons-learned cycle and the knowledge reuse process made it possible to present an adapted process for the purpose of lessons-learned reuse consisting of 7 activities, namely: intention; definition of the search question; search for expertise; assess and select from among the search results; endorsement and tasking; implementation and monitoring; and validation.

Based on the adapted process of lessons-learned reuse, it was possible to study the factors that influence the reuse process for the project managers. By understanding the intention and behaviour of the project managers, it was possible to give recommendations how to stimulate project managers in reusing. It was found that lessons can only be learned from past projects if they are effectively applied in new projects. As a consequence, there should be a change in personal and/or organizational behaviour. The behaviour denotes the range of actions and mannerisms that are susceptible to personal and professional factors and psychological processes. Furthermore, the stimulating role of project managers, as heads of the project teams, is described as crucial for the success of reusing lessons-learned. On the basis of the behavioural framework by Wang et.al. (2010), it was possible to take into account the temporary, challenging, gigantic and complex characteristics of the project environment in relation to the intention and behaviour of the project managers. The underlying dimensions in this behavioural framework made it possible to answer the first sub-question:

What factors influence managers of new projects to reuse lessons-learned?
—The three underlying dimensions of the behavioural framework - environmental, individual, and motivational - are the factors that directly or indirectly influence the behaviour of project managers. The environmental dimension incorporates factors of the organizational environment, interpersonal and team characteristics and cultural characteristics, while the individual dimension includes factors such as work experience, personalities, self-efficacy and perceptions. The motivational dimension comprises perceived benefits and costs, trust, and belief of knowledge ownership.

On the basis of the literature study, a qualitative study via semi-structured interviews was set up. In total, seven project managers were questioned regarding the reuse process. This process yielded a rich amount of data to code, check and analyse on the basis of the framework by Wang et al. (2010). As a result of this assessment, it is possible to answer the second sub-question:

*What factors and underlying trends influence the behaviour of Fluor project managers in the current reuse of lessons-learned?*

The analyses based on coding the interview results revealed more specific factors and underlying trends, which are described in the following (see also figure 21).

The project managers are externally motivated by environmental factors, which are categorized in the sub area’s organizational environment, interpersonal and team characteristics and cultural characteristics. For these sub-areas constructive communication, responsibility, team consensus and effort are found important, and that knowledge-sharing culture and collectivism are found challenging.

Internally, the project managers are motivated by individual factors, which are the result of personalities, perceptions and experiences. The results show that reduced self-efficacy with respect to the execution of a certain task, increased self-efficacy with respect to the reuse processes and systems and specific work experience and education are seen as motivational. Attributes that support the motivation are being open, result-driven, confident and persevering.

The motivation factors were mainly indicated by the degree to which the individual could perceive the benefit for the project results and on top of that the personal and team gain. Other important factors include trust, belief of knowledge ownership and attitudes of comprehension, commitment and responsibility. The earlier explained factors stimulate the intention and behaviour. Strategy development, active monitoring and decision-making are indicated as contributing behaviours. Though indicated as valuable for efficiently executing normal day-to-day tasks, the routines and habits of the individuals were identified as behavioural barriers for reusing lessons-learned. To change routines and habits, vast and continuous effort should be applied.

![Figure 21 factor-identification model](image-url)
From these results, it was possible to discuss the most important motivational trends: stimulate the comprehension; facilitate constructive continuous communication; create a critical mass; define responsibility; develop strategy; and active monitoring and feedback. To specify, comprehension was the result of experience and education, personalities, accurate perception of self-efficacy and environmental factors such as interactive context and culture. Considering the results and trends, it is possible to develop a framework that matches the reuse process with the motivational dimensions. This framework (figure 18) contains the factors that are seen as the success criteria for improving the behaviour for the purpose of effective lessons-learned reuse.

As a result of the discussion, key steps and actions for improvement were developed (Figure 19), combining the results of the literature and practical studies. These key steps for the motivational dimension and actions for the individual and environmental dimension, all three dimensions are part of the earlier mentioned behavioural framework (Wang et al., 2010), ensure that the success criteria in the discussion (figure 18) are exploited. These recommendations are the answer to the third sub-question:

What key steps and actions are recommended for effectively reusing lessons-learned by Fluor project managers?

The key steps and actions were validated with the head of the project management department and a senior to enhance the practical value.

The strength of the recommended framework of key steps and actions is that it takes into account the characteristics of the temporary, challenging, gigantic and complex characteristics in the project environment in relation to the intention and behaviour framework of the project managers. It ensures the commitment of the project managers towards exploiting and finishing the reuse of lessons-learned; it creates a well-supported decision-making process by creating a critical mass in the early phases; it standardized the key steps to increase accurate self-efficacy and the ability to routinize these steps. Therefore, the answer to the research question is,

The managers of new projects can be stimulated to reuse lessons-learned by the application of the recommended key steps and actions.

Further, it is observed that a unilateral project-management approach that is focused on individual actions is not adequate to solve complex issues with respect to mega projects, and that constructive collaboration among people is key to the effective reuse of lessons-learned to maximize project performance. Also, key to success in improving the effectiveness of the reuse of lessons-learned lies in practice. By way of illustrating the importance of the practical application of this study, Dale Carnegie once said:

"Knowledge is not power until it is applied"

Finally, the practical contribution of this study lies in its assessment of the current situation within Fluor and in the key steps and actions offered for stimulating project managers to reuse lessons-learned. The identified key steps and actions give specific recommendations for development on individual, motivational and environmental levels in each of the seven process activities within the reuse phase of lessons-learned. In addition, because the recommendations are action based, visualized and validated, the practical applicability has increased significantly. The contribution to the knowledge base lies in the fact that the knowledge reuse process is now adapted for lessons-learned reuse and in the identification of dimensions that influence the individual in the lessons-learned reuse process.
8.2. LIMITATIONS

In general: the decision to use a qualitative research method via semi-structured interviews provided the researcher with an opportunity to obtain an in-depth view. However, several limitations of this approach can be identified. These limitations influenced the internal and external validity of this study. According to Verschuren and Hartog (2005), internal validity is defined by the quality and accuracy of the outcomes; external validity is defined by the generalizability of the outcomes to a different context.

8.2.1.1. RESEARCH DATA AND METHODOLOGY

- The major limitations in this study have to do with the relatively small size of the sample of interviews and with the fact that this study only takes account of interviewees working in one geographic area with specific socio-economic characteristics (Chileshe, Rameezdeen, Hesseini, 2016). The findings are bound to differ across the various countries and cultural borders that Fluor operates. In the same way, the data was gathered only from the group of project managers. This does not mean that the same findings can be directly applied to the engineers, although many project managers started their careers as engineers (Verschuren et al., 2005). Therefore, the limitations and the assumptions based on the context of Fluor Netherlands should be considered before a generalization of the findings can be made to other Fluor locations (external validity).

- Further, it was noticeable that some project managers were passionate about the use of lessons-learned and kept emphasising some factors; other project managers had more difficulty describing the benefits and therefore their intentions and actions. For these reasons, the statistics cannot be seen as factual; they may be used merely as a valuable indication. Nevertheless, the statistics create a strong impression of what the project managers perceive as important factors of reusing lessons-learned.

- Also, a threat towards the validity in using semi-structured interviews is the use of leading questions based on the researcher’s preconceived ideas about what is valuable and what is not. Considering the live nature of face-to-face interviewing and the complexity of the language that is used, it is indicated that it is not easy to avoid all these challenges. Although, according to Newton (2010) the same vulnerability and complexity produces a richness and depth in the data, which mitigates the risks.

- Finally, the differentiation between lessons-learned and project experiences is only a year ago introduced. Consequently, the project experience database is still developing. This could be one of the reasons why project managers do not know how it works. First, to reduce the effect of this internal dynamic within the organization the lessons-learned and project experiences are defined as equal. Second, the body of science does not make this differentiation either and would have made the literature study unnecessarily difficult.

Despite these restrictions, this study on the reuse of lessons-learned provides a valuable foundation for further study in this important research area.
In addition to the contribution this study made to the body of knowledge concerning lessons-learned, it has also indicated several opportunities for future research. The following recommendations are given for future research:

- Although that the process and actions are based on the factors found in the results and discussion, a pilot should be completed to increase the practical validation. Furthermore, it is possible to test the process on the whole, as it is currently built up from the components indicated in the literature and from the factors defined in the assessment of Fluor. However, as Aristotle said, “The whole is greater than the sum of its parts”. Therefore, it would also be interesting to quantitatively measure the effect of the measures and to measure the effect of the process in the whole.
- Furthermore, the group of participants for research could be extended to include the lower-level engineers. It would be interesting to know if the same motivational, individual and environmental factors are important for the reuse of lessons-learned.
- In addition, it would be interesting to study the effect of international lessons-learned reuse. This means overcoming the barriers from physical appearance and cross-cultural clashes.
- Also, based on the underlying factors and trends, process step and actions for improvement have been developed. Although, it would be interesting to know to what extent it is possible to standardize the process and actions for all project managers or that a fit-for-purpose approach for each project manager should be developed on the basis of the framework ‘success criteria’ (figure 18). The top management in collaboration with the project managers should determine which option to choose, or possibly choose for a mixed approach
- The current research outcome is limited to Fluor. It would, however, be interesting to generalize this concept to different sectors. In addition, it would be interesting to look for solutions in other sectors for training mechanisms and culture developments.
- Finally, An out-of-the box idea; the cause for inward-looking project teams, project managers and engineers, who like to solve problems themselves instead of looking for solutions from others could be related with education on universities. This phenomena of inward-looking project teams is also mentioned by Hertogh (2011). Research is suggested on education of engineers in university and the effect this has on their professional behaviour in the organization for the purpose of reusing lessons-learned. It is currently indicated by project managers that inward-looking behaviour is related to learning at the university and to pure intrinsic joy. For education, the emphasis was put on the way of learning at technical universities. In the same way, it was indicated by several project managers that a lower level of education or a different type of university leads to their perception of lower self-efficacy on specific knowledge tasks and provides a reason to be more open to others people’s solutions. For these reasons, these arguments could be a topic for further research. However, the arguments of project managers contradict to the argument made by Cabrera et al. (2006) and (Lin, 2007), who say that people with high level of education are generally more likely to share their expertise and have positive attitudes towards using lessons-learned. However, as the project managers show in this research, it is all relative to your peers in the project environment.
Furthermore, the research conducted, defined the following future work for Fluor:

- During the discussions, it appeared that the preferred approach differs for each project manager. The application of lessons-learned is executed to the taste of the project manager and the dynamics of the team. Therefore, it is advisable to use a fit-for-purpose approach for each project manager and his/her team. The framework ‘success criteria’ (figure 18) developed in the discussion of this thesis can help identify the improvement areas.

- Although, this study is not focused on the development of an updated central database, some recommendations can be offered. It appears that the project managers lack trust and the ability to use the system. Their trust in the central system is influenced by the possibility of interaction, feedback, traceability and transparency of the lessons-learned. Therefore, it is recommended to improve the central system on the basis of these four requirements.

- Multiple project managers indicated that the crux is in the communication between project team members within the team, within the organization, and outside the organization. It was indicated that communication—such as via meetings, document transfer and visual representation within Fluor—could be improved. A positive development, currently, is the visual management room. The aim is to communicate effectively within the team and with Fluor employees in India. First results were promising on overcoming ambiguities and aligning intended results. It is advised that similar principles be used for the reuse of lessons-learned.

- The results of the interviews indicate a need for a real knowledge-sharing culture. Specifically, trust and stimulating interpersonal interaction is hard to achieve. However, results indicate that the focus is too much on the individuals and not enough on team collaboration. For more effective team collaboration, one could look at initiatives such as Scrum. It was found that, for complex mega projects, an individual and linear process is insufficient and that a knowledge-sharing culture should be stimulated.

- It was indicated that the education of Fluor employees is mainly focused on content. However, it became clear from the interviews that hearing or reading is one thing but doing is something completely different. Therefore, it is recommended that the company invest in interactive and execution-related methods, which really teach an individual to apply knowledge and to focus on the end-results. Keep in mind the quote of Benjamin Franklin: “Tell me and I forget, teach me and I remember, involve me and I learn”

- Furthermore, it is recommended that Fluor put effort into personalities and skills training. This increases the accuracy of the self-efficacy, which is one of the major individual drivers of the intention to reuse lessons-learned.

- From the findings of the study, it appeared that capturing and reuse depends on the interpretation of the author or user. This means that, when project managers are aware that a lessons-learned is captured by one person, the lessons-learned will have a reduced validity. Therefore, it is suggested that the capturing be done in structured lessons that are learned collection sessions guided by a facilitator. For an extensive elaboration, the previous study by Buttler (2016) on the capturing phase of lessons-learned is recommended.

- Furthermore, the framework success criteria (figure 18) functions as a guide to determine areas of improvement. It directly influences the major trends, impacts the behaviour of all project managers in the short-term (short-term recommendations). However, a fit-for-purpose approach is preferred to get the best results in the long term. In this situation, the top management in collaboration with the project manager determines which areas need improvement.
8.4. Reflection

In general it was a challenging, but interesting topic. For engineering students, it definitely lies outside the box. Though, I think it is really valuable to my development. Many of the project managers also stated this. Organizational issues have three dimensions: technical, organizational and social. In my studies I have been in contact with the first two, but the social dimensions was new to me. Further, I think it has been valuable to the research that I, as engineering student, performed this research, because also I am one of those engineers who is ‘in-ward’ looking in solving problems. My empathy with the project managers and engineers made it easy to level in the interviews and understand their real motivation.

Learning Process
The learning process was twofold: first, the research methodology and, second, simultaneously also the content of research had to be mastered in a short amount of time. Especially, because I was not familiar with research methodology and was also a novice on the research content.

The most challenging aspect of the research is that I was my own feedback loop. Therefore, I needed the confidence to build on my own decisions and judgement. However, if you have to take many decisions in uncertain process with an overload of new information, eventually you get doubtful. The upside to this, is that I have learned to trust and rely on my own capabilities. At many moments, I was grateful for the support of Merlijn Lojenga and Yan liu. Additionally, I recognize many of the motivational concepts in my emotional statuses during the writing of this thesis.

Research
A lot of time is spent on reading research methodology literature. I have tried to stick to the guidelines from literature, however, if I reflect, I would earlier plan my own research. It became clear to me that every research needs its own suitable methodology or adaption of the steps in literature. The literature has, even, a bit confused me and I could have better focused on clearly explaining my steps. However, this was challenging because I got mixed suggestions for improvement during the meetings.

Further, the search for literature, as warned by Hans Bakker, was puzzling, because there is not that many research on reusing lessons-learned. This costed a lot of time and effort, but luckily I found literature on knowledge reuse, behaviour and direct application of lessons-learned. Juxtaposing these literature made it possible to research the lessons-learned reuse. If I would reflect on my literature study, I would earlier try to make the writing concise.

The practical study went really well; the interviews were a pleasant experience and the coding on the framework of wang et.al. (2010) was really valuable. If I have to reflect, the difficulties were the amount of effort I had to put in Atlas.ti. As well as, the policies of TU Delft regarding facilitating and updating software, which gave enormous problems and I almost lost all of my data.

The recommendations were the most enjoyable part to execute. In this part I could transform the findings to something practically valuable for Fluor. Fortunately, the head project management also underlined this value in the validation discussion.

The final reflection is on writing the thesis and could be best explained by the quote of Stephan king:

“kill your darlings”

I wish I focused earlier on writing concise, instead of only focusing on the content part of writing a thesis.
REFERENCES


APPENDIX A RESEARCH DYNAMICS

A.1 INTERNAL AND EXTERNAL DYNAMICS

To achieve the goal for the reuse of lessons-learned by project managers the research should be managed. Due to dynamic environment a project approach will not be suitable for this research on the application of reuse of lessons-learned. Both external and internal dynamics played an important role for the choice for process approach (De Bruijn & Ten Heuvelhof, 2010). The external dynamics influencing are the client parties outside of Fluor in the oil and energy industry, with increasingly more organizations requiring knowledge management practices from EPCM organizations for contract awarding. Second, the external dynamics are of existence due to increasing intensive collaboration by EPCM organizations in the form of consortia. Internal dynamics exist within Fluor as a result of the updating process of the lessons-learned and the development of procedures and the efforts for knowledge sharing.

For a process management approach it is important to involve the relevant parties in the various research stages. In the research steps described in the last paragraph managers are involved in the research steps. This will create a form of openness and a sense of urgency for the need of improvement of the reuse of lessons-learned. As well, by actively involving the quality department (knowledge management) the sense is created that the strategy will be the result of the negotiating process. However, important to note is that openness is not without risk and should be handled carefully. Therefore, the core values of the involved parties should be protected. On corporate level this means that reassurance regarding confidentially of information is given to the project managers in the semi-structured interviews and discussions. On personal level anonymous results of the interviews are used for implicating the current situation to ensure that confidentiality for managers.
APPENDIX B: ASSESSMENT METHOD FLUOR

Email:

Beste meneer ……

Graag zou ik de afspraak met u van morgenmiddag 00:00 willen bevestigen.


Wat ik wil doen

In mijn onderzoek wil ik graag de motivatie, ervaringen, persoonlijke eigenschappen en acties in kaart brengen die het het gebruik van lessons-learned door project managers stimuleerd. Hiervoor wil ik een aantal project managers interviewen en hoor ik graag waarom jullie een bepaalde perceptie hebben over het gebruiken van lesson-learned. In het interview zal ik u onderliggende vragen stellen over uw motivatie om lessons-learned te gebruiken en hoe u deze intentie omzet in succesvol gedrag. Ik wil erachter komen welke ervaringen of persoonlijke eigenschappen er toe geleidt hebben dat u deze perceptie heeft.

Met vriendelijke groet,
In this part the questions of the interviews are showed.

**Semi-Structured Interview**

Interviewee:  
Interviewer:  
Date:  

**Total Length:** 60 min  
**Per question:**

**Tot overeenstemming komen over:**  
*recording  *tijdslimiet  *tempo van beantwoorden vragen  *geheimhouding

**Outline**

This interview is to determine the underlying elements & experiences stimulating project managers to use lesson learned in new projects. In this interview the personal characteristics & skills and motivational factors influencing project managers are investigated. This will be done in a sequential order in line with the process which project managers go through when applying lesson learned (fig. 1)

![Diagram](image)

**Figure 1**

**General questions**

Function:

Age:

Male/Female:

Career:

Years at Floor:

Background:

International:

On-site:

Training on KM:

Responsibilities:

1


QUESTIONS

Introduction

1. What is your current process for using lessons learned in new projects?
2. For what kind of situations do you use lessons learned?
3. What is in your opinion the critical value to project success in applying lessons learned in a new project? What and when was this moment?
4. What is your goal for using lessons learned?
5. What do you see as the biggest challenge in using lesson learned?
6. When do you need & apply the most lessons learned? What is influence of the team and project development status at that point?
7. How do you use Lessons learned?
8. Who do you involve?

Environmental factors

9. What is the management support for using lesson learned?
10. What are the organizational rewards/ incentives for a project manager to use lesson learned?
11. Do you think the organizational structure is suitable for sharing lesson learned?
12. What is the influence of culture and climate for using lessons learned?
13. Where and how do you communicate with other experts or project managers?
14. How do you perceive the general cultural characteristic in the organization? Collectivism vs individualism

INTENTION:

1. What is your intention of using lesson learned in a new project? Can you please explain this for personal characteristics, motivation and external factors?

Characteristics

Attitude:

2. What is your attitude towards your intention of using lessons learned in your project? Please explain first for your own lessons learned and then for other people’s lessons learned?
   a. Which experience or behavior has led to this attitude?
   b. How important was the experience to your current intention to use lesson learned?
   c. How do you express your positive behavior towards using lesson learned? Please explain with actions?
3. What is the influence of the culture between project managers on using lesson learned?
4. What is in your opinion your role and responsibility in the successful application of lessons learned?

Retentive: (ability to routinize practices)

5. What is in your opinion the uniqueness and the climate of each project? Can you elaborate on this in relation to the intention of using of lesson learned?
6. What is your approach to standardize the process of using lesson learned in your projects? Can you please explain by means of actions?
7. How often do you apply similar tactics/strategies of former projects on a situation of former projects?
Motivational factors
1. What motivates you to use the lesson learned in a new project?
   a. Why
   b. Actions?

Perception of effort:
8. What is your perception of effort on finding a lesson learned?
   How do you find or get informed about lessons learned?
   In your opinion, what are these efforts?
9. What is your perception of effort on applying a lesson learned?

Perception of performance gap
10. In relation to your performance in the project, what is your motivation for using lesson learned in new projects?
11. What do you think the role of habits and personal experience is in the intention of using lesson learned in your project management execution?
12. What kind of critical experience did make you realize this perception?

Trust on knowledge
13. What is in your opinion on the accuracy and timely for successful use of lesson learned in your new projects?
   What is the role of social contact and networks in trust on the lessons learned? Given via community, or system?

Perceived personal added value
14. What do you see as a personal gain from applying lesson learned in a new project?
15. And for your team?
   Can you elaborate on the type of gain you experience?
   a. What result do you want to reach with using lessons learned?
   b. Can you give concrete examples where you have achieved results?
   c. How important was this as a driver for your motivation?
   d. Do you evaluate the results of the implementation of lessons learned?
16. To what extent do you feel supported by higher management?
17. What is the influence of incentives/rewards?

Familiarity with Knowledge Management System
18. What is your opinion about the availability of lessons learned? To what extent does this stimulate you intention for reusing?
   How do you know about the availability of information?

THE LESSON LEARNED REUSE PROCESS

Definition of the search question (knowing what to ask)
19. PROCESS VRAAG: What makes you personally successful in defining the correct lesson learned?
   Please explain
   How did you define your search question?
   On what basis did you know where to look for?
   Do you find what you looking for?
20. What is your focus balance between positive and negative lesson learned?
   a. Why do you focus on this one?
Search for expertise (easier finding)

21. PROCESS VRAAG: In your case, what is your strategy to find the correct lesson learned? Please explain on the basis of actions.
   a. What are you actions?
   b. Why are this your actions?
   c. Who is involved?

   Where do you get your lesson learned from? (connections, team, colleagues)
   Are you familiar with the lessons learned database or communities of practice?
   Do you think there are other more effective or additional ways?

22. What is your impression on the knowledge availability while searching for lessons learned?

23. What is your experience with the searching tools and possibilities?
   How often do you search for lesson learned?
   How would you judge your skill & experience on with the knowledge sharing system?

24. What is the role of social networks for your search of knowledge?

Asses and select among search results

25. PROCESS VRAAG: What is your strategy on decision making of selecting lessons learned?
   a. What are you actions and how do you make the decision?
   b. Why are these your actions?
   c. Who is involved?

Openness

26. When making a decision on a certain lesson learned, to which experience and knowledge sources are you open to explore?
   a. Can you give me concrete examples
   b. Which actions do you take to be open for other knowledge sources and opinions?

27. What is your strategy on dealing with uniqueness and time limits when assessing a lesson learned?
   a. Which actions to take to counter these barriers successfully

Absorptive capacity

28. What is in your opinion the usability of knowledge when assessing a lesson learned? Please explain:
   a. What actions you take to determine this?
   b. Can you elaborate this with a critical experience which gave you this perception of usability?
   c. How can it be improved?

Trust on knowledge

29. On the basis of what do you determine the credibility of the lessons learned author?
   a. Have you taken action (direct contact) to change this perception?
   b. Why is this your opinion?
   c. What will improve your trust in the lesson learned?

30. What is your opinion about the ambiguousness of a lesson learned? Please explain with the conflicting lesson learned, incomplete information, a different opinion about project management practice?
   a. How do you deal successfully with this ambiguity?
Endorsement & tasking
31. PROCESS VRAAG: What is your strategy on successful applying lessons learned in your new projects?
   a. What are the actions?
   b. Why do you think these are successful
   c. How do you institutionalize it in your project execution
   d. What are barriers?
   e. How do you stimulate your project team to apply lessons learned?
      i. Which actions do you take?
      ii. Which are successful? Or not?
      iii. How do you deal with the urge of engineers to reinvent the wheel?
      iv. What leadership characteristics are in your opinion successful?

Implementation & Monitoring
32. PROCESS VRAAG: What is your strategy to implement and monitor the successful use of lessons learned?
   a. What are in your opinion key elements in successfully monitoring the lesson learned?
   b. What control mechanisms are successful?
   c. How often do you monitor?

Validation
33. What kind of acknowledgement do you expect for successful use of lesson learned?

Future use
34. PROCESS VRAAG: What is your strategy to reach the successful results in the application of lesson learned?
   a. What actions do you take to meet the results?
   b. Do you evaluate the results and actions and how?
   c. Can you give a where you have measured the result of implementing a lesson learned?

Future trends
35. PROCESS VRAAG: What is your strategy to maintain the knowledge on the lesson learned and the process for future reference?
   a. What actions did you take?
   b. Do you share your experiences with other project managers or individuals?
   c. How do you see your role in maintaining the knowledge for the organization when the project team breaks up or during the project?

36. What do you see as future developments & trends in the lesson learned application?
B2. Qualitative data analyses Atlas.ti 7/8

For the qualitative data analysis the software of Atlas.ti is used. This software has the ability to code in a structured manor, to identify relations that are difficult to find by the use of conventional methods and to address importance by word counts. To illustrate in the figure below, a print screen of Atlas.ti in this research is shown.
APPENDIX C: LESSONS-LEARNED IN FLUOR

In this part the definitions of project experiences and lessons-learned within Fluor are explained. Further, an example of the electronic document and flowchart of lessons-learned is given.

C.1 DEFINITIONS OF PROJECT EXPERIENCE AND LESSONS-LEARNED WITHIN FLUOR

Project Experience
Information which may be developed following the occurrence of a project event. This generally describes what happened, why it happened, and what was implemented in response to the event in sufficient detail to allow it to be meaningful for other projects. The event (positive or negative) can be caused by an error, outside cause, incorrect procedure, a successful or unsuccessful alternative approach, etc., which is outside previous experience. The emphasis is on benefiting from an experience by making it available to the organization.

Lessons-learned
A project experience that creates the need for a new work practice or changes to an existing practice.
APPENDIX D ELABORATION ON THE RESULTS OF THE INTERVIEWS

KEY FINDINGS: ORGANIZATIONAL ENVIRONMENT

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>OC: Context (communication, visual, face to face, online)</td>
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</tr>
<tr>
<td>OC: Incentives/awards/recognition/accountability</td>
<td>12</td>
</tr>
<tr>
<td>OG: Knowledge sharing culture</td>
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</tr>
<tr>
<td>OC: Context: search for expertise: social network</td>
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<td>OC: Management support</td>
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<td>OC: Leadership characteristics</td>
<td>6</td>
</tr>
<tr>
<td>OC: Project climate</td>
<td>4</td>
</tr>
<tr>
<td>OC: Context: search for expertise: ICT</td>
<td>4</td>
</tr>
<tr>
<td>OC: Context: search for expertise: procedures or reports</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 22: Appendix: factor of the organizational environment

As illustrated in figure 5 XXX, the context, incentives and the culture are perceived as most important factors influencing the project managers’ motivation. Other contributing factors are leadership, management support and the project climate. The factors will be elaborated in the next paragraphs.

**Context and the search of expertise**

The *context* means in what manner the lessons-learned are communicated. The project managers indicate they prefer face to face and continuous communication in the form of a constructive dialogue. This gives them the possibility to give nuances and context, discuss certain viewpoints, and create trust by consensus on the importance and the solution for the lessons-learned. Potential area for improvement stimulating the comprehension and keeping on agenda of lessons-learned is by making lessons-learned process visual or understanding enhancing activities such as site visits.

As indicated in figure 6 XXX and within the factor ‘context: search of expertise’ the *social network* is indicated as most significant in searching lessons-learned. Furthermore, the *documents and information, communication and technology systems* are indicated as in a supporting role and therefore these factors are mentioned the least within analysis of the organizational environment. The project managers explains this is due to the fact they use an inside out approach to find the correct lessons-learned, starting within the team and/or social network. Although project managers indicated they were not familiar with the systems, they indicated it is valuable to examine a broad set of knowledge sources to overcome that a potential issue is not identified. In this case and to prevent other important issues from arising the central system of lessons-learned could be of benefit. This means in most cases a kick-off session for lessons-learned from the system or former projects. As the project progresses it completely shift towards the social network of the project managers.

**Incentives and recognition and knowledge sharing culture**

The *incentives*, including *rewards, recognition and accountability*, are the stimulating means that are given to re-using lessons-learned in new projects. In general, all project managers grasp the rewards of the reuse of lessons-learned back in the project results indicators. The lessons-learned itself are not monitored actively and assessed, due to late effect of lessons-learned and the focus of project managers during the project execution on negative encounters. Positive effects of lessons-learned are therefore not fully recognized and consequently not of priority for the individual. Further, it is indicated that the recognition from *happy clients and rewards* for team and relation developments are important external factors. Besides, the project managers indicate improvement could be by incentives for knowledge sharing culture, pro-active and result-oriented behaviour, and by active involvement, monitoring and recognition for success and by demolishing the ‘knowledge is power’ wall.

In the perception of the project managers there is a lack of a *knowledge sharing culture* between the project managers. This is influenced by the perception that knowledge is power in a knowledge intensive organization like Fluor. However, it is indicated that knowledge has only value if it is shared and used, but people are afraid to ask questions. With feedback and assigning consequences the project managers should
be careful and make sure it does not influence the knowledge sharing culture. Giving recognition and compliments is not a common practice in the organization and there is a perception that the database is for nerds and that nobody uses it. The following improvements are indicated: in knowledge sharing culture you stimulate and appreciate that people take ownership over the lessons-learned, are not afraid to ask questions and there is room for personal development. Team setup, communication, openness and responsibility are influencing resources the project managers apply.

**Findings on management support, leadership and project climate**

The management support is perceived as a prerequisite and a stimulating factor for re-using lessons-learned. On one hand, without the support of the management the mission is almost impossible. On the other hand, a real commitment of the management stimulates the intention of the project managers and their team and could be used as accelerator. Although, the project managers indicate there is management support, they also indicate it currently it still in the saying form and lacks an action & control mechanism. Actions of management support currently focuses on negative effects within projects.

According to the project managers’ leadership is an important factor in stimulating the team, in recognition and creating a knowledge sharing culture for re-using lessons-learned. A prerequisite is leading by example, but also supporting your team instead of enforcement of the procedures. Furthermore, by giving a strategy, vision and getting critical point on the agenda are stimulating means for action.

The project climate is a challenging factor for re-using lessons-learned. The project managers indicate that it is always a balance between learning and doing and due to the project climate (time-, targets and cost pressure) the focus shifts in crucial moments to the doing side. However, the project managers also indicate that the setup of a project gives chances for re-using lessons-learned as not all relations and positions are settled yet.

**KEY FINDINGS: INTERPERSONAL AND TEAM CHARACTERISTICS**

The analysis of the interpersonal and team characteristics (figure 6 XXX) shows that the project managers indicate that the team characteristics and processes are the main factors. Afterwards, the social network, team development stage and diversity are seen as contributing to the reuse of lessons-learned. The factors will be elaborated in the next paragraphs.

*Figure 23: Appendix: interpersonal and team characteristics*

**Findings on role responsibility, team consensus and team effort**

Indicated by the project managers, in the interpersonal and team characteristics are role responsibility, team consensus and the team effort within the reuse of lessons-learned. All the project managers state the individual’s responsibility of the application of a lessons-learned in the current process. However, they note that to make the reuse of lessons-learned a success it should be a team effort, a team consensus and state that most mistakes are made because an individual’s mistake. Therefore there is a misalignment in the preferred and real role responsibility (interpretation).

Moreover, the understanding of a lessons-learned, as well as the solution development depends on the person. To overcome this issue the majority of project managers state that the lessons-learned should be a team effort to remove the personal bias. Unsuccessful processes focus on the individuals’ responsibility and interpretation of the lessons-learned.
A crucial note was made by the project managers about *team consensus*. Team consensus is necessary due to the fact that a person, even a project manager, has not the ability by him- or her-self alone to get a lessons-learned on the agenda of the project. A critical mass with the comprehension about the lessons-learned and its effect and impact on project success is a prerequisite for success of the application of a lessons-learned. This support should come from within the team in the form of a critical mass and/or by support of the higher management.

In addition, it was noticed that *team consensus* forms a strong foundation for the reuse of lessons-learned. Different disciplines have their view and experiences on a certain lessons-learned. If these perceptions are not aligned in the beginning of the project it will definitely give issues later on.

**Findings on interpersonal and team communication and social networks**

Communication is perceived as a crucial factor for re-using lessons-learned. First, communication between the top management, the project managers and the project engineers could help to align the intended results and create a comprehension level and trust at all levels. Second, communication is needed to ensure consensus within a critical mass of people to support and make the reuse of the lessons-learned possible. Third, continuous (and visual) communication is needed and is an effective manner to keep the lessons-learned on the informal agenda.

The social networks within interpersonal and team characteristics form the basis of knowledge and lessons-learned exchange. The project managers indicate that they start the search question for lessons-learned at people with whom they have strong ties, due to the easiness of informal contact and the trust on quality and person. Several project managers also acknowledge that sharing experiences within the team and outside the team are important to prevent mistakes. As well, they indicate it is effective as team members stimulate one another to use the systems and share experiences and thereby create a knowledge sharing culture. Besides, the project managers have in a project team the role of receiver and sender of lessons-learned.

**Findings on team development stage and diversity**

The project managers indicated that the *team development stage* is a demanding phase where a lot of crucial decisions are made, however due to the fact that not everything and everyone is settled yet there is room for overcoming routines & habits. This can be an opportunity for re-using lessons-learned. As well in this first phase in the project it is important to create a sense of urgency and comprehension within the project team to do it better. On behavioural note, it is smart to come up with lessons-learned as early as possible, because the procedures still need to be adjusted.

Alternatively, a challenging element is that project team members, including project managers, not all contribute in the project from beginning to end. So, over the course of the project the reuse of lessons-learned process has a multitude of responsible persons. As application of lessons-learned is a team effort in multiple phases in the project execution, the involvement of many different disciplines during the phases lead to a diffusion of task responsibility, dependence and alignment. Successful actions to deal with this are strategy development and an end result-driven approach.

*Diversity* is another factor mentioned by project managers. They indicate that lessons-learned are susceptible to the peoples' perception and character. Inter-disciplinary these perceptions and characters are indicated
differently and could lead to one discipline overshadowing the others and consequently only their perception will be seen relevant.

**Key findings: Cultural characteristics**

In this part the cultural characteristics are briefly described. The knowledge sharing culture and cultural collectivism are examined as factors. The factors will be elaborated in the next paragraphs.

A real knowledge sharing culture and cultural collectivism is challenging in Fluor due to the perception that knowledge is power in a knowledge intensive organization like Fluor. Although, Fluor has setup a multitude of processes and sessions to create a knowledge sharing culture.

In the project management department meetings on re-using lessons-learned there was observed that lessons-learned are shared between the project managers, there was notable interest of the group and there were questions asked. However, the meetings were somewhat intense and could not be identified as a constructive discussion, but more one person presents and the others challenging the presented information. The group is made up of persons with strong personalities, and a lot of experience and not afraid for confrontation. In the interviews the project managers describe that within the project team that there is in-group behaviour within the disciplines but inter-disciplinary there is room for improvement.

**Key findings: Individual characteristics**

The analysis of individual characteristics (figure 8 XXX) shows the factors that the project managers indicate as stimulating the reuse of lessons-learned. Most indicated is the perception of self-efficacy, as well as work experience and education. Specific personalities are seen as prerequisites for re-using lessons-learned. The factors will be elaborated in the next paragraphs.

**Self-efficacy** is seen as an influencing factor for re-using lessons-learned. In the role of receiver, the perception of the project managers as not having sufficient knowledge/experience to perform the task is indicated as stimulating for the reuse of lessons-learned. In the role of sender the project managers are more willing to share knowledge if he has the confidence that they understand the lessons-learned. **Work experience** is indicated as an imperative factor for re-using lessons-learned. The project managers indicated that working on-site, a longer functional exposure and client encounter lead to increased comprehension on the importance of the results of lessons-learned and the contribution to the results itself. An emphasis is put on working on site as a prerequisite for re-using lessons-learned.

**Education** within Fluor is seen as stimulation to get familiar with the lessons-learned processes, procedures, the systems and themselves and the team. However, education should not be seen as a one-hour computer course, but more by the listen, read and doing interactive manner. As for a change in behaviour you need extensive effort and learning is not a singular session. One of the project managers indicated it as follows: education is succeeded if you do not have to think all the time about what you learned anymore, but that it
is just normal knowledge to you. The project managers within Fluor indicate that they have limited experience with system and lessons-learned database. There is a perception that it cost a lot of time, there are too many lessons-learned and they cannot find the right lessons-learned.

**Personalities** that are important for the lessons-learned reuse are **result-driven, openness, confidence and perseverance** and **action-oriented**. Result-driven is indicated as a personality character that if you have the capability to see the end result of the lessons-learned, too see the process to this result and most importantly too see the importance of the lessons-learned application. The definition of end result goes further than the job description for the lessons-learned. Openness is indicated as are project managers really open to other people’s opinion by lessons-learned, open to improve oneself, and eager to learn. Most project managers’ stress they became more open due to project- and work- experiences, especially in the field. Confidence is seen as not afraid to ask questions, swim against the mainstream and routines and being eager and **persevere** to successfully finish the lessons-learned. At last, the project managers indicate action-oriented as to try to prevent failures before they happen.

**Evaluation apprehension** is indicated as not feeling attacked by other persons or lessons-learned if it has a different opinion about your practise or way of doing, but to embrace the value.

**Motivational dimension**

In this part the motivational dimension of the project managers is described. In general all project managers indicate they are motivated by the higher level benefits of re-using lessons-learned. Additional motivation is also perceived as the lessons-learned reuse contributes to a more personal goal. As well, the project managers are motivated by attitudes of comprehension and feeling responsibility and interpersonal and reputational trust. Furthermore, the belief of knowledge ownership is an essential contributing factor. The factors will be elaborated in the next paragraphs.

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Perceived benefit Project results</td>
<td>15</td>
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<tr>
<td>Attitude Comprehension</td>
<td>13</td>
</tr>
<tr>
<td>Attitude Feeling responsibility</td>
<td>13</td>
</tr>
<tr>
<td>Team level trust en cohesion</td>
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<tr>
<td>Belief of knowledge ownership intention &amp; implementation &amp; results</td>
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<tr>
<td>Belief of knowledge ownership Manageable amount of lessons learned</td>
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<tr>
<td>Perceived benefit Personal and team development</td>
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</tr>
<tr>
<td>Trust</td>
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<td>Fruite / credits</td>
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</tr>
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<td>Attitude Commitment</td>
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<tr>
<td>Perceived benefit Client satisfaction</td>
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<tr>
<td>Perceived costs Initial effort</td>
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<tr>
<td>Attitude Pro-active problem solving</td>
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</table>

*Figure 26 appendix: factors in the motivational dimension*  

**Findings on perceived benefits and costs**

**Perceived benefit** in the form of **project results** is mentioned as the most central factor. Although, the project managers say in general that results of lessons-learned are difficult to identify in the overall project results and that if the results of lessons-learned show up clearly, it will be in a late phase or at the end of a project. Nonetheless, several project managers indicate that the process goes smoother and faster due to the fact that lessons-learned prevent issues during execution. Further, lessons-learned are mostly not complex issues and/or solutions and could therefore be a quick win. Other project managers only use lessons-learned if it directly and with high impact influence the project results.

In some cases, the project managers mention they are able to really see the benefit of lessons-learned for the project result. This is due to the fact that they have been to construction site or other work experiences which have led them see that the finish of a project is the most important and not the document which is in your job description. Other benefits the project managers indicate is that lessons-learned do not
necessarily have to be followed exactly, but can also be used as attention point before developing a solution and adapting it to the situation at hand for better results.

Additional perceived benefit managers indicated were personal and team development and client satisfaction. Although indicated less, the personal and team development were seen as vital factors, since in the end the ultimate goal for project managers is to develop him/herself and his/her team to be superior after the project has finished and to be more valuable for future projects. As well, project managers’ focus on lessons-learned were they have a feeling they or the team, have room for improvement. At last project managers indicate that client satisfaction is a stimulating factor, as they are obligated to the client to execute their work properly, but also to prevent negative encounters. Although, a client who is too negative all the time works adverse in the motivation.

Perceived costs of initial effort are indicated by the project managers as challenging. First, this is due to the project climate at the beginning of a project, when lessons-learned are indicated, the project itself is already demanding. Second, it is not that the lessons-learned itself are a lot of work to execute, but merely that you need to communicate and persuade others that it saves work, and that you have to invest time and effort in finding and assessing lessons-learned. This is time and effort which you might never get back.

Findings on attitudes
Attitudes of Comprehension, feeling responsibility and commitment are indicated as significant motivating factors. Comprehension for lessons-learned is to identify usefulness and to understand the results of re-using lessons-learned, the intention to do yourself and your team a favour by investing time and effort on re-using lessons-learned in the beginning of the project leading to a more successful project execution and results later. Project managers with comprehension have seen the consequences by work experience, are result driven and have reduced self-efficacy for a particular situation. The perception of usefulness of lessons-learned is also influenced by team characteristics and culture, and own versus others people’s lessons-learned.

The attitude of feeling responsibility is characterized by responsibility to the client, yourself and your team, and your work. The project managers feel obligated not to make a mistake twice, take as many precautions as possible and supporting your team. Feeling responsible is also related to the task description, duration at the job, and perceived management support. The project managers also indicate that feedback and monitoring will influence their attitude towards re-using lessons-learned. Genuine commitment ensures overcoming barriers and lead to actions. A reduced amount of lessons-learned, constructive communication, keeping on the (in)formal & visual agenda relate to stimulating commitment. The project managers indicate also that the attitude is different for pro-active and re-active problem solving. A pro-active attitude leads to preventing mistakes from happening and looking for possible positive lessons-learned. A re-active attitude leads to action when issues arise and therefore has to be solved urgently.

Findings on belief of knowledge ownership
The project managers are stimulated by belief of knowledge ownership in the intention, implementation and results. Successful intention is the result of project managers delving into and interacting with the content, context and author of the lessons-learned to increase the belief of knowledge ownership. This ownership is logically higher for own lessons-learned compared to other people’s lessons-learned, but it could be overcome. During implementation the belief of ownership is influenced by the degree the lessons-learned are associated with their achievement and duration they are responsible for the lessons-learned application. Therefore the more personally attached you are to the lessons-learned the more belief of knowledge ownership. Proper belief of knowledge ownership lead to strategy development to foresee a plan the future and to persuade that your lessons-learned is crucial. The belief of knowledge ownership for the results differs between the project managers, some are really individual focused and other team focused.
Belief of knowledge ownership in manageable amount of lessons-learned is an factor were all project managers where unanimous that it should be reduced to increase ownership and commitment within affordable time and cost spans. Ideally, project managers, but also engineers, should themselves come up with the lessons-learned they want to implement and it should be clearly communicated that these will be assessed at the end on the process and result. The project managers give a range of 3 to 5 lessons-learned as effective per person.

Team level trust and cohesiveness can stimulate the project managers in the process for re-using lessons-learned. It can help with stimulating each other with getting lessons-learned on the agenda, in the search question, in overcoming barriers, and understanding the importance of the lessons-learned. Although team level trust and cohesiveness is difficult to measure, it is perceived as vital part of the job description of the project managers. Team bonding, strategy and vision are means to help. However, the reuse of lessons-learned is still human work and mistakes can still be made if unconditional trust is employed on one person.

Trust on the lessons-learned is seen as motivating by the project managers based on the reputation and capability of the authors of the lessons-learned, the identified usability of lessons-learned and the possibility to interact. Trust is easier and uncomplicated if you can call someone you know than that you have to choose form a large database. Trust in the database is not really high and most project managers perceive over fifty percent clutter in there.

The project managers indicate justice and/or credits as a motivating factor for re-using lessons-learned. They perceive recognition and results as a justification of their effort which they put in re-using lessons-learned. This is the case for both sharing and using lessons-learned. The project managers indicate a scope for improvement in positive feedback and celebrating positive developments. As well, in connection with a central system and/or database they indicate they do not get credits or are not been done justice for the effort they put in. The project managers perceive that the lessons-learned get lost in the organization. They indicate this is not necessarily the case, but it is due to the inability of interaction with the system, loss of track and lack of credits.
All the factors described in the former paragraphs lead to a positive mind-set for intention and the corresponding behaviour for re-using lessons-learned. The project managers indicate the crux is in the mind-set the individual has towards re-using lessons-learned and work itself. This mind-set is motivated by factors from the environmental and the individual dimension.

The behaviour that corresponds with the reuse of lessons-learned is strategy development, routines and habits, active monitoring and decision-making. Strategy development stimulates creating comprehension for the process and results, early alignment, dealing with task uncertainties, commitment to reduced amount of lessons-learned, and foreseeing and planning for future critical mile stones and obstacles in the lessons-learned reuse process. Furthermore, it is critical for constructive communication and to prevent falling back in your old routines & habits. However, routines and habits are also indicated as valuable to easily and without a lot of effort execute most tasks and situations, which provides opportunity for selective improvement. Though, the project managers indicate it is difficult to change habits and routines when necessary, as for in example when re-using lessons-learned. Therefore to implement lessons-learned vast effort is needed to break the barrier of routines and habits.

The project managers indicate that active (continuous) monitoring should be added to the standard behaviour to support the process and leading to the desired result. As well, it could be a stimulating activity for future use of lessons-learned by feedback, recognition and incentives and its influence on the culture and the individual characteristics.

With feedback and assigning consequences the project managers should be careful and make sure it does not influence the knowledge sharing culture(komt bij culture vandaan)

The project managers also mention that in all factors the behaviour of decision-making plays an important role. First, many decisions have to be made on which, what, who and why and weighing a multitude of opinions, weighing the positive benefits and costs and determining where to look for and what to do with it. Second, the decision-making is not done alone and the project managers should make decisions which could count on enough support to reach consensus and commitment
### Appendix E: Discussion Excel

The excel model below forms the basis for the discussion. It links the factors to the different lessons-learned reuse process activities.

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<thead>
<tr>
<th>Dimensions</th>
<th>Importance</th>
<th>Clusters</th>
<th>Lessons Learned</th>
<th>Tools and Techniques</th>
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</tr>
</tbody>
</table>

**Investment / prerequisites levers**
- Financial
- Human
- Technical

**Process Imporance**
- Critical mass: early alignment
- Critical mass: awareness
- Critical mass: facilities
- Critical mass: energy

**Implementation & Monitoring**
- Active monitoring
- Internship
- Compliance
- Evaluation

**Validation (results)**
- Comprehension
- Retention
- Comprehension

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The excel model below forms the basis for the discussion. It links the factors to the different lessons-learned reuse process activities.
APPENDIX F

In this appendix the email, the assessment form and alterations to the key steps and actions of the recommendations are described.

EMAIL

Beste meneer ……

Naar aanleiding van uw gesprek met Merlijn Lojenga mail ik u. Graag zou ik de afspraak met u van woensdagochtend 09:00 willen bevestigen voor het evaluaren van mijn onderzoeksproject.


Wat ik wil doen

In mijn onderzoek heb ik de motivatie, ervaringen, persoonlijke eigenschappen en acties in kaart gebracht die het gebruik van lessons-learned door project managers stimuleerd. Hiervoor heb ik meerdere project managers geïnterviewd. Deze heb ik geanalyseerd en vervolgens een strategie bedacht om dit te verbeteren. In het interview wil ik een aantal vragen stellen zodat ik deze strategie en mijn onderzoek kan valideren. Ik wil graag mijn onderzoek toetsen op Werkzaamheid, kwaliteit, en bruikbaarheid.

Met vriendelijke groet,
Rickwin Huisman
**ASSESSMENT FORM**

General:
- How do you implement this in the organisation? (merlijn can help) (wie neemt de leiding van dit project in de organisatie? (mıllingen, 1 person verantwoordelijk))
- Team responsibility? Je moet iemand accountabile maken, vanwege grote hoeveelheid taken die iedereen heeft en die kunnen aantasten. Of je moet iets opzetten van teams voor hergebruik, bv 5 teams, en die incentives geven om samen te werken, bv scorebord en team prestaties op gebied van gedrag enzo.
- context in content van lessons learned... momenteel teveel anoniem gemaakt vanwege aansprakelijkheid klant en legal dus alles weggegooid. Moeten een manier vinden om weer context te kunnen geven, zonder dat het problemen geeft met legal.
- Who is responsible for actions and responsibility throughout the project? First top down for determination of the goals, potential succes elements, and criteria, afterwards a bottom up approach of collection lessons learned. And than top (pmt) decision making and combination of strategy and implementation. (plaatjes maken)

<table>
<thead>
<tr>
<th>INDIVIDUAL</th>
<th>MOTIVATIONAL STRATEGY</th>
<th>ENVIRONMENT</th>
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<tbody>
<tr>
<td><strong>EFFICACY</strong></td>
<td>A Formal Process is really valuable for Fluor good</td>
<td>Communicate organization and client goals for Fluor,</td>
</tr>
<tr>
<td><strong>INTENTION</strong></td>
<td>Pull in Responsible owner &amp; Help Human resource management</td>
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<tr>
<td><strong>QUALITY</strong></td>
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<tr>
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<tr>
<td><strong>DEFINITION OF SEARCH QUESTION</strong></td>
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<td>Implement lessons learned</td>
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<tr>
<td><strong>SEARCH OF EXPERTISE</strong></td>
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<tr>
<td><strong>EFFICACY</strong></td>
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<tr>
<td><strong>ASSESS &amp; SELECT AMONG SEARCH RESULTS</strong></td>
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<td><strong>ENDORSEMENT &amp; TASKING</strong></td>
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<td><strong>VALIDATION (RESULTS)</strong></td>
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**ALTERATIONS TO THE KEY STEPS AND ACTIONS**

The text highlighted in red were altered. These are incorporated in the final recommendations.