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Dissemination and communication of lessons learned for a project-based business with the application of information technology: a case study with Siemens

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Abstract
Lessons learned is one of the most frequent practices associated with project management and knowledge management. With the recent development on a knowledge-based economy and project-based work, organisations gather and store their lessons and knowledge gained from projects to avoid 'reinventing the wheel' in other projects and to improve their effectiveness and efficiency. They have also been seeking good learning mechanisms in place to disseminate knowledge and experience at the group and organisation levels, and to develop a procedure to support project-based learning. However, business organisations have often failed to implement lessons learned and knowledge in their future projects. Therefore, this study is to conduct an in-depth case study in Siemens to gain a deeper understanding in the perception of the individuals on barriers and enablers of implementing lessons learned. This study is also interested in providing practical recommendations on how to enhance the dissemination of knowledge throughout the organization. The results of this study show that the retrieval of the information is a major barrier to lessons learned. To encourage more informal learning, organisations need to adopt different information communication systems, including social media, and support learning with appropriate organisational culture and structure.

1. Introduction

Since the 21st century, British manufacturers have been facing growing global competition, higher customer expectations, and dynamic and changing business environment. These factors fostered two important trends in British manufacturers. Firstly, they shifted organisations' focus away from competing solely by their products and technological assets and made them see knowledge as a vital resource for success (Maqsood, *et al*., 2007 and Claver-Cortés, *et al*., 2007). The idea of a knowledge-based economy in which organisations need to gather and store their knowledge for competitiveness and innovation has been widely accepted from both researchers and practitioners (Argote *et al*., 2003 and Anand *et al*., 2010). With the rising acceptance of a knowledge-based economy, the number of research in the area of knowledge management (KM) and organisational learning has been increased significantly. The second trend is the boost of organisation transition from a merely functional structure to a more project-based structure (Maylor *et al*., 2006 and Williams, 2008). Project-based work enables companies to adapt to a rapidly changing business environment, and improves servitisation and customer focus (Keegan and Turner, 2001, and Disterer, 2002). Together, these trends present companies with a new problem, which is called the "project learning paradox" (Bakker *et al.,* 2011, p. 494). Although projects are seen to be especially suitable to create, acquire and transfer knowledge, business organisations have often failed to capture lessons and knowledge after project completion. This is mainly due to the cross-functionality and temporary nature of projects. Projects are "inevitable discontinuities […] in the flow of resources (especially personnel and information), across time and space, from one project to the next" (Bresnen *et al.*, 2003, p. 158). The nature of projects leads to the decentralisation and fragmentation of knowledge (Disterer, 2002). When project team members move on, all of the created knowledge seems to disappear (Schindler and Eppler, 2003 and Bakker *et al.*, 2011). Milton (2010) found, in a study of 70 organisations, that more than 80% of them introduced lessons learned from projects (as an approach to KM) but over 60% of them were not satisfied with the results. To develop project-based businesses, manufacturers need specialised KM systems to enable the retrieval of relevant lessons from each project in order to cope with uniqueness, uncertainty,

and complexity, and to establish learning as a continuous process within organisations (Perez Lopez *et al*., 2004).

With the development of information technology, various KM systems were developed to support project-based learning and avoid 'reinventing the wheel' in other projects, and to promote group learning and organisational learning (Madsen and Lindegaard, 2017, Weber *et al*., 2001 and Bresnen *et al*., 2003). While the early work that came from information technology (IT) is for managing knowledge, more recent attention is from the organizational learning literature, with a more social perspective on KM. Although business organisations made huge investment on KM systems to capture knowledge and experience for their future work and support organisational learning, the return on investment is little. Several studies have investigated the barriers and problems in regard to KM (Schindler and Eppler, 2003, Williams, 2008, Duffield and Whitty, 2015 and Hartmann and Dorée, 2015). However, the majority of them proposed holistic frameworks and concepts for learning which tend to be rather descriptive (Jugdev, 2012). There is a lack of studies with practical approaches to lessons learned from projects. Lessons learned from projects are complex issues that involve people, processes and technologies. How to transfer knowledge as well as encourage learning from and across projects becomes a major problem in the literature in operations management or computer science (Duffield and Whitty, 2015 and Hartmann and Dorée, 2015). Tan *et al*. (2006) further pointed out that in most cases it is knowledge dissemination and application that leads to the failure of a KM system.

This research aims to investigate how IT system can support the dissemination of lessons learned from projects throughout organisations. Both push (passive) and pull (active) disseminated activities will be studied to support organisational learning. A case study on Siemens Power Generations, which struggles to effectively share lessons from projects and strives to identify the best approaches to facilitate learning from projects, was conducted for this research. Various qualitative research approaches have also been applied to this case study, i.e. cross-sectional interviews, analysis of company documents and informal conversations. This study gives an insight on barriers and enablers of the lessons learned process and investigates how IT systems can support lessons learned dissemination throughout the organisation. This study will contribute to the existing literature by understanding the employee perspective of lessons learned, to help managers motivate individuals to learn, and to develop appropriate organisational culture and structure to encourage learning. Based on the findings of the study, recommendation on changes are provided, including a discussion of the use of social networks and social media. The remainder of this paper is structured as follows: Section 2 reviews the literature on relevant lessons learned research topics, i.e. project management, organisational learning, KM and KM system. Section 3 is concerned with the research design of the study, including data collection and data analysis. The findings of the study are presented and discussed in Section 4. Conclusion including a short summary and limitations to the study and a prospect on future research is drawn in Section 5.

2. Literature Review
2.1 Lessons Learned from Projects
Lessons learned is knowledge or understanding gained by experience, which must be assumed to have significant impact on future operations to improve organisational learning (Carrillo *et al.,* 2013). It is one of the most frequently research topics on KM practices associated with project work. Individuals can learn lessons from either positive experience to spread best practices or negative experience to avoid making the same mistakes again in the future. Due to the cross-functional and transient nature of projects, researchers see lessons learned from projects as especially suitable for creating knowledge and link them in many ways to KM (Schindler and Eppler, 2003 and Bakker *et al*., 2011). Perez Lopez *et al*. (2004) even stated that KM and learning go hand in hand. However lessons learned are not an overly simplistic KM practice (Jugdev, 2012). Lessons learned needs a personalised, self-directed

process as well as highly subjective and social construct. Several studies have found dissatisfaction with the lessons learned approaches (Keegan and Turner, 2001 and Milton, 2010). In addition, the literature suggests that organisations are often concerned with the identification of lessons rather than the dissemination of the lessons. Various practices, like lessons learned workshops, after action reviews, post project appraisals/reviews, project milestone reviews and project audits, have been developed to identify lessons to learn (Jugdev, 2012 and Duffield and Whitty, 2015). While some people mistakenly think that the process ends after capturing lessons, lessons learned from projects actually start after these practices. Accordingly, Weber *et al.* (2001) stressed that there is a difference between identified and stored lessons, and actual lessons learned which need to be implemented and reused. Knowledge application and implementation often require a significant effort, commitment, and understanding of people behaviour at both individual and organisation levels. In fact, organisational learning from projects rarely happens or fails to deliver the intended results (Keegan and Turner, 2001). Williams (2008) further stated that there is a need for wider research into how lessons from projects can be disseminated throughout an organisation and incorporated into organisational practices (Duffield and Whitty, 2015). In most cases it is the dissemination and application of the knowledge that lead to the failure of KM (Tan *et al.*, 2006). Therefore, how to disseminate knowledge throughout an organisation and promote organisational learning is the aim of lessons learned from projects.

2.2 Lessons Learned to Contribute to Organisational Learning

Individuals and organisations learn knowledge not only by passively adapting to the demand, but also by actively selecting aspects that provide opportunities for incorporation into their own needs (Bateson, 1972 and Chia, 2017). Individuals compared the information received to their existing knowledge and constructed new knowledge and understandings based on what they already knew and believed. However, individual learning is not automatically organisational learning (Argyris and Schön, 1996 and McClory *et al.*, 2017). In contrast to humans, who have the central nervous system to process information, organisations need to create analogous structures to enable the individuals to learn as one holistic group (Duhon and Elias, 2008, and Duffield and Whitty, 2015). Individual learning is the first vital step to enable group learning and consequently organisational learning. While it is true that organisational culture, procedures and processes might influence learning, it is still the individual who has to perform the task. This study thereby emphasizes that firstly the individual has to learn before the whole organisation can benefit. It agrees with Duhon and Elias (2008), who stated that an 'organization knows something if at least one member knows it' (p.5), however to get from individual learning to organisational learning the information needs to be independent of one particular individual and therefore needs to be shared and distributed throughout the organisation. Wilson *et al.* (2007) reviewed research papers on group learning and stipulated that "group learning occurs when the members possess both the knowledge […] and an understanding that others have the same knowledge, and it is a property of the group" (p.1045). This means that the knowledge now is independent of any particular individual and a new group repertoire exists. Hence, group and project-based learning can be seen as a precursor to organisational learning and often, instead of focussing on information sharing between individuals, researchers concentrate on group-to-group learning or inter-project learning (Prencipe and Tell, 2001 and Hartmann and Dorée, 2015). Organisational learning is supported by the knowledge bank through KM system, but in order to be realised, it must be accompanied by individual learning (McClory *et al.*, 2017).

2.3 Barriers to the Lessons Learned from Projects

Despite the efforts made, progress in improving lessons learned from projects appears to be slight (Hartmann and Dorée, 2015). We followed the framework developed by Nakamba *et al.* (2017) for the literature review via identifying sources and keywords; selecting articles; classifying articles; and analysing data. As the keyword "project based lesson learned" is not widely accepted and used in academic journal publications, we refined search strings and eventually identified them as

"learning/knowledge sharing/knowledge management", "project management" and "organisational learning". We were particularly interested in these topics with the implementation of IT system and published in peer-reviewed journals with good citations (Nakamba *et al.*, 2017). The literature review revealed various barriers to lessons learned (Table 1), which were divided into nine main groups: (1) a lack of resources, (2) a lack of motivation, (3) a lack of perceived value, (4) no cultural acceptance in which people do not want to learn from others and there is a blame culture, (5) a lack of management support, (6) lessons learned process is not included into the project work, (7) the project environment in that projects often are unique and quite specific, hence difficult to compare, (8) a poor IT system, which is difficult to access and (9) bad quality and thereby no applicable information in database.

Table 1: Barriers to lessons learned

Author	Year	Journal	Research Findings	Coded barriers
De long and Fahey	2000	The academy of Managemetn Executive	-Research in more than 50 companies found organizational culture as major barrier -Culture influences the perception about useful important or valid knowledge -Culture dictates what knowledge belongs to the organizaiton and what knowledge remains in control of individuals -Culture influences social interaction and communication -Culture shapes adoption of new knowledge	-Organisation: cultural acceptance
Disterer	2002	Disterer Journal of Knowledge Management	-Projects lead to decentralization and fragmentation of knowledge -Necessary work after project must be dropped due to missing time resources -No open and constructive atmosphere to analyse errors -Prospective benefit for single employee to vague	-Project environment -Lack of resource/time -Organisation: cultural acceptance -Value
Tseng	2008	Expert System with Application	-No way of systematically recording knowledge -Complicated to search for and retrieve documents	-Quality of the information -IT system
Julian	2008	Project Management Journal	-Study with interview of 20 project management office leaders -Lack of authority of facilitators -Time pressures -Staff rotation -Fear of airing mistakes publicly -Lack of senior management support -Difficulty in accessing past lessons learned -Reflection just at the end of the project	-Lack of resource/time -Project environment -Organisation: cultural acceptance -Lack of management support -IT system -Project integration
Bartsch *et al.*	2012	International Journal of Project Management	-Unique and discontinuous nature of project-based work -Lack of comparability of projects -Lack of motivation due to unclear value -Competition between project teams due to scare resources.	-Project environment -Motivation Value -Organisation: cultural acceptance -Lack of resource
Carillo *et al.*	2013	International Journal of Project Management	-Study with 41 construction contractor organizations -LL only at the end of a project -Not wanting to share problems or to learn from other people's mistakes -LL are repeated, already exist in a different format -No motivation due to lack of perceived value -Internal competition -Reduced quality of data due to legal concerns -Silo environments of project team, lack of communication -Lack of time -Culture of blame.	-Project integration -Organisation: cultural acceptance -Value -Motivation -Quality of the information -Project environment -Lack of resource/time
Ranjbarfard *et al.*	2014	Journal of Knowledge Management	-Study at Iranian gas and petroleum companies -Categorise and rank barriers according to people, technology, process/organization, environment and knowledge type -Lack of appropriate reward -Lack of technical support of integrated technology -Weak performance measurement system -Lack of teamwork -Lack of time.	-Value -Motivation -Organisation: cultural acceptance -IT system -Lack of resource
Hartmann and Doree	2015	International Journal of Project Management	-Time constraints -Lack of perceived value, unclear purpose -Needed balance between generalisation and specification -LL not part of the project work.	-Lack of resource/time -Value -Project environment -Project integration
Duffield and Whitty	2015	International Journal of Project Management	-Time pressure -Poor IT -Blame culture -Knowledge is power -Social barrier.	-Lack of resource/time -IT system -Organisation: cultural acceptance

Most studies in the literature focus on the key reasons of the difficulties of sharing knowledge, not the situated nature of knowledge. According to learning theories, learning is embedded in practice, context and culture (Jugdev and Wishart, 2014), and developed through interactions with other people, not only in their own mind (Hartmann and Dorée, 2015 and Duffield and Whitty, 2015). This study thus considers the influence of organisational factors, project procedures, and information systems to investigate lessons learned from projects from a practical aspect rather than a theoretical aspect. The first research question of the study is to address the main perceived barriers: *How do employees rate*

the importance and success of the lessons learned process and what do they perceive to be barriers to the learning from lessons?

Individual employees as the end-users of lessons learned from projects are responsible for the retrieval of stored lessons and apply them to their future projects. Therefore, this study is also interested in enablers to the individual learning. *How can the employee's individual learning be facilitated and how can employees be motivated and attracted to actively learn and share knowledge?*

2.4 Knowledge sharing and knowledge management system
The knowledge-based view suggests that the goal of an organisation is to encourage the efficient utilisation of individual knowledge (Sarin and McDermott, 2003). Effective knowledge sharing can help individuals and project team members to exploit knowledge-based resources, and capitalize on them, which will contribute to sustainable competitiveness of an organisation (Davenport and Prusak, 1998). Nonaka (1994) created a framework to explain the conversion and sharing of explicit and tacit knowledge and postulated four different modes. It can be seen as a cycle of knowledge conversions in order to generate group knowledge. Several frameworks and models have been designed for KM. One of the most popular seminal frameworks is SECI-model by Nonaka and Takeuchi (1995). In the SECI-model knowledge flows through different modes in a spiral form, with the interaction between tacit and explicit knowledge being strengthened through each mode (Nonaka *et al.*, 2000). Lessons expected to be learned from projects are tacit knowledge, which is personal, and difficult to formalise, communicate and distribute to others (Nonaka and Takeuchi, 1995). While the importance of KM is widely accepted by organisations, this is not always done effectively and systematically. Carrillo *et al.* (2013) stated that a big problem is that most lessons are 'tacit' and held in peoples' 'heads' or 'minds' and therefore cannot be captured easily. Fong and Chu (2006) found in their research that 48 % of UK construction contractors are unable to access the knowledge they require using practices in place.

In recent years, with the development of IT, several technologies have been suggested in the literature as knowledge repositories, i.e. intranets and extranets, competitive intelligence portals, social network platforms, online discussion forums, and e-learning platforms. The IT based KM systems make use of techniques that allow users to simultaneously store and process information effectively. They in many ways support organisational KM process, particularly for knowledge sharing. The benefits of knowledge sharing are well documented including creating new knowledge, developing skills, improving problem solving, improving organisational performance and sustaining competitiveness (Darroch, 2005). By implementing IT, business organisations efficiently manage organisational knowledge and create company-wide knowledge repositories which map the internal expertise of the organisation (Alavi and Leidner, 2001). The Ford Motor Company managed to cut their car development time from 36 months to 24 months through internal knowledge sharing (Alavi and Leidner, 2001). While the intentions of KM systems are good, some researchers criticise overreliance on IT and little contributions to individuals (Beach, 2004 and Duffield and Whitty, 2015). Sarnikar and Deokar (2017) even stated that KM systems are often implemented as separate systems independent of business processes.

2.5 Implement Information Technology for Lessons Learned
Project-based businesses require a consistent organisation-wide database to enable the retrieval of relevant lessons. Effort has been put in to updating the system to prevent the falling into disuse due to obsolete information, or into misinterpretation through the lack of contextual information (Hasan and Crawford, 2003). However while people think knowledge has been created and updated with a database, in most cases it is the dissemination and application of the knowledge that leads to the failure of a KM system (Tan *et al.*, 2006). Wijnhoven (2003) claimed that a lot of KM systems failed, because their complexity is underestimated and usually fail to live up to the expectations regarding the

dissemination of knowledge. Knowledge can be disseminated by push (passive) and pull (active) activities (Andrade *et al.*, 2008). Push dissemination takes the initiative to either broadcast lessons as bulletins or actively cast information according to people's interests and job roles (Weber and Aha, 2003). In contrast pull dissemination relies on the individuals to search for relevant information and common used systems are repositories or databases (Chirumalla, 2016). Lessons learned is not only to push the knowledge to individual passively, but is active learning pulled by individuals via knowledge seeking (Yuan *et al.,* 2013). Searching processes are thus critical for active lessons learning. They take individuals through encountering pieces of information and lead to new directions and ideas until satisfying knowledge is gathered (Bates, 1989). For example, area scanning strategy can be especially seen in a physical library, where the surrounding areas of a found piece of information are also investigated for relevant information. This searching strategy can be adopted to web databases by including a section like 'other users also looked at' (also used by Amazon). It has been stated that the more different strategies searchers can use, the more retrieval effectiveness and efficiency is possible (Bates, 1989). However, the most common approach to start searching for information is a keyword search, like used by Google. Studies have found that this type of search supports the users, who do not specifically know their target (Wilson *et al.*, 2009). The searching process of an individual might not be well-formed at the start, but evolves and focusses through encountering new pieces of information, which in turn can lead to new directions and ideas to search until satisfying knowledge is gathered (Bates,1989). Understanding individual different searching strategies can also help them to adapt IT systems better and to meet their individual behaviour requirements in order to promote learning.

Recently more and more research investigate social networks and informal knowledge sharing in order not to depersonalise employee interaction (Davison *et al*., 2013). A social network is combined with various other media tools, such as interactive IT communication tools, videos, audios, or photos, and feedback systems (Davison *et al*., 2013 and Kwahk and Park, 2016). Through a social network, individuals can easily share not only their explicit knowledge through written communication, but also their tacit knowledge, which may be difficult to express in written form (Kwahk and Park, 2016).The use of a social network model or knowledge map allows people to depict colleagues with different types of expertise and to have a positive influence on knowledge sharing (Newell *et al.*, 2006). In addition, knowledge sharing is a social-relational process, which individuals need to establish a shared understanding and the potential abilities to transform this understanding (Boer, 2005). Social network allows individuals to initiate their diffusion which is a bottom up approach. This attracts individuals and groups to spread their knowledge cross their network. This process is different from traditional collaboration tool where users have passive roles in the process. Taking the aforementioned subjects into account the last research question will be *How can information technology enhance dissemination activities and facilitate learning from projects?*

3. Research Method
3.1 Case Study
Case studies are widely used in business research and focus on understanding the dynamics present within single settings (Eisenhardt and Graebner, 2007). They allow the questions to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon (Voss *et al.*, 2002). Unconstrained by the rigid limits of questionnaires and models, case studies can lead to new and creative insights, development of new theories, and have high validity with practitioners (Voss *et al.,* 2002). A case study was chosen for this study to understand why organisations are struggling with lessons learned processes and to give them practical recommendations for future improvement. With the overall aim to give practical recommendations to a specific problem, this research adapts a pragmatist stance, which allows the adoption of different philosophical concepts in order to answer the research questions in the best way. Pragmatism has a relevance-to-practice principle and "seeks relative rather than absolute truths" (Watson, 2011, p. 208). The research therefore accepts that

different people with different backgrounds and different roles create different meanings. The validity of case study can additionally be increased by triangulation of data collection methods, thereby this study uses cross-sectional interviews as well as the analyses of company documents and informal conversations (Voss *et al.*, 2002).

3.1 Case Company

Siemens Power Generation is a Siemens AG subsidiary dedicated to repairing and maintaining gas, steam turbines and generators, and offer specialist assistance on maintenance and operations services to power plants. It nowadays has also specialised in service operations additional to traditional manufacturing processes. In recent years, Siemens have been striving to seek an effective approach to compete on value. They are trying to change their focus from what to offer to what value the offer bring to their customers. Therefore, they shifted from the mere production and assembly of finished goods with a product-service oriented system. Such a process, leading to the offering of a unique combination of product and service, is more difficult to replicate than the mere products. This will also provide opportunities for business innovation and increase long term profitability.

The case company overall retains its functional organisational structure, the employees sit according to departments, while at the same time different individuals are members of different project teams. Although a cross-functional project team is created for each project in order to provide high quality customised service, and at the end of projects, there are lessons learned sections facilitated by a neutral moderator. The company is struggling on two aspects 1) The gathered information after each project is not used regularly and the knowledge does not spread through the organisation; 2) Different databases cross departments have been adopted. The gathered information is stored at the departmental local SharePoint and not shared with other departments. These scenarios have made the knowledge more vulnerable by increasing the possibilities of losing it which could also compromise customer service. The case company seeks a new effective IT system to allow the data transferred/combined.

3.2 Data Collection

Across-section individuals were interviewed in order to ensure a highly diverse view on the topic. The rationale for gaining a heterogeneous sample is that any commonality found across a diverse group of cases is more likely to be a widely generalisable phenomenon (Robinson, 2014). Overall eight semi-structured interviews and various non-standardised informal conversations were conducted in order to find out people's perceptions. Before each interview the participants received a cover letter, stating the aims of this study, the contents of the interview, the voluntary nature of the participation and the protected anonymity (Robinson, 2014). All interviews lasted 40-60 minutes and were recorded to support a detailed analysis of the answers (Yin, 2003). While there was an interview scheduled with fixed questions and topics, according to the answers of the respondents additional or different questions were asked (Eriksson and Kovalainen, 2011). At the end of the study each interviewee had the opportunity to raise any issues which were not addressed during the interview.

In addition to the aforementioned interviews, company documents i.e. procedures, project reports and lessons learned documents, were examined in order to get a better understanding about the status quo. Seeing the limited time frame of the study conversations, meetings and informal discussions were used to complete the gathered informal information. Some of the findings of this were afterwards addressed in the interviews.

4. Data Analysis and Research Findings

CAQAD tool NVivo 11 was used to analyse the audio-recorded data and a three-stage coding scheme suggested by Strauss and Corbin (1998), namely open, axial and selective coding was followed.

4.1 Barriers to the Lessons Learned from Projects

The first research question on the barriers to lessons learned was analysed by a deductive content analysis following Elo and Kyngäs's approach (2008). The answers were coded and allocated according to the pre-formulated thematic scheme from the literature (Yin, 2003, and Eriksson and Kovalainen, 2011). After the open coding of the literature, the identified issues were grouped together to ten main barriers according to their relations (axial coding). For a further level of abstraction, those barriers were then allocated to four main categories, namely technology, people, project work and organisational factors (selective coding). The preformulated topics were then used to analyse and code the interview answers to test which barriers are existent. Table 2 shows the answers given by the participants regarding perceived barriers.

Table 2: Coded and analysed answers to perceived barriers

Literature	Interviews							
	Participant A	Participant B	Participant C	Participant D	Participant E	Participant F	Participant G	Participant H
Project Environment	At project end, assigned to new projects		Projects sometimes one-off, too specific	No communication of LL to people not involved in project	Limited sharing due to differed projects	Only project team know; lack of communication		
Project Integration			Need to be fed back into new projects; it is not daily routine yet	Only lessons learned on larger projects	Time between lesson learned and projects end; LL as after thought;	Make it happen as soon as projects end;	Workshop long after activities, only at the end;	Not mandatory to attend workshops;
Organisation Cultural Acceptance		Culture of just satisfy the process; point-scoring at meeting;	More ticking the box; People too defensive;	Lessons learned not high priority; personnel affects atmosphere	Not contract work but admin; can't be bothered;			
Value		People repeatedly coming with same issues;	Ticking the box rather than value adding;		Other things more important;	Lack of awareness of need to troll through lessons learned;		Other things to do; don't find things of use;
Lack of Management Support					Not implemented because of management decision;		Lack of management support to improve system;	
Lack of Resource/Time	People need to take time; lack of resources;	Need more common discussion but no time;	Lack of time	Lack of time	Lack of resources and time;			Lack of resource; No time;
Ownership of Follow-up Action	Need improvement on "follow-up";	For somebody else to deal with it;	Ownership of following up actions;			Lessons not implemented;		
Motivation	Sit and read through; People take time; Motivation until end;	Relies on one people reading it; repeatedly same issues; demotivation;	Too much reading;	Troll through lot of lesson learned;	Can't be bothered;	Troll thought all that; demotivation because lessons not be implemented;		Not turn up to workshop because something more important to do;
Quality of Information	Consistent form; need full story;	Identify lesson learned not comprehensively;	Might miss main issues;	Not applicable information; not really clear;	Few bits might get missed;	Irrelevant information needs to be filtered out; often too general;	Lot of irrelevant information;	Not always capture all the information;
IT system	Multiple database; Documentation and retrieval difficulties;	Waiting through lots of information; massive list;	Find relevant information; grainy list of actions; multiple, different databases;	Troll through lot of lessons learned; list of every problem;	Don't know where to look	Just a list of projects; need to be better filtered;	Just listed by projects; hard to search;	Perceived as difficult to find; need to know what to look for;

The frequency of the statements was recorded in order to rate the respective importance of each barrier. Figure 1 shows the percentage of respondents, which mentioned perceived barrier.
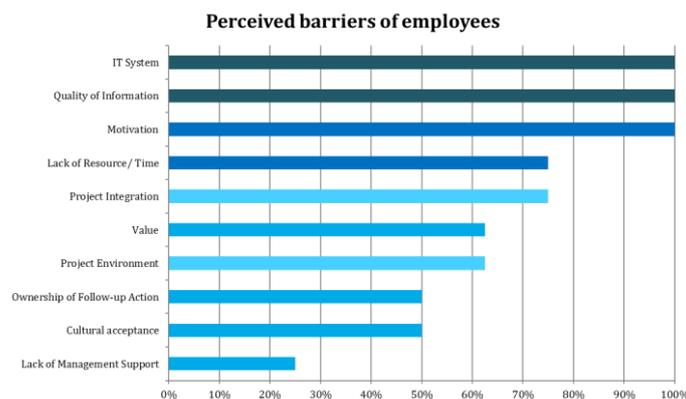

Figure 1: Frequency of perceived barriers mentioned during interviews

All interviewees stated that the retrieval of the information is a major barrier to lessons learned from projects. The old database, as well as the local SharePoint, lists the lessons learned information with limited functions. While the old database consists of a list of individual lessons, at the local SharePoint all lessons are grouped together in a project report, but again those reports cannot be searched for directly. *"You have to have a reasonable idea on what you are looking for. Because if you are just going in blind and starting to troll through all the information there, it will take forever"* (Participant H). Interviewees also stated that the information in the databases is a *"massive list"* (Participant B), which is *"very difficult to analyse"* (Participant A). One participant even stated that he does not know where to find relevant lessons learned information. Also all respondents mentioned their concerns on the quality of the information in the databases. Some information is simply *"irrelevant"* (Participants F, G) and should be filtered out, others mention that *"not all of the important issues get captured"*, especially because *"sometimes the workshops take place long after the end of a project"* (Participants E, F, G). Halawi *et al*. (2007) also found that information quality is significantly related to future uses. Higher-quality information better fulfils users' needs, thereby users will increasingly use it.

There is a new perceived barrier mentioned by serval interviewees – ownership of follow up action. *"In every lessons learned, you should, normally it all segregates the problem. Somebody needs to prevent it happening again. Like, someone to take ownership of the problem"* (Participant D). This means the interviewees are interested to know how lessons created from previous projects benefit their future work. They would like to involve their department for group learning. *"How, as a group or as a department, the lessons associated with them will get the information and learn from the lesson"* (Participant F). When individual people who are personally involved in creating the lessons or problem solving processes, they often want to be a part of a project's documentation and to know the contribution of the lessons they created. If there are follow-up actions, they usually take their new experiences with them and share with other people when they return to their line functions after having completed their tasks in projects (Argyris and Schön, 1996).

It is also very interesting that none of participants directly saw the employee's motivation as a barrier although they perceived it as a significant influencing factor. In fact, respondents often linked the employees' motivation to other barriers. For example, they see a link between motivation and the lack of time and resource of the employees, because there is *"too much reading and reviewing"* (Participant C) and it does not seem to be *"effective"* (Participant B). The interviewees also acknowledged that lessons learned is *"not high priority"* (Interviewee D) and the process is more a *"tag on, it's an afterthought"* (Participant E), which eventually correlates with the cultural acceptance and the integration of the lessons learned process in the project work. Some participants see a demotivation in the fact that the follow-up actions are not implemented. *"I think the big thing that puts people off lessons learned is that bit, where they, if they're repeatedly coming with the same issue and they do not see anything happen"* (Participant B). *"It's fine that all these meetings are assayed, but if we do not follow and close all the actions, the whole process is a waste of time"* (Participant C).

Overall, every barrier found in the literature review was mentioned during the interviews. Although the employee's own motivation was never mentioned directly as a barrier, demotivation was mentioned as a result of the other barriers. There are various issues which can demotivate employees. For example, participant A stated that people use IT system as an excuse for not researching the database. *"So regardless what system we have, people will always have problems"* (Participant A). Motivation needs to be seen as a crucial factor that drives and sustains the desired employee behaviour (Pinder, 2008), and influences an employee's willingness to participate (Turner and Pennington, 2015). Most studies stated that people share their knowledge for personal outcomes, i.e. self-esteem, expected to be viewed as skilled and knowledgeable. However, knowledge sharing

motivation stemmed from an expectation of community-related outcomes, rather than individual (Chiu *et al.*, 2006 and Ozlati, 2015). Although motivation alone might not be the constraining factor to influence individual behaviour, individuals also seek opportunities from the environmental or contextual mechanisms that enable action (Siemsen *et al.*, 2008). While there is lack of opportunities or abilities, individuals will be demotivated and sometimes blame other things. In order to prevent culture of blame, a positive organizational culture is needed to promote lesson learned. *"I think right culture needed for lessons learned. You do the lessons and then it's for somebody else to deal with how to implement the corrective measure. So we just put something in place to satisfy the process"* (Participant B). It needs to focus on the psychosocial interaction where individual, departmental, and organizational characteristics play a major role. One respondent mentioned that "*people sometimes might get too defensive in pressured situations and there might be 'point-scoring' in a way that people try to distract from their own mistakes, by pointing out mistakes from others*" (Participant E). To promote lessons learned, a supportive culture should offer employees development opportunities, encourage employees to improve their abilities and also engage the sense of collegiality, collaboration and sharing.

4.2 Enablers of Lesson Learned
To answer the second and third research questions a more inductive approach was chosen and the qualitative data from the interviews was coded without pre-existing topics. It was an iterative process. Findings and coded topics from the initial interviews have been reviewed after subsequent interviews. Voss *et al.* (2002) emphasise that the research needs to be aware of patterns even prior to the formal data analyses, since there is an overlap between data collection and data analysis. Again, the frequency of mentioned topics was used as a reference to establish a ranking on what people expect from a good lesson learned system.

It is very interesting to notice that the conception of motivation as a barrier changed further. All interviewees stated that incentives cannot influence their motivation to learn, instead learning has to be the employees' own drives. When asked about what would be the strongest motivation to learn, half of the participants answered that it is simply because they want to do a good job and achieve self-esteem. *"If a job goes well, it's a lot less stressful"* (Participant D). The other half stated that it is important to make the people aware of the benefits, not only personally, but also for the whole business. *"It's demonstrating the benefits to people. It's the improvement that we make. It should make everybody's job and life easier. It should get to greater customer satisfaction. In doing that the organisation probably get better business opportunities and become more profitable."* (Participant C)

All interviewees recognise the importance of lessons learned and have a self-driven motivation to learn, however the barriers affect their motivation. They stated that individual motivation is not easily influenced positively. In combination with the results of the first part of the interviews, it is reasonable to believe that although the motivation is not a barrier itself, it is a fixed variable and influenced and decreased by all the barriers. Facing difficulties with the IT system, not seeing follow-up actions of lessons learned implemented, all those factors decrease employees' motivation.

The interviewees pointed out that the overall open, productive and collaborative organisational culture as well as the group culture are important for lessons learned. *"I would say, the culture in this organisation is pretty good in terms of people wanting to do a good job."* (Participant H). They also stated that companies need to encourage learning at different levels not only during project team meetings, but also in their functional department members. The majority of respondents even agreed that it is a benefit that the organisation has a functional structure. *"We have a very good communication system within the business. Again the way we sit, it tends to make you appreciative even more, because*

you have all the other departments sitting very close to you. We do have meetings, but it's also easy for people to pick up the phone or just walk around and speak to people." (Participant F)

Respondents further pointed out that they discuss their problems via formally during meetings and informally conversations as well (see Figure 2). These open discussions are very valuable and in fact people rated learning through conversations and discussions as their second preferred way of learning-only after 'learning-by-doing'. The lessons learned practice, namely 'reflecting on actions', is the third preferred learning style. Everyone stated, that they would ask their colleagues for help and that they would be interested in that experience. At the same time, the motivation to share their knowledge and experience is high, simply in order to help others and "*make things as easy as possible for other people within the organisation". (*Participant H)
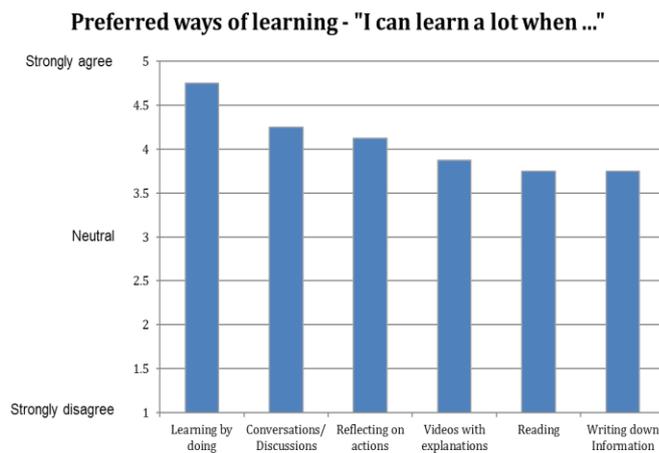

Figure 2: The preferred ways of learning

4.3 The implementation of Information Technology on Lessons Learned

Table 3 lists their expectations on information system. It is surprised to find that employees perceive IT system and the quality of information are main barriers after Siemens made huge investment in their IT systems. Respondents stated that they see the retrieval of lessons from the IT system as a major barrier and need improvements in this area in order to encourage the individuals to reuse the lessons learned information. In fact Duffield and Whitty (2015) stated that technology only accounts for 10% of the success of information system, the people factor accounts the other 90% as the main reason for failure. In addition, Siemens relies on their database for lessons learned. This is a pull dissemination method applied for the employees to search information. Yuan *et al.* (2013) found that these databases and digital archives typically do not have built-in tools that allow searching or communicating with document contributors, hence their value for developing awareness of expertise distribution and social capital is limited.

Table 3: Ranked expectations on information system

Expectations of a lessons learned database	Mentioned by
1. Effective, quality-filtered lessons	Participant A, B, C, E, H, G
2. Easy accessibility of information	Participant A, B, E, H, G
3a. Clear actions with indication about active measures in place	Participant C, D, F G
3b. Additional filter for departments	Participant A, D, E, F
4. Minimal maintenance and administrative work	Participant B, G
5. Short summary of lessons	Participant F

It is very interesting to see organisational culture and structure, projects environment and human factors been mentioned for the implementation of IT for lessons learned. Specifically the following three aspects have been highlighted:

Develop organisation culture and structure for both formal and informal knowledge sharing
The interviewees stated that information systems contribute to formal knowledge sharing but organisation culture and structure can help informal knowledge sharing. Similarly Davison *et al.* (2013) found in their case study that informal knowledge is often highly contextual in nature and held in a tacit form by individual employees. In contrast to formal information dissemination, people frequently rely on personal networks when searching for past experiences, through either asking someone they know or seeking an expert familiar to their contacts (Chirumalla, 2016). Active sharing of informal knowledge is very much part of the organisational culture. It also was derived from our interviews that the culture of the case company is open and collaborative which still exists in functional organisational structure. The close and open seating arrangements in the offices foster the informal knowledge sharing and conversation. This means that a mixed organisational structure would work for project-based manufacturing. This is in accordance with the view of Prencipe and Tell (2001) that 'pure project-based firms lack the organisational mechanisms for the knowledge acquired in one project to be transferred and used by other projects' (p.1391). The conversions with colleagues of the same department are formal ways of knowledge sharing and functional departments are also essential for their explicit knowledge. However, organisations need to prevent boundaries between departments being too rigorous, which can lead to internal competition (Sandhawalia and Dalcher, 2011 and Carrillo *et al.*, 2013).

Additionally, Claver-Cortés *et al.* (2007) emphasised the positive influence of fewer hierarchical levels, thereby a horizontal structure in order to encourage discussions and interaction between all staff members. Business organisations need to facilitate effective and easy communication channels for individuals and groups. This can include chat applications, instant messaging, social communities or forums, everything that fosters informal knowledge sharing. Through these informal discussion (socialisation) valuable tacit knowledge can be transferred. The idea to build up a social network, or knowledge map, something like 'internal yellow pages' with a directory about the participation of employees in projects, experience and expertise knowledge should be considered. This 'who knows what' directory provides employees with opportunities to access not only explicit knowledge codes, but actually with the source of the knowledge (Disterer, 2002, Newell *et al.*, 2006 and Andrade *et al.*, 2008).

Develop effective and easy use information communication system
Business organisations need to facilitate effective and easy communication channels for individuals. Davison *et al.* (2013) explained that interactive IT tools like chat applications 'are often preferred to face-to-face interaction between both co-located and distributed workers because they are unintrusive and commonly support multitasking'. The participants however expressed their preference of face-to-face interaction or telephone calls. Although the enterprise social media called Siemens Social Network is in place, they have not received the potential benefits from it. In the future, interactions as 'commenting' to provide feedback, 'bookmarking' to save information for a later point of use or 'tagging' to share relevant information with specific people, can be seen as big benefits. The use of enterprise social networks enables knowledge sharing by making it possible to unobtrusively traverse the activities and connections of others through media streams and notifications of user activity (Ellison *et al.*, 2015).

Interviewees mentioned the need for an additional category for searching relevant information when indexing lessons. This would simplify the searching process in a way that it filters relevant information.

Weber and Aha (2003) highlighted that indexing lessons learned according to applicable tasks rather than occurred problems will promote a retrieval based on applicability and hence will again simplify the search. Bates (1989) used "berrypicking" to describe a common approach to finding relevant and useful data. Berrypicking can include a mix of different searching strategies with a subject search, some abstracted or indexed topic (Bates, 1989). Instead of searching for potential problems they might face in the future, different searching strategies also let users find similar tasks and satisfy their needs for applicable and relevant knowledge. For example, visual data, like photos and pictures, can also be used for searching indices. Some lessons can be explained better with visual data, and therefore makes it easier for the individuals to understand the context of a lesson.

Refine project management processes
Lessons learned workshop should be a fixed routine in project work: Firstly, it is important to have the lessons learned workshop shortly after projects end, because the motivation for sharing their experience as well as the memories for the lessons are still fresh. Secondly, it is beneficial to start gathering lessons as the project progresses, because again, the memories are new and things that would have been forgotten in the end, still get collected. This ensures a consistent quality and especially language of data. It means no 'one-liners' as explanations of lessons and also that all lessons are inputted in the same language. Therefore, a fixed role with the responsibility to check the quality of the inputted lessons is recommended. It is also important to combine lessons learned database with individual profile, where users can pre-select their interests. This can have two benefits: on the one hand, this can support a push dissemination, sending alerts to the profile, when new interesting lessons are added (active casting). On the other hand, these profiles at best could be used in combination with the 'yellow sites'. Again the easy contact information might lower the inhibition threshold to contact the person and foster informal conversations.

5. Conclusion
Overall, this study sees lessons learned as a valuable tool aligning people, organisation and technology factors in order to help organisations to learn from their project experience. The literature lists a number of barriers to the process and especially stresses the people factors as the main reasons for the failure of KM system. In contrast to that, however, this research finds that the IT system rather than people factors acts as the main barrier to the lessons learned process and dissemination of lessons learned information. Although the employees are motivated to learn, the difficulties to find relevant and applicable information in the database are demotivating. Other concerns are the quality of the information and a lack of time, also emphasised in this study. This study also identifies the influence of organisational culture and structure on the effectiveness of information communication system. Apart from formal knowledge sharing, this research also stresses the importance of informal knowledge sharing for project based business. While it is crucial for an organisation to have a functional structure to support formal knowledge sharing and to facilitate organisational learning, informal knowledge sharing should also be emphasised through interactions of individuals within their departments and across different departments, especially for project-based businesses. The application of social networks and social media is very limited and would need to be expanded further in the future. This study therefore gives practical recommendations, regarding the lessons learned database in order to help the dissemination of knowledge through the whole organisation.

Future research needs to further discuss the potential use of social networks. At the moment, the use of companies' own social networks is not widespread, but the trend is growing. The use of social media in order to enhance informal information sharing and the influence of such platforms on social capital needs to be addressed in the future. Additionally, ways of increasing the motivation of employees should be investigated more closely in order to enhance the reuse of lessons further. Lastly, the interviewees indicated that there are not only ties between barriers and the motivation, but that there

are correlations between the different barriers themselves. Future research therefore should aim at defining the relationships between those barriers in order to give even more specific recommendations, which barriers might influence the reuse of lessons learned and individual learning the most.

By interviewing project team members from different departments, project managers and a senior manager, this study ensured a most differentiated view on the topic. However, it is lack of empirical data that limits the generalization of the results and recommendations. While some of the recommendations are specifically aimed at the studied organisation, it is still plausible to assume that most of the recommendations are equally useful for other organisations, since they are based on an extensive literature review.

Reference:
Alavi, M. & Leidner, D. (2001) 'Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues', *MIS Quarterly*, 25(1), 107-136.
Anand, G., Ward, P.T. & Tatikonda, M. V. (2010) "Role of explicit and tacit knowledge in Six Sigma projects: An empirical examination of differential project success", *Journal of Operations Management*, 28 (4), 303–315.
Andrade, J., Ares, J., García, R., Pazos, J., Rodríguez, S. & Silva, A. (2008) "Formal conceptualisation as a basis for a more procedural knowledge management", *Decision Support Systems*, 45 (1), 164–179.
Argote, L., McEvily, B. & Reagans, R. (2003) "Managing knowledge in organizations: An integrative framework and review of emerging themes", *Management Science*, 49 (4), 571– 582.
Argyris, C. & Schoen, D. (1996) *Organizational Learning II: Theory, Method, and* Practice, Reading: Addison-Wesley Publishing Company.
Bakker, R.M., Cambré, B., Korlaar, L. & Raab, J. (2011) "Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer", *International Journal of Project Management*, 29 (5), 494–503.
Bartsch, V., Ebers, M. & Maurer, I. (2013) "Learning in project-based organizations: The role of project teams' social capital for overcoming barriers to learning", *International Journal of Project Management*. 31 (2), 239–251.
Bates, M.J. (1989) "The design of browsing and berrypicking techniques for the online search interface", *Online Information Review*, 13 (5), 407–424.
Bateson, G. (1972) *Steps to an Ecology of Mind*, Ballantine Book
Beach, R. (2004) "Adopting Internet technology in manufacturing: a strategic perspective", *Production Planning and Control,* 15 (1), 80-89.
Boer N. I. (2005) *Knowledge sharing within organizations,* Rotterdam, The Netherlands: Erasmus Research Institute of Management
Bresnen, M., Edelman, L., Newell, S., Scarbrough, H. & Swan, J. (2003) "Social practices and the management of knowledge in project environments", *International Journal of Project Management*, 21 (3), 157–166.
Carrillo, P., Ruikar, K. & Fuller, P. (2013) "When will we learn? Improving lessons learned practice in construction", *International Journal of Project Management*, 31 (4), 567–578.
Chia, R. (2017) "A process-philosophical understanding of organizational learning as "wayfinding": Process, practices and sensitivity to environmental affordances", *The Learning Organization*, 24(2), 107-118.
Chirumalla, K. (2016) "Organizing lessons learned practice for product-service innovation", *Journal of Business Research*, 69 (11), 4986–4991.
Chiu, C. M., Hsu, M. H. and Wang, E.T (2006), "Understanding knowledge sharing in virtual communities: an integration of social capital and social cognitive theories", *Decision Support Systems,* 41, 1872-1888.

Claver-Cortés, E., Zaragoza-Sáez, P. & Pertusa-Ortega, E. (2007) "Organizational structure features supporting knowledge management processes", *Journal of Knowledge Management*, 11 (4), 45–57.

Darroch J. (2005) "Knowledge management, innovation and firm performance", *Journal of Knowledge Management,* 9, (3), 101–115.

Davenport, T. & Prusak, A. (1998) *Working knowledge: how organizations manage what they know*, Boston, MA: Harvard Business School Press

Davison, R.M., Ou, C.X.J. and Martinsons, M.G. (2013) "Information technology to support informal knowledge sharing", *Information Systems Journal*, 23 (1), 89–109.

De Long, D.W. & Fahey, L. (2000) "Diagnosing cultural barriers to knowledge management", *Academy of Management Perspectives,* 14 (4), 113–127.

Disterer, G. (2002) "Management of project knowledge and experiences", *Journal of Knowledge Management*, 6 (5), 512–520.

Duffield, S. & Whitty, S.J. (2015) "Developing a systemic lessons learned knowledge model for organisational learning through projects", *International Journal of Project Management*, 33 (2), 311–324.

Duhon, H.J. & Elias, J.S. (2008) "Why It Is Difficult To Learn Lessons: Insights from Decision Theory and Cognitive Science", *SPE Projects, Facilities & Construction*, 3 (3), 1–7.

Eisenhardt, K. & Graebner, M. (2007) "Theory building from cases: opportunities and challenges", *Academy of Management Journal,* 50 (1), 25–32.

Ellison, N.B., Gibbs, J.L. & Weber, M.S. (2015) "The Use of Enterprise Social Network Sites for Knowledge Sharing in Distributed Organizations", *American Behavioral Scientist*, 59 (1), 103–123.

Elo, S. & Kynga, S. H. (2008) "The qualitative content analysis process", *Journal of Advanced Nursing*, 62(1), 107–115.

Eriksson, P. & Kovalainen, A. (2011) *Qualitative methods in business research (Introducing qualitative methods)*, Los Angeles; London: SAGE.

Fong, P. & Chu, L. (2006) "Exploratory study of knowledge sharing in contracting companies: A sociotechnical perspective", *Journal of Construction Engineering and Management, September*, 928-939.

Halawi, L.A., Mccarthy, R.V. & Aronson, J.E. (2007) "An empirical investigation of knowledge management systems success", *Journal of Computer Information Systems*, 48 (2), 121-135.

Hartmann, A. & Dorée, A. (2015) "Learning between projects: More than sending messages in bottles", *International Journal of Project Management*, 33 (2), 341–351.

Hasan, H., Crawford, K., (2003) "Codifying or enabling: the challenge of knowledge management systems", *Journal of Operations Research Society*, 54, 184–193.

Jugdev, K. (2012) "Learning from Lessons Learned: Project Management Research Program", *American Journal of Economics and Business Administration.* 4 (1), 13–22.

Julian, J. (2008) How project management office leaders facilitate cross-project learning and continuous improvement. *Project Management Journal.* 39 (3), 43-58.

Keegan, A. & Turner, J.R. (2001) "Quantity versus Quality in Project-Based Learning Practices", *Management Learning*, 32 (1), 77–98.

Kwahk, K.Y. & Park, D.H. (2016) "The effects of network sharing on knowledge-sharing activities and job performance in enterprise social media environments", *Computers in Human Behavior*, 55, 826–839.

Madsen, E. S. & Lindegaard, M. (2017) "The need for knowledge modification in technology change: a framework to consider changes in domain complexity, knowledge and productivity", *Production Planning and Control,* 29 (2), 91-105.

Maqsood, T., Walker, D.H.T. & Finegan, A.D. (2007) "Facilitating knowledge pull to deliver innovation through knowledge management: A case study", *Engineering, Construction and Architectural Management*, 14 (Ci), 94–109.

Maylor, H., Brady, T., Cooke-Davies, T. & Hodgson, D. (2006) "From projectification to programmification", *International Journal of Project Management*, 24 (8), 663–674.

McClory, S., Read, M. & Labib, A. (2017) "Conceptualising the lessons-learned process in project management: Towards a triple-loop learning framework", *International Journal of Project Management*, 35(7), 1322-1335.

Milton, N.J. (2010) *The lessons learned handbook practical approaches to learning from experience.* Oxford: Chandos Publishing.

Nakamba, C.C., Chan, P.W. & Sharmina, M. (2017) "How does social sustainability feature in studies of supply chain management? A review and research agenda", *Supply Chain Management: An International Journal*, 22(6), 522-541.

Newell, S., Bresnen, M., Edelman, L., Scarbrough, H. & Swan, J. (2006) "Sharing Knowledge Across Projects: Limits to ICT-led Project Review Practices", *Management Learning*, 37 (2), 167–185.

Nonaka, I. (1994) "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, 5 (1), 14-37.

Nonaka, I. & Takeuchi, H. (1995) *The knowledge-creating company: How Japanese companies create the dynamics of innovation,* New York: Oxford University Press.

Nonaka, I., Toyama, R. & Konno, N. (2000) "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation", *Long Range Planning*, 33(1), 5-34.

Ozlati S. (2015), "The moderating effect of trust on the relationship between autonomy and knowledge sharing: a national multi-industry survey of knowledge workers", *Knowledge and Process Management*, 22(3), 191-205.

Perez Lopez, S., Montes Peon, J.M. & Vauquez Ordas, C.J. (2004) "Managing knowledge: the link between culture and organizational learning", *Journal of Knowledge Management*, 8 (6), 93–104.

Pinder, C. C. (2008) *Work Motivation in Organizational Behavior* (2nd ed.), New York: Psychology Press.

Prencipe, A. & Tell, F. (2001) "Inter-project learning: Processes and outcomes of knowledge codification in project-based firms", *Research Policy*, 30 (9), 1373–1394.

Ranjbarfard, M., Aghdasi, M., López-Sáez, P. & López, J.E.N. (2014) "The barriers of knowledge generation, storage, distribution and application that impede learning in gas and petroleum companies", *Journal of Knowledge Management*. 18 (3), 494–522.

Robinson, O.C. (2014) "Sampling in Interview-Based Qualitative Research: A Theoretical and Practical Guide", *Qualitative Research in Psychology*, 11(1), 25-41.

Sandhawalia, B.S. & Dalcher, D. (2011) "Developing knowledge management capabilities: a structured approach", *Journal of Knowledge Management*, 15 (2), 313–328.

Sarin, S. & McDermott, C. (2003) 'The Effect of Team Leader Characteristics on Learning, Knowledge Application, and Performance of Cross-Functional New Product Development Teams", *Decision Sciences*, 34(4), 707-739.

Sarnikar, S. & Deokar, A. (2017) "A design approach for process-based knowledge management systems", *Journal of Knowledge Management*, 21(4), 693-717.

Schindler, M. & Eppler, M.J. (2003) "Harvesting project knowledge: A review of project learning methods and success factors", *International Journal of Project Management*, 21 (3), 219–228.

Siemsen, E., Roth, A. V. & Balasubramanian, S. (2008)" How motivation, opportunity, and ability drive knowledge sharing: The constraining-factor model", *Journal of Operations Management*, *26*(3), 426–445.

Strauss, A. & Corbin, J. (1998) *Basics of qualitative research: techniques and procedures for developing grounded theory*, London: SAGE.

Tan, H.C., Carillo, P., Anumba, C., Kamara, J.M., Bouchlaghem, D. & Udeaja, C. (2006) "Live capture and reuse of project knowledge in construction organisations", *Knowledge Management Research and Practice,* 4 (2), 149–161.

Turner, T. & Pennington, W. W. (2015) "Organizational networks and the process of corporate

entrepreneurship: how the motivation, opportunity, and ability to act affect firm knowledge, learning, and innovation", *Small Business Economics*, *45*(2), 447–463.

Voss, C., Tsikriktsis, N. & Frohlich, M. (2002) "Case research in operations management", *International Journal of Operations & Production Management,* 22 (2), 195–219.

Watson, T.J. (2011) "Ethnography, Reality, and Truth: The Vital Need for Studies of 'How Things Work' in Organizations and Management", *Journal of Management Studies*. 48 (1), 202–217.

Weber, R., Aha, D.W. & Becerra-Fernandez, I. (2001) "Intelligent lessons learned systems", *Expert Systems with Applications*, 20 (1), 17–34.

Weber, R.O. & Aha, D.W. (2003) "Intelligent delivery of military lessons learned", *Decision Support Systems*, 34 (3), 287–304.

Williams, T. (2008) "How do organizations learn lessons from projects - and do they?" *IEEE Transactions on Engineering Management,* 55 (2), 248–266.

Wilson, J.M., Goodman, P.S. & Cronin, M.A. (2007) "Group learning", *Academy of Management Review*, 32 (4), 1041–1059.

Wilson, M.L., Schraefel, M.C. & White, R.W. (2009) "Evaluating advanced search interfaces using established information-seeking models", *Journal of the American Society for Information Science and Technology*, 60 (7), 1407–1422.

Wijnhoven, F. (2003) "Operational knowledge management: identification of knowledge objects, operation methods, and goals and means for the support function", Journal *of the Operational Research Society*, 54 (2), 194–203.

Yin, R.K. (2003) *Case Study Research*, 3rd edn. Thousand Oaks: SAGE.

Yuan, Y.C., Zhao, X., Liao, Q. & Chi, C. (2013) "The Use of Different Information and Communication Technologies to Support Knowledge Sharing in Organizations: From E-mail to Micro-Blogging", *Journal Of The American Society For Information Science And Technology*, 64 (8), 1689–1670.