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MASTER'S THESIS

Importance of the Project Management Knowledge Areas during Project Planning – The Viewpoint of Supply Chain Management Unit

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ABSTRACT

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Project Management can be divided into Knowledge Areas, such as Scope, Time, Cost, Quality, Risk and Communications management, but the literature does not identify their relative importance for the entire project. The study focuses on these knowledge areas, their relevance and importance during the project planning phase in the context of supply chain organization in a single case company. Research was conducted in a qualitative study method by semi-structured interviews.

The results confirmed that the case company's supply unit values Time and Cost management above all other knowledge areas, and from these angles the project performance was estimated being on a good level. Participants brought up that especially Communications management is a problematic area. Cost management was seen very important, but the supply organization lacks the authority to influence on it. To tackle these issues, the case company should consider implementing project knowledge management practices during the planning phase.

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Projektijohtaminen voidaan jakaa eri osa-alueisiin, kuten laajuuden-, ajan-, kustannusten-, laadun-, riskin- ja kommunikoinninhallintaan. Aiemmat tutkimukset eivät kuitenkaan ole määritelleet näiden osa-alueiden keskinäistä järjestystä projektin suoriutumisen kannalta. Tutkimus keskittyy projektijohtamisen osa-alueiden merkitykseen projektin suunnitteluvaiheessa toimitusketjun hallinnan näkökulmasta. Tutkimus on toteutettu yhden yrityksen tapaustutkimuksena. Tutkimus on kvalitatiivinen, teemahaastattelujen kautta toteutettu.

Tutkimuksen tulokset vahvistavat, että toimitusketjun hallinnan näkökulmasta kohdeyritys arvostaa eniten ajan- ja kustannustenhallintaa yli muiden osa-alueiden. Ajan- ja kustannustenhallinnan näkökulmasta kohdeyritys arvioi projektin suoriutumisen olevan hyvällä tasolla. Haastateltavat toivat esille, että erityisesti kommunikointi on ollut ongelmallinen osa-alue. Vaikka kustannustenhallinta nähtiin erittäin tärkeänä, niin siitä huolimatta toimitusketjun hallinnan organisaatiolla oli oman näkemyksensä mukaan vain vähän keinoja vaikuttaa siihen. Kohdeyrityksen tulisikin ottaa huomioon tietojohtamisen näkökulma projektin suunnitteluvaiheessa.

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I'm grateful for all the experiences, friends and unforgettable moments LUT has given me during the years.

The greatest thank you belongs to my family who I know have always believed in me. This would not have been possible without your support.

Now it's time head towards new exciting challenges!

in Helsinki, 4th of February 2019

Jesper Lempinen

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1. INTRODUCTION

1.1. Background

Project management is an area which has provided extensive amount of academic research on various topics. Project management is supported by so-called bodies of knowledge and frameworks. Worldwide, the most popular body of knowledge is the one described in *A Guide to the Project Management Body of Knowledge* (the PMBOK Guide 2004), which identifies nine *Knowledge Areas* (Scope, Cost, Quality, Risk, Communications, Integration, Human Resources, Procurement and Time Management) for project management to focus during the project life-cycle. However, the PMBOK Guide itself does not identify the relative importance of the Knowledge Areas, which Zwikael (2016) has argued could help the project organization to accordingly distribute the limited time and resources projects typically have. This research aims to provide further clarification on what should be improved and how in project management to increase the possibility of achieving a successful project.

In this thesis, the effect of Knowledge Areas is empirically studied during the project planning phase in a single case company's supply chain management unit, which operates in international environment having several key suppliers worldwide. The case company is highly dependent on achieving successful projects since the entire business is organized according to the project-based model. The consensus among scholars has been that project planning is an important part for the whole project, and it has been confirmed through practice and become an essential part of projects (Serrador & Turner 2015; Serrador 2013; Kerzner 2013, 378).

The study looks project management from the supply management unit's point of view and explores how persons responsible for projects' supply management evaluate case company's project management practices and how supply chain can contribute to achieving a successful project through the means of project knowledge management.

1.2. Research Questions, Objectives and Limitations

The PMBOK Guide to the Project Management Body of Knowledge by (the PMBOK Guide) by Project Management Institute (PMI) has classified project management into different Knowledge Areas. The PMBOK Guide identifies a total nine Knowledge Areas. Six of the knowledge areas – Time, Scope, Cost, Quality, Risk and Communications Management – were chosen to this case study for research since these are knowledge areas all stakeholders in the case company's supply organization unit share, while Integration, Human Resources and Procurement Management were excluded. Time, Scope and Cost Management are included in the research since these three areas form the so-called "Triple Constraints" or the "Iron Triangle" of project management. In addition, project quality management is included since project quality is affected by balancing these three factors. Risk and communications management has been added to the study since these factors play an important role contributing to the overall performance of the case company's projects.

Focus of this case study is on the project planning phase which is recognized as the most crucial part of project life-cycle (Diallo, Lavagnon & Thuillier 2010). The study aims to identify the importance of the project management knowledge areas during the project planning phase and increase supply organization's and its internal and external stakeholders' (e.g. project managers, logistics and procurement personnel) understanding about the challenges projects can face due to the different perspectives stakeholders have. Study also provides suggestions to improve project management practices and increase the overall project success level.

Limitations of this study include the fact that the research is only limited to a one single industry. Results can be sensitive to the industry in which the projects are undertaken. This case study also focuses only to a single company. It is possible that, in addition to industry, the results are dependent also on the company and the product. The main research question has been defined below. Three sub-questions were also examined to achieve better understanding about project outcomes in the context of the Project Management Knowledge Areas. It is assumed that different

Knowledge Areas differ in their overall impact to the project management practices and project success in general.

RQ. *How can project outcomes be anticipated using KM (Knowledge Management) in project planning?*

The study also aims to answer three sub-questions described below. The first and the second sub-question connect the importance of the PMBOK Guide's Knowledge Areas while the third and final sub-question (along with the second sub-question) aims to connect project success factors with the organization's view on these issues.

SubQ1. *What is the role of different Knowledge Areas on project success?*

SubQ2. *How different project stakeholders view the relative importance between Knowledge Areas?*

SubQ3. *How success factors can be related to context of the organization?*

1.3. Theoretical Framework

Theoretical framework of the study consists of project management and the PMBOK Knowledge Areas during the project planning phase. These areas are looked through the project knowledge management and together these three areas all impact on the overall project performance.

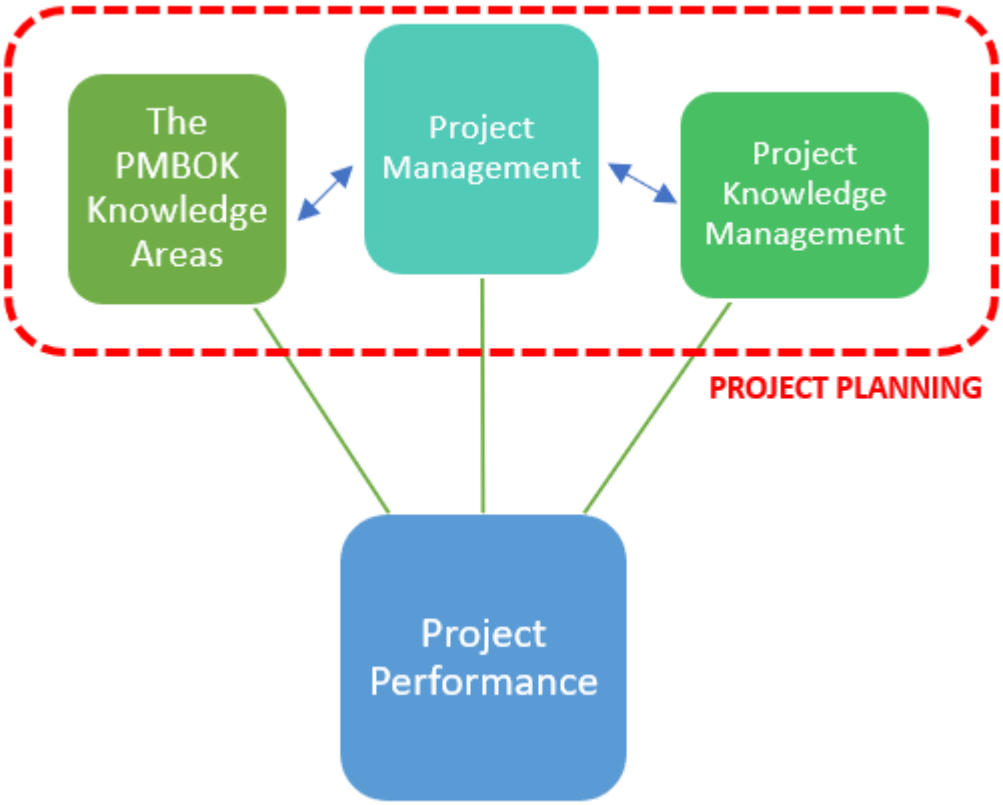

Figure 1 Theoretical Framework of the study.

1.4. Study Structure

The thesis consists of the theoretical part which provides literature review to the certain aspects Project Knowledge Management, Project Management and Project Performance. Theoretical part of the study is followed by the empirical part where the case study is introduced and findings from the research are presented.

Research has been conducted by interviewing persons in charge of the supply operations in the case company. Details about the research method are presented before introducing the case study. After reviewing the research, the discussion section is presented where results from the research is compared with the aspects from theory. Conclusions is the final part which includes a section for managerial implications and suggestions for future research.

Theoretical part of the study consists of chapters 2 and 3. The second chapter goes through the general literature about project management in knowledge management perspective and provides an overview to project planning and its importance for the whole project. The second chapter also describes project life-cycle and the PMBOK Knowledge Areas that were selected for this study. The third chapter focuses on the definition of project performance and project success.

The literature is gathered from wide range of academic articles and journals, especially the articles from the *International Journal of Project Management* have been a key content in the theoretical part of the study. In many instances, the study refers to the well-known the PMBOK Guide to Project Management Body of Knowledge.

1.5. Key Concepts and Definitions

PROJECT PLANNING

Project can be divided into different phases. Zwikael & Smyrk (2011, 11–15) have suggested four phases with planning being one of them. PMBOK Guide (2004, 40–41) divides project management into process groups which includes a planning process group constituting of 21 processes to be executed by the project management team. Planning is seen as an important part of the project (Serrador & Turner 2015).

PROJECT MANAGEMENT

Project management is a strategic competency and improving it is very important for any project-based organizations. (Kwak et al. 2015) Different types of projects require different approaches. Projects are managed, controlled, planned and organized in different ways (Andersen 2015). The adaptation of project management methodologies varies from informally to formally defined approaches. Organizations have many ways to improve their project management practices. (Fernandes, Ward & Araújo 2015)

KNOWLEDGE AREAS

The PMBOK Guide identifies nine Knowledge Areas for project managers to focus (Zwikael 2016) though the idea of standardizing project management practice for example in the form of Knowledge Areas has been subject of criticism (Hällgren, Nilsson & Blomquist 2012).

PROJECT SUCCESS

Project success can be narrowly defined as achieving the intended project outcomes. Historically research on project success has focused on project achieving its goals on cost, quality and time objectives. (Tsiga, Emes & Smith 2017) The definition of project success has varied, but cost, time, quality and stakeholders' satisfaction have been generally seen as the main components which can affect project success. (Mirza, Pourzolfaghar & Shahnazari 2013)

PROJECT KNOWLEDGE MANAGEMENT

Knowledge is one thing in common for all projects and effective management of knowledge, both explicit and tacit, is the prerequisite for effective project management. Project knowledge management is one of the main success factors in project management. (Gasik 2011)

2. KNOWLEDGE MANAGEMENT IN A PROJECT ENVIRONMENT

Knowledge is the basic feature in all projects and proper knowledge is the foundation for an effective project management. (Gasik 2011) Even project success can be dependent on the organization's ability for continuous learning process from the previous projects. Only a small number of project-based organizations have managed to implement systems for utilizing knowledge from past to future projects. (Todorović et al. 2014) Normally, projects are subject to restrictions on both budget and time. These restrictions and the fact that projects involve a complex set of processes help to understand why so many projects fail to achieve its initial goals. Along with budget and time restrictions, projects also face the increasing turbulence in the modern business environment. (Andersen et al. 2006) The role of projects in accommodating a complex set of business processes has been a common feature particularly in the construction industry and has also become important in other industries as well (Wikström et al. 2010). Besides the construction industry, technology-based and service-providing companies have also adapted the method of organizing their business activities in project form. Organizing business in the form of *"management by projects"* has become a way to motivate organizations towards higher performance. (Fernandes, Ward & Araújo 2013)

Project management is a strategic competency and improving project management performance is very important for any project-based organizations but also a great challenge due to the changing nature of these organizations. (Kwak et al. 2015) Knowledge management's challenges in a project environment come from these project characteristics. Organizational learning is challenging since projects are by nature unique and short-term orientated. (Hanisch et al. 2009) Most of the project-based companies engage in custom-made deliveries and their offerings go beyond traditional project delivery model by integrating maintenance, spare parts, services etc. in the package. This model requires the company not only to overcome cross-organizational boundaries but also to co-operate with other stakeholders such as suppliers and customers. Project business is a unique business model due to its specific relational context, time-limitedness, value creation properties, type of complexity and its high degree of uncertainty and limited possibilities for

standardization. (Wikström et al. 2010) It has been recognized that different types of projects require different approaches. Projects are managed, controlled, planned and organized in different ways. (Andersen 2015)

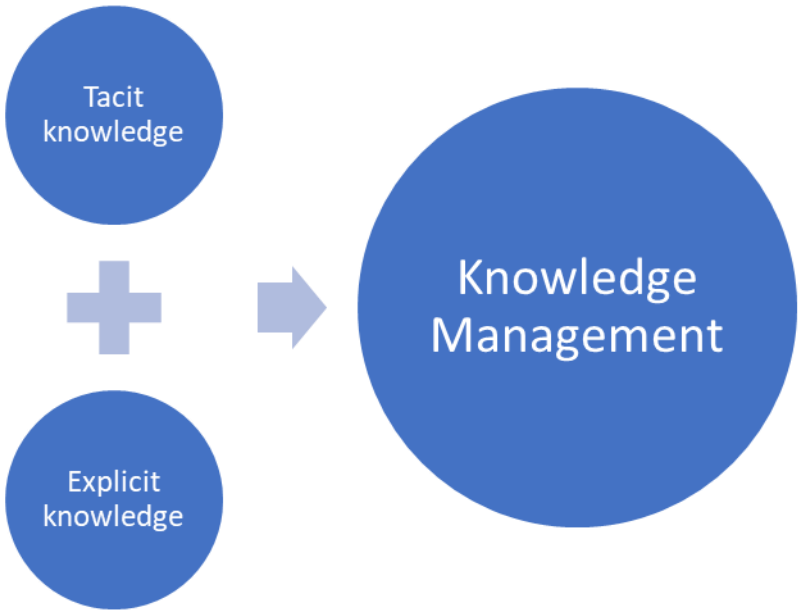

Figure 2 Tacit and Explicit knowledge form the basis for knowledge management in the organization.

Knowledge is divided in two types, both explicit and tacit, and the importance of having systems to organize these both types is highlighted in knowledge management. (illustrated on Figure 2) Explicit knowledge is more easily attained since it's usually expressed or documented in a formal, systematic manner – in practice meaning for example in the form of directives, policy manuals, meeting minutes or technical documentation. On the other hand, tacit knowledge is a more difficult concept since it's usually subconscious, internalize, and the person may not even be aware what he / she knows or how the results have been accomplished. Organization can attain tacit knowledge through dialogue and sharing best practices and lessons learned. (Terzieva 2014) For the organization, capturing and codifying both explicit and tacit knowledge from individuals is very important (Yeong & Lim 2010).

Todorović et al. (2014) have argued that knowledge management has not been sufficiently explored in project management literature. Project knowledge management works as the link between the principles of knowledge management and project management. (Frey et al. 2009) Various forms of information and experience is generated during the project within the organization. This knowledge should be recorded and shared in the organization to increase the possibility of success in the next projects. Failure to do so can lead to increased project costs as knowledge that once existed in the company have to be defined again. Usually people involved in the projects, for example project manager, project team, project stakeholders or a customer, are the ones who establish project knowledge which comes from both internal and external sources. Each project phase creates knowledge starting from the planning phase where the working steps, time and budgets are allocated, and responsibilities are defined regarding where new knowledge is expected to be generated and how experiences related to this should be documented and perceived. (Polyaninova 2011)

2.1. Methodology for Project Management

The adaptation of project management methodologies and frameworks varies from very ad hoc or informally to very formally defined approaches. In general, there are many ways for organizations to improve their project management practices. (Fernandes, Ward & Araújo 2015) Besides the PMBOK Guide, there has been an emergence of several other bodies of knowledge. Most influential ones with the PMBOK Guide are APM BOK from Association for Project Management and P2M from Project Management Association of Japan. Some major corporations, such as Ericsson, Motorola and Philips, have developed their own project management methodology. These corporate-founded bodies of knowledge are used by project management professionals as the “Best Practice” guides. Despite many existing methodologies, the differences among them are relatively minor (Fernandes, Ward & Araújo 2013; Zwikael & Smyrk 2011, 5–6) but especially in the Japanese project management standard knowledge is recognized as the main source of project value (Gasik 2011).

Frameworks and bodies of knowledge have been developed to support project management practices. Kwak et al. (2015) have estimated that a project organization's ability to adopt and implement project management frameworks has improved over time because project management professionals have improved their ability to match improvement actions into the organizational context. The most popular Body of Knowledge is the one described in the PMBOK Guide published by Project Management Institute. Implementing the PMBOK Guide Body of Knowledge has been recognized by most scholars as a method to increase the chance of a successful project (Zwikael 2016) though its use has also been criticized as being unsuitable for complex, uncertain and time-limited projects. (Williams 2005)

Figure 3 Project Management Knowledge Areas according to the PMBOK Guide (2004, 21–24)

The PMBOK Guide identifies nine Knowledge Areas (figure 3) for project managers to focus. Scope, Quality, Time, Cost and Risk Management are not only these knowledge areas but also represent competing project constraints. The tight association between these constraints means that if any of these constraints are changed, at least one other is likely to be affected – therefore the project constraints are considered as being interdependent. (McCann 2013, 6–7) Standardizing project management practice for example in the form of the PMBOK Knowledge Areas has been subject of criticism in the literature. Hällgren, Nilsson & Blomquist (2012) have argued the diffusion of generic project management knowledge can lead to loss of relevance at two levels: when project management practice is transferred into these so-called “Best Practice” through generalization and standardization and when the “Best Practice” is transferred back to e.g. education, research, certification and practice – where it is applied.

2.2. Project Life Cycle

An organization can divide projects into phases which are collectively known as Project Life Cycle. Idea is the provide better management control with appropriate links to the ongoing operations of the organization. (The PMBOK Guide 2004, 19) Project life cycle varies depending on the size and complexity of the project and typically all projects go through a life cycle which consists of multiple phases. Each organization should build its own life cycle diagram based on its particular needs. (Lester 2014, 47–50) The transition from one phase to another typically involves some sort of technical transform or handoff. Usually, the deliverables from one phase are reviewed and approved before the project moves to the next phase. However, it’s normal that the next phase has begun before the approval of the previous phase if the risks involved are estimated being on acceptable level (The PMBOK Guide 2004, 20).

The PMBOK Guide identifies 44 processes that are performed by a project manager during the project life-cycle. These 44 processes are divided into five process groups as described below. The PMBOK highlights that process groups are not

considered the same as project phases: complex or large projects can be separated into different phases or sub-projects, but all the processes mentioned in the process groups would normally be repeated for each project phase or sub-project. (The PMBOK Guide 2004, 40–67)

(1) **Initiation Process Group:** This phase is meant for defining and authorizing a new project and consists of two processes: developing project charter and developing preliminary statement for project scope.
(2) **Planning Process Group:** Defining and refining objectives and selecting the best options to achieve the project objectives.
(3) **Executing Process Group:** Coordinating people and other resources dedicated for the project.
(4) **Monitoring and Controlling Process Group:** This phase is meant for monitoring progress, identifying variances from project plan and take necessary actions so that project can meet its objectives.
(5) **Closing Process Group:** Formal acceptance of the project by its customers and other stakeholders. This final phase is meant for bringing project to a conclusion.

Project life cycle diagram shows that each project phase can be viewed as a project of its own. Each of these phases have very different sizes and complexity. Each phase must also be broken down further into multiple stages or tasks, which then can be further broken down into subtasks. The choice of tasks to be included in the so-called *work breakdown structure* (WBS) is a decision that is best made by the project team. The object of dividing projects into smaller phases and tasks is to be able to control the project by allocating resources. It is easier to control a series of smaller entities that make a whole. (Lester 2014, 51–56)

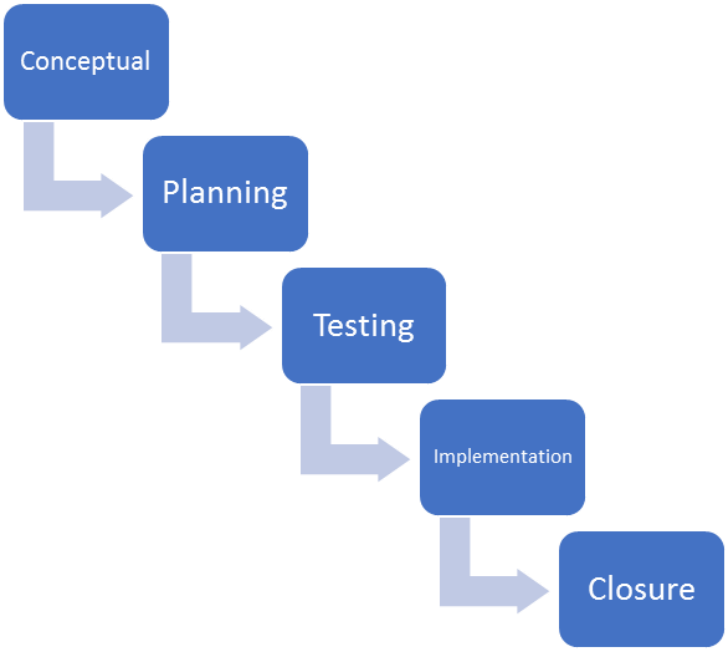

Figure 4 Project life-cycle phases according to Kerzner (2013, 71)

Kerzner (2013, 69–73) argues there is no universally agreed model for project life-cycle modelling. Instead, at least partial agreement exists of product life-cycle model which includes e.g. research and development, market introduction from growth and maturity and to deterioration and death of a product. Kerzner applies these product life-cycle phases into a system applicable for a project. According to Kerzner, project life-cycle phases include: conceptual, planning, testing, implementation and closure of a project. Project life-cycle definition varies greatly depending not only about the industry but also about the company: even industries, like construction, which are well aware about the importance of a proper life-cycle analysis one could survey ten different companies and find ten different definitions for project life-cycle. Finally, Kerzner points out that not all projects can be transformed into life-cycle phases, such as research and development (R&D) projects.

2.3. Project Planning

The PMBOK Guide (2004, 40–41) divides project management into five different process groups including the *planning process group* constituting of 21 processes to be executed by the project management team. Planning process group is meant to define project objectives and plan the actions required to achieve project objectives and scope. The PMBOK Guide highlights the fact that the process groups cannot be defined as a project phase, instead, processes within the process group are meant to be repeated for each phase of a project. In addition to the PMBOK Guide's approach, a project can also be classified into different phases where the planning phase is in general considered a critical phase in any project with great impact on project success (Diallo, Lavagnon & Thuillier 2010). Practice has confirmed the need for a planning phase and it has become an essential part of all projects. Recent literature has focused on how much planning is needed to achieve the best results in the planning process. (Serrador & Turner 2015)

Zwikael & Smyrk (2011: 85, 181) have argued that the planning phase has three main objectives: to set up a work model that fulfils the promises made in the project scope statement, to re-confirm the project funding decisions made and to establish the environment where the project will be executed. Zwikael & Smyrk (2011, 183–185) break project planning phase in two parts: planning project part (1) and set-up part (2) as illustrated in Figure 5.

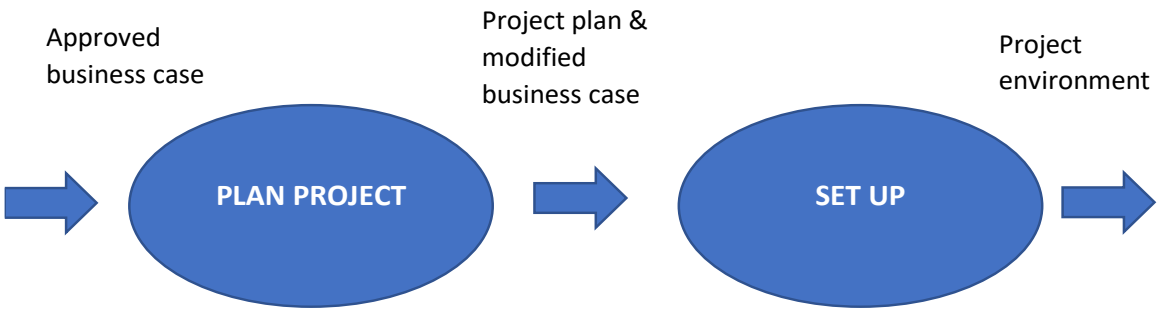

Figure 5 Project planning phase broken into two parts: planning and set-up (Zwikael & Smyrk 2011, 184)

Zwikael & Smyrk (2011, 183–185) focus mostly on the first part but acknowledge that especially in larger projects the second phase may be a significant exercise for the whole project just on its own. Project set-up phase, which means establishing the project environment, may include practicalities such as establishing temporary offices, acquiring necessary office equipment or handling visas for overseas project team members. Primary meaning of the planning part is the assembly of a project plan, but this phase also includes updating or revising parts of the business case. In summary, the planning phase has two outputs: an (updated) project plan and modified business case as illustrated in Figure 2.

According to Kerzner (2013, 378) the greatest advantages appropriate planning brings to the project are reducing uncertainty, operation efficiency improvement, obtaining better understanding of project objectives and providing a basis for monitoring and controlling. Some previous case studies have shown that extensive planning can have a negative effect on overall project performance (Choma & Bat 2010; Diallo, Lavagnon & Thuillier 2010). Zwikael (2006) puts the project manager to be entirely responsible for project planning: the project manager must ensure proper execution of the project from start to finish and ensure that all relevant stakeholders are satisfied.

The likelihood of project success has been shown to increase when planning processes are improved. Criticism of project planning practices is also discussed in literature, especially regarding the ability to estimate project cost and schedule during planning. Studies have found a strong statistical significance that cost estimates used during project planning phase are highly and systematically misleading which can lead to high cost overruns at the end of the project. (Zwikael 2016) Despite criticism raised, implementing the use of a project management body of knowledge, such as, the PMBOK Guide, is believed by most scholars to increase chances of successful project. Williams (2005) has argued that bodies of knowledge are inappropriate for complex, uncertain and time-limited projects, while some critics have pointed out the lack of covered scope by the total nine Knowledge Areas: the missing issues include, for instance, environmental issues, and business and commercial issues. (Zwikael & Smyrk 2011, 181–182; Morris 2001)

Planning requirements have also been found to be dependent on the industry. Serrador (2013) pointed out that despite this conclusion there has been only little empirical research about project planning differences between industries, but two; construction and information technology stand out. The importance of project planning is clearly present especially in the construction industry. In comparison with other industrial sectors, Zwikael (2006) found construction companies having a high quality of project planning and the highest success rate. In the construction sector, the activities having the highest impact on project success were “activity definition” and “project plan development”. Zwikael (2006) also discovered that despite their recognized importance, project managers in construction industry do not always put enough effort in these critical planning processes.

Zwikael & Globerson (2006) aimed to identify the industries with the best project planning practices: in four industries analyzed the quality of planning was highest in construction and engineering organizations while the lowest was in manufacturing. Result is of internal factors such as better organizational support that is available for project managers in construction and engineering organizations, while the other three industries give support only in limited fields related to tactical aspects, for instance in the procurement of project management software. Overall, planning in software and communications organizations was of high quality but despite this the organizations often concluded projects with poor results. Reasons for this could be a riskier technology and environment, poor control or too ambitious commitments that have taken place already during the initiation phase. Zwikael & Globerson (2006) also found evidence that planning quality correlates with project success and improving project planning could enhance project management during the entire project life-cycle. Once the planning phase is performed properly it’s easier for the project manager to continue the project with the same level of quality. Large projects involving complex scenarios, such as complicated planning and numerous interdependencies have generated a need to develop better practices for project planning process. Pinto (2013) has suggested planning complex projects in segments rather than as a whole. This means breaking projects down into smaller segments and handling them one at a time. The introduced method would reduce the complexity and have a positive effect to project performance and could also mitigate other negative effects of poor project planning.

Sokhanvar, Matthews & Yarlagadda (2014) empirical research on what type of knowledge is important at various phases of a project concluded that during project planning the individuals (project stakeholders) ranked legal and statutory knowledge as the most important type of knowledge followed by procedure knowledge and at fourth place both project management knowledge and supplier knowledge. Heravi, Coffey & Trigunarsyah (2015) have pointed that project stakeholders have different involvement in the planning phase. Designers and contractors are not very involved in the process of establishing a project in the context of the construction industry, also reinforced by previous studies. Identifying an understanding of the needs of key project stakeholders is a necessary part of the planning phase and can make a difference between project success and failure. Heravi, Coffey & Trigunarsyah (2015) found also that in many cases contractors are only viewed as builders and are assigned only to the project execution process – when the planning is finished.

2.4. Scope Management

The first Knowledge Area is Scope Management, which in the project context can refer to both product scope and project scope. The PMBOK Guide focuses on processes used to manage the project scope. The project scope definition is the foundation for the project and is used to develop the schedule and the budget estimate. (McCann 2013, 50–51) Project scope planning is an ongoing process that should be updated when the project progresses. In the context of supply chain projects where multiple companies are involved it is likely that there are several triggers for re-evaluation of scope, for example supply chain partner's failure to keep its promises on deliverables on time or at all (Ayers 2004, 92).

McCann (2013, 52) argues that scope change is expected in projects and therefore the PMBOK Guide provides tools for project management professionals to control scope changes. The scope control process includes activities for defining what should be monitored and controlled when approved changes are integrated to the project. This process also assists with managing schedule and budget corrections that come with scope changes. While McCann (2013, 52) believes that change is

expected, Pinto (2013) argued that there are still many organizations where the false belief that all rework can be eliminated exists. Pinto defines three major causes for rework (1) changing requirements, (2) engineering “gold plating” which refers to the desire to add features outside of the original scope and (3) poor initial planning and scoping. It is also pointed out though, that sometimes rework is desirable.

Mirza, Pourzolfaghar & Shahnazari (2013) have recognized failure to understand project and product scope at the start of the project as a major contributor to unsuccessful projects. Poor scope definition has been seen for a long time as a significant problem that correlates negatively to project performance. Proper definition of project boundaries has a great effect to the final project costs which tend to be higher due to changes that interrupt project flow, rework, project time increase, lower productivity and negative effect to the field work. Project team can also discover that external stakeholders such as suppliers can cause problems to project scope if conflicts related to cost and quality or delivery of materials happens during the project. They concluded that project and product scope should be better distinguished from each other to achieve higher possibility of project success. Issue of the importance of scope on project success has so far been only a little discussed in the literature. Mirza, Pourzolfaghar & Shahnazari (2013) found four problems related with the project scope and ways to overcome these issues. Unclear scope definition, incomplete or partial scope, not finalizing scope documents and unshared scope statements are problems that can be overcome by defining realistic, demonstrable scope and understanding real requirements and responsibilities related to the project scope.

2.5. Time Management

Time management is the most visible area in project management together with cost management. Time control and preparation of schedules, networks etc. are the initial objectives of project time management. Especially in the construction industry effective time management is essential and project delays has been recognized as one of the most frequent problems in the industry. (Chin & Hamid 2015; Solís-

Carcaño et al. 2015) Failure to meet time targets affects all people and organizations involved in the project and usually results in cost overruns and other additional expenses. In competitive business environment failure to meet project time targets may cause damage to reputation which in return makes it more difficult to obtain new contracts. (Solís-Carcaño et al. 2015) Changes in the project scope force the re-evaluation of the milestone schedules but also other events can trigger a need for changes in the project schedule (Zwikael & Smyrk 2011, 250–251).

A failure to manage and ultimately to achieve the time targets set is regarded as an inherent weakness of large-scale projects. There are many examples of projects to provide that demonstrate how project failure can occur due to an inadequacy of the initial planning process. Dey & Ogunlana (2001) suggest that initial planning process is in key role to achieve project milestones successfully. In addition to time management, also cost and quality management are additional priorities. Dey & Ogunlana have proposed by using a case study of a cross-country petroleum pipeline construction a methodology for achieving time duration of a project by using a Monte Carlo simulation technique for risk analysis.

Solís-Carcaño et al. (2015) found evidence of a poor application of project time management in the construction industry and noted a link between effort put to project time management and successful completion of the project in schedule. Previous studies have also shown poor project planning and controlling as one of the main reasons for project delays. Chin & Hamid (2015) have concluded that project control methods in time management is needed in order to minimize the risk of project delay. Therefore, project progress monitoring and control is one of the most important tasks of project management. Every project team member should be able to keep track on the project progress.

Chin & Hamid's (2015) study about the practices of Malaysian construction industry on project time management concluded that project manager plays an important role in the construction work planning process. Meyer & Visser (2006) have also agreed that many projects do not meet time targets and they have suggested improving project schedule estimates by using historical data and simulation. Their results indicated that a more accurate project total duration estimation can be achieved by taking advantage of historical project data. Duration estimates could

also be improved by developing a project schedule database which could be a valuable tool for the project manager in the project time controlling. Meyer & Visser also recommended putting project manager in charge of maintaining the database.

2.6. Cost Management

Financial targets for the project are initially set in the budget. Cost management includes planning, estimating, budgeting and controlling processes which make sure project stays on budget. Processes interact with each other and with other knowledge areas. Primarily cost management is seen as being mostly concerned with the costs of the resources needed to complete the activities related to the cost management processes but project cost management should also be concerned of the effect of project decisions on the cost of using, maintaining and supporting the end-product of the project. This is called life-cycle costing and is considered as the broader view of project cost management. (The PMBOK Guide 2004, 157)

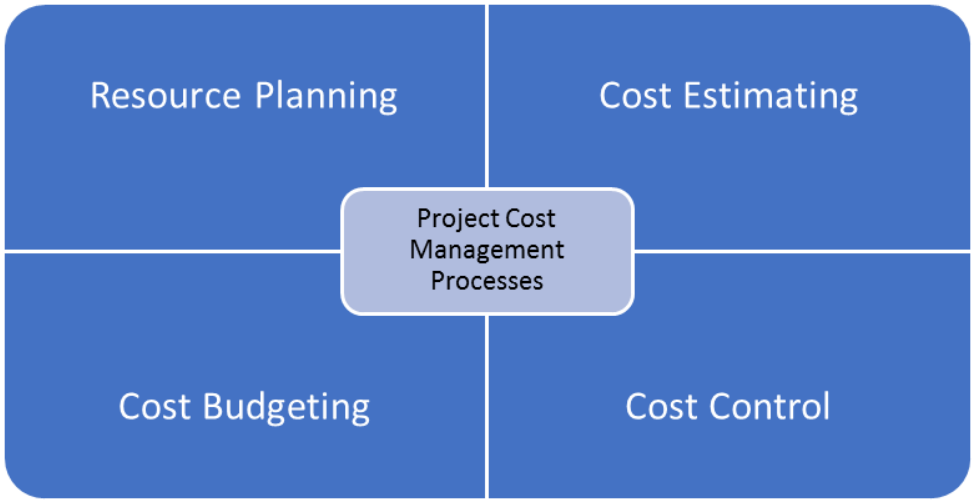

Figure 6 Four project cost management processes (Ayers 2004, 94–95).

Ayers (2004, 94–95), based on the PMBOK Guide, has divided project cost management into four processes (figure 6) and two process groups. Resource planning, cost estimating, and cost budgeting processes are put into the so-called

Planning Process Group and cost control process forms the Controlling Process Group. Ayers' model focuses on managing supply chain projects and their resource planning process turns Work Breakdown Structure (WBS) into resource requirements where key requirements can include resources such as expertise, facilities, systems and materials. The PMBOK Guide names three cost estimating techniques: analogous (top-down) estimate, parametric modeling and bottom-up estimating. Ideally cost budgeting process follows estimating but, in many cases, projects may be budgeted before estimates are done. Cost estimates are updated by implementing cost control process where actual project experience is used to update cost estimates.

On the other hand, Zwikael & Smyrk (2011: 58–59, 201–207) argue that project budget is a separate concept from the estimated cost of a project and therefore these two should be distinguished. Project budget in their view is barely a pool of money which is approved to cover project outlays while project's cost is defined as "the outlays required to purchase resources for the project". Zwikael & Smyrk have introduced a classification of project costs which divides costs into three categories: (1) production, (2) management and (3) operations. Production cost ("below-the-line" cost) arises from the acquisition of the resources needed to achieve the outputs defined in the project statement of scope while Management cost ("above-the-line" cost) includes costs that arise from the project's planning, management and administration processes. Operations costs are associated with any outlays required to support the ongoing operation of any of the project's outputs.

Cost overruns have been recognized as a global problem and it has been found to be common especially on infrastructure and construction projects worldwide. This applies to both developed and developing countries. (Smith 2014) Despite all the progress made in the fields of project management and cost engineering, severe budget overruns and delays are still quite common, especially in large-scale projects. Klakegg & Lichtenberg (2016) have proposed using so-called Successive Principle as a solution which they claim has shown in practice that it is possible to make accurate project cost analyses and estimates. The Successive Principle is at its best for estimating the cost from an inside view position, but it has not been able

to solve the issue of cost escalation in large projects from the initial idea and up to the point when the go / no go decision regarding the project is made.

2.7. Quality Management

The Project Management Institute (PMI) defines quality as *"the degree to which a set of inherent characteristics fulfills requirements."* Scope, Time and Cost Management form the so-called "triple constraint" of project management. When Quality Management is added the triple constraint still stands. Quality should never be traded off in favor of scope, time, or cost issues and therefore the triple constraint is always added with quality management. (Steinman 2014) The PMBOK Guide (2004, 185) divides quality management processes in three categories: Quality Planning, Quality Assurance and Quality Control which all are dependable. Project stakeholders may have a different view about what exactly quality means. This is not a surprise since usually quality is described in vague terms that are hard if not impossible to describe in quantitative measurements.

Quality Planning is a three-step process that should start at the very beginning of the project. The first step is to identify all the customers of a project and the second is to identify quality requirements in cooperation with the customers to understand their requirements for the project. After requirements are identified they can be used to develop specifications to specify what is measured and how. Quality Assurance aims to prevent defects before they occur and is focused on the process while Quality Control is focused on the product and identifying and correcting defects after they occur. Businesses often use these terms interchangeably, but they have a different meaning. (Steinman 2014)

Basu (2014) has proposed a three-dimensional model for project quality which is illustrated in Figure 7. The model defines project quality with three dimensions of Design Quality, Process Quality and Organization Quality where lack of attention to details in Organization Quality is identified. Basu summarized in three points the best practices of project quality management: a formal quality management system with proper procedures should be developed for the project team and it should be

in place before entering to the project implementation phase. Basu suggested these systems and procedures should follow the guidelines of the PMBOK Guide. Secondly, to cover the design and process conformance and supplier deliverables, a formal quality audit procedure should be placed for the project. Finally, a project performance management system should be structured, and the system should be based on the principles of the Balanced Scorecard. Basu noted it is vital that a performance management system goes across project groups and key suppliers with a milestone reviews in place to monitor project progress.

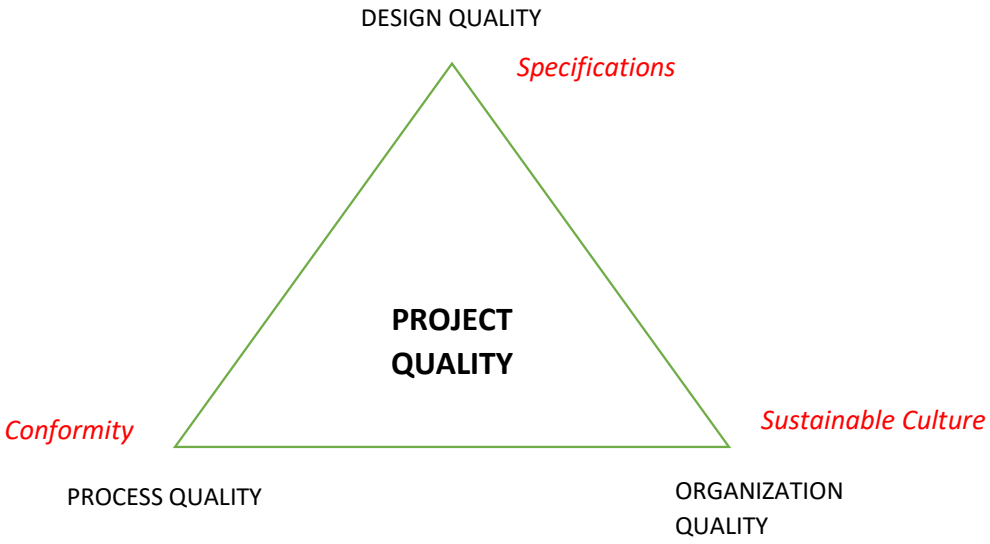

Figure 7 Three dimensions of project quality. (Basu 2014)

Academic literature has not paid attention to project quality management as one of the PMBOK Knowledge Areas. According to Padalkar & Gopinath (2016) this is surprising since quality is one of the variables often present in studies on project success or failure factors. Steinman (2014) has argued the importance of meeting the customer's needs while avoiding adding project deliverables with features that add little or no value to the customer – this doesn't still mean project should aim just meeting bare minimum contract requirements. Exceeding minimum requirements must be done in a way that adds value to the customer. Basu (2014) noted that what is meant by quality is often variable and the answers are vague. Quality can have

many meanings and for some it can simply mean working on activities related to quality management systems recommended in bodies of knowledge.

2.8. Risk Management

Risk Management is considered as one of the main factors contributing to project success and companies' long-term success in general. (Hartono et al. 2013) Project risk management has not been widely discussed topic in academic research despite its important role in project management. (Roque & de Carvalho 2013) The PMBOK Guide (2004, 237) includes risk management planning, identification, analysis, responses and monitoring and control on a project as the project risk management processes, most of which are meant to be updated during the progress of the project. These so-called *risk management subgroups* are the traditional way to divide project risks. Risks have become more numerous and interdependent in complex projects such as new product development and construction projects. This development is caused by technological and organizational complexity. Since project risks are numerous, it is nowadays considered as a normal approach to break this risk list down into subgroups or clusters for better project risk management. (Marle & Vidal 2011)

In addition to the PMBOK Guide's approach, several ways to divide project risks have been proposed: these proposals include for example grouping risks according to their nature (e.g. financial or technical risks), grouping risks according to one of their numerical attributes (e.g. probability, impact etc.) or grouping them according to their risk owner. This approach has been criticized by Marle & Vidal (2011) for not properly considering project risk interactions and they have proposed a risk clustering approach which enables comparisons between several risk grouping possibilities using several indicators: total value of interactions inside the clusters and the structure of the clustering solution. Multiple tools have been developed to mitigate project risks and their impact on project success: most organizations have a formal policy for risk management and analytical tools for supportive purposes.

These tools can include different risk identification, analysis, response and evaluation tools (Zwikael & Ahn 2011).

Zwikael & Ahn (2011) found industry and country where a project is executed have a significant impact on perceived levels of project risk and risk management processes. Conclusion was that risk management practices overall help to reduce their negative impact on project success. This was evident even with just having a moderate levels of risk management planning. Pinto (2013) advocates for an effective, proactive risk management processes that recognize an organization can learn both from the response to actual events and using these events for better response in the future. According to Pinto (2013) most organizations lack a proper risk management plan and overall it is an area which is not used as a critical component in the entire project planning process.

Organizations have become more aware of the need for risk management processes, but according to Pinto (2013) typically the organizations are lacking an agreed risk management methodology that is routinely adopted. Risk planning tools have become widely-used popular method to mitigate project risks but despite their popularity, some criticism has been present in academic literature in recent years. Zwikael & Ahn (2011) have summarized this criticism in five points: (1) use of only a limited variety of tools (2) poor quality of use (3) complexity of existing tools (4) low authority of project managers and (5) perceived low effectiveness of these tools

2.9. Communications Management

Ramsing (2009) has proposed that the term “project communication” would be discussed as the overall term for all aspects of project communication where project team is understood consisting of project manager, other project team members and project stakeholders both internally (in the organization) or externally (e.g. suppliers, consultants for the project). According to Ramsing (2009) the term “project communication” needs clarification and her findings included that the term itself is just emerging in the literature. Her study found that despite growing understanding that there is a need to focus more on project communications there is no

collaboration between research in the field of corporate communications and the field of project management.

The effective implementation of information management strategies contributes heavily towards project cost and schedule goals since project management process is information intensive and information dependent. Information management is a continuous process that is essential to a company's normal workflow. (Back & Moreau 2001) The PMBOK Guide (2004, 221–222) has defined project communications management as one of the project management knowledge areas which provides the critical links between people and information that are necessary for successful communications. According to the PMBOK Guide everyone involved in the project should be able to understand how communication affects to the project.

1. Communications Planning
• Information and communication needs of the project stakeholders
2. Information Distribution
• Making needed information available to project stakeholders on time
3. Performance Reporting
• Collection and distribution. Includes status, progress and forecast reports
4. Manage Stakeholders
• Communications management to satisfy the requirements and resolve issues with project stakeholders

Table 1 Project Communications Management processes (The PMBOK Guide 2004, 221)

Table 1 describes the Project Communications Management processes as defined in the PMBOK Guide (2004, 221). Communications processes interact with each

other and occur at least once in every project and in one or more phases if the project is divided into multiple phases. In practice the phases may overlap and interact with each other in the ways table 1 doesn't detail. (The PMBOK Guide 2004, 221–222)

Back & Moreau (2001) have proposed three project information management strategies to improve the project management process. These strategies are not dependent on technology, information technology is viewed as enabling tools. Information management is characterized by having many areas for improvement, many benefits attributed to information management and many technologies from which to choose. This reality means that information management strategies are needed to help businesses to develop their work processes and IT implementation. According to Back & Moreau (2001) information management strategies should be technology independent. Communication has been recognized even as "the lifeblood of a project". Zulch (2014) studied communication planning in the construction industry and argues that project managers' skill to communicate impacts on the most important aspects of project management. Effective project communication is needed in the areas of cost, scope, time and quality and in these areas the project manager must be effective since these are factors where the project success is dependent on. According to Zulch (2014), communication integrates cost, scope and time to achieve a quality product. It is the project manager's responsibility to develop the project's organizational structure, and the project's communication plan and communication lines. A formal communication plan should be in placed to agree how stakeholder opinions and actions will be managed.

3. PROJECT PERFORMANCE

Project success and causes of failure is one of the most relevant fields of study in project management research. Each stakeholder working on a project has their own view about the importance of determinants for project success or failure which goes beyond the traditional criteria of time, cost and quality. (Montequín et al. 2018) In general, each project is constrained by its goals related to project scope (specifications of what shall be delivered), time (the completion date) and cost (project budget). These limitations are sometimes referred in project management as the triple constraint (or project triangle). Project management must consider and balance all these three constraints to reach success. Detailed planning therefore must be conducted at the start of the project. (Andersen 2015; Schwable 2009: 6–7) In complex projects, knowledge management has also been described as one of the main the main project management success factors while the lack of knowledge management has been described as one of the main reasons for project failure (Gasik 2011).

In their paper Andersen et al. (2006) studied project success factors and implicated in their findings that project managers should concentrate more into improving communication within the project and towards the project environment. In addition to the traditional triple constraint, in recent years several indicators have been developed to estimate other aspects of project performance. However, it has been pointed out that most of these new indicators are characterized by being primarily used for benchmarking purposes rather than for controlling the performance during projects. (Al-Jibouri & Haponava 2008) Luu, Kim & Huynh (2007) have proposed applying benchmarking approach to evaluate and improve project management and thus project performance. Their study focused on projects in the construction industry and was conducted from the contractor’s point of view. Luu, Kim & Huynh provided nine key performance indicators that can be applied to measure project management performance.

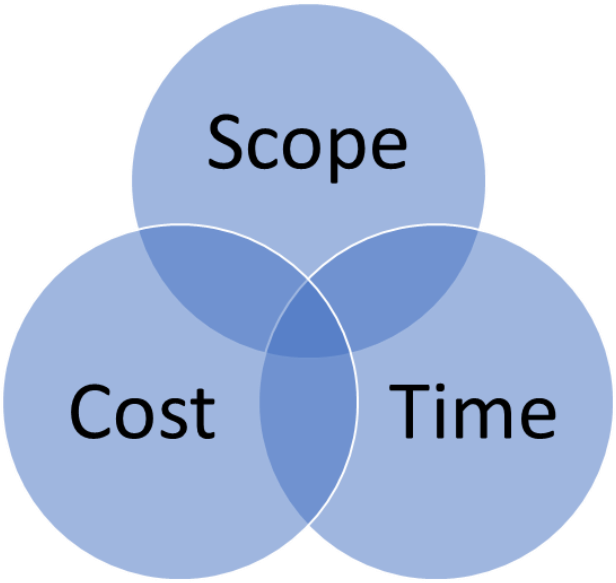

Figure 8 Project scope, cost and time form so-called “Triple Constraint of Project Management” (or “Iron Triangle” of Project Management) (The PMBOK Guide 2004, 8)

Project success has provided extensive amount of discussion topics in project management literature. Project performance has been measured by financial criteria, including economic return and cost / benefit analyses and profits. The most often used performance metrics are related to achieving the initially planned delivery schedule and achievement of target costs at the end of the project. In addition to these criteria one possible way to assess project performance is to analyze the margins of a company’s ongoing projects. (Carvalho et al. 2015) Andersen (2015) argues that project management can be viewed from different perspectives by project managers. Andersen divides perspectives in two categories: task and organizational perspectives. If a project is viewed from task perspective the project manager is focused on delivering on time, within the budget and with specified quality. The organizational perspective on the other hand sees project manager focusing more on supporting the value creation in the receiving organization. Andersen conducted a survey which revealed that perspectives depend among project managers.

Carvalho et al. (2015) investigated the effects of project management on project performance under three aspects: schedule, cost and margin parameters. Their

study also adopted an approach that evaluates the project complexity, according to four categories, the effect of industry sector as well as the effect of country. Results indicated that project complexity has a significant effect on two project success aspects: margin and schedule. This significant explanatory effect was demonstrated in both cross-country and cross-industry analyses. Demirkesen & Ozorhon (2017) aimed to develop a complete performance measurement model specifically for the construction industry by using the PMBOK Guide defined *Project Management Knowledge Areas* (Scope, Time, Cost Management etc.) as the main determinants of performance.

Demirkesen & Ozorhon's (2017) findings revealed project financial and risk management to contribute both directly and indirectly to performance while project communications and cost management had only direct impact on performance. Project scope and time management on the other hand had only indirect impact on performance through risk and cost management. Companies should pay attention to the existence of clear objectives and expectations based on the indirect impact of scope and time management. Positive effect of communications and cost management should encourage companies to improve their performance in those fields, it is suggested that companies should take benefit from e.g. project-based knowledge management systems and enhance cost performance through determining critical milestones and cost breakdown structures. Risk management should be prioritized by setting up proper risk management procedures

Zwikael, Shimizu & Globerson (2005) focused solely on the project planning phase and compared cultural differences in project management between Israeli and Japanese project managers. Their study found significant differences and concluded that Israeli project managers were more focused on performing Scope and Time management processes while Japanese project managers paid more attention to Communications and Cost management processes. Measurement of project success and performance also differed: Japanese organizations used clear and measurable success metrics for each project, while unclear project objectives were common in Israeli organizations.

3.1. Role of Project KPIs

Project KPIs (Key Performance Indicators) is a crucial criterion against which a part of the project can be measured. KPI can be a milestone, design, delivery, production, testing, erection or any other important project phase. Some KPIs cannot necessarily be measured until the completion of the project or after the project has been running for several years. (Lester 2014, 37–39) Key Performance Indicators along with Balanced Scorecard, maturity models and critical success factors have been in focus regarding project performance measurement research in existing studies (Demirkesen & Ozorhon 2017).

Performance measurement has received a lot of attention in the academic literature with extensive research but since performance measurement criteria vary heavily from project to project there is still no common framework for mega project performance measurement. Toor & Ogunlana (2010) investigated the perception of key performance indicators in large constructions projects in Thailand. Construction industry has traditionally relied on the conventional measures of time, cost and quality (“triple constraint”) but their findings suggested that the traditional “triple constraint” is no more applicable to measure the performance of large-scale development projects. In addition to the measures of triple constraint, other research has suggested considering e.g. customer satisfaction, overall stakeholder satisfaction or project team’s risk management ability as performance evaluation criteria. There are signs of construction industry moving away from the traditional measures of time, cost and quality towards a mix of quantitative and qualitative key performance indicators.

Although using Key Performance Indicators is well-known and widely common in practice, the research is still lacking evidence on e.g. how often KPIs are reported and how many KPIs are being used. In the literature KPIs are traditionally used to continuously report and monitor the progress of the development. Staron, Niesel & Bauman (2018) explored the practical use of project KPIs in a large company with special focus on whether the KPIs are used continuously or only during a short time period. Their study was based on 12 different projects at Volvo Car Group in Sweden related to software and non-software projects. Results of the study found that KPIs

are mostly reported before reaching a project milestone and manual assessment of KPI status is as important as the automated data provided by the KPI reporting system.

3.2. Project Success

Historically research on project success has focused on project achieving its goals on cost, quality and time objectives. (Tsiga, Emes & Smith 2017) Project success can be narrowly defined as achieving the intended project outcomes. In the early literature on project management the intended outcomes were mainly looked in terms of specification, time and budget but as the project context has shifted it is now recognized that a wider set of project outcome measures is needed. (Andersen et al. 2005) In some industries there are additional indicators that are equally or even more important than the traditional performance measures, such as safety, sustainability, reliability, legacy etc. (Lester 2014, 37–39). Project managers' role is extremely important, and they play a vital part in achieving project success. Project manager works with the project team and other project stakeholders to meet the defined project goals. Project manager should also consider the fact that their view of a successful project is not necessarily the same as the customer's. This means that the customer's expectations need to be considered. Understanding project success criteria should help you to develop Key Performance Indicators needed to estimate the project success. (Schwalbe 2009, 12–13) It must be addressed that success criteria can obliviously be subjective and depend often on the observer's point of view (Lester 2014, 37–38).

Measuring project success through the traditional time, budget and requirement criteria has been indeed criticized but according to Taherdoost & Keshavarzsaleh (2016) it is nevertheless a structure routinely used to determine the success factors in almost all semi-complex projects, e.g. information technology projects. This structure is shown also in Figure 9.

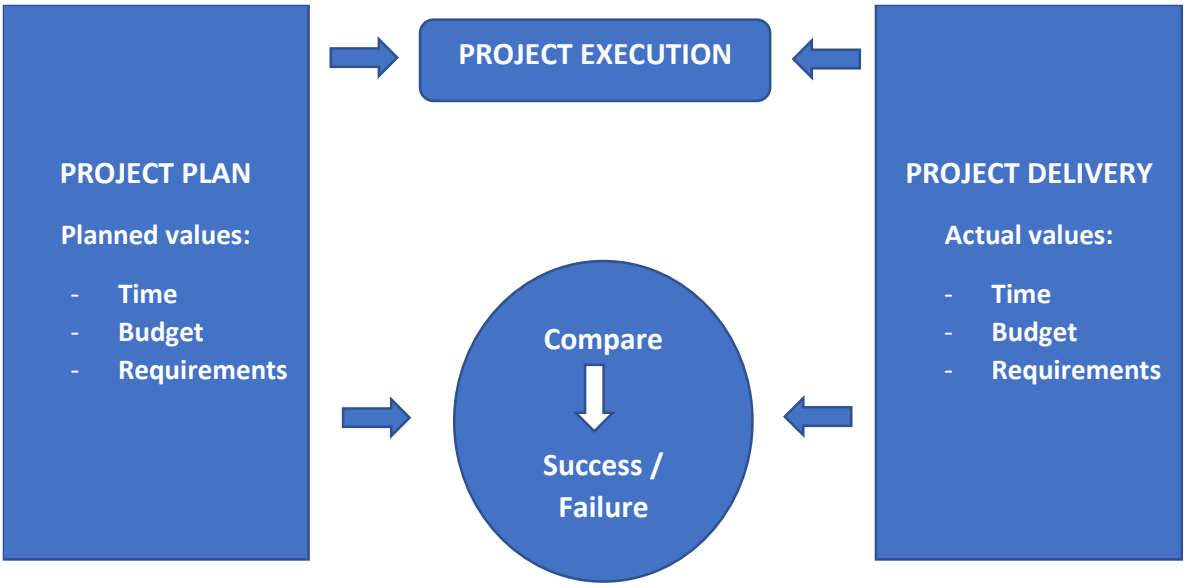

Figure 9 Success factor structure in semi-complex projects (Taherdoost & Keshavarzsaleh 2016)

Andersen et al. (2005) findings have suggested multiple factors contributing to project success. Strong commitment, early stakeholder influence, stakeholder endorsement of project plans and rich communication were defined as the most important factors in improving managerial ability to deliver good results regarding time and cost. Their results suggest that project managers' energies should be increasingly focused on rich communication both within the project and towards the project environment. This is due to the conclusion that project approach increases in use as a means for implementing strategic goals which means success is measured more on long-term benefits and impacts. For project success, this implies that a stronger stakeholder approach – whether it is internal or external to the organization – should be applied.

Instead of linking project management success with the so-called "The Iron Triangle" of cost, time and quality management, Atkinson (1999) has proposed dividing project success into three categories: (1) Doing the process right (2) Getting the system right and (3) Getting the benefits right. Atkinson has argued that in project management time and cost are in most cases estimated at the very beginning of the project – when the least is known. Quality, on the other hand, is subject to people's own attitudes and beliefs, which often change during the project life cycle. Atkinson's

framework suggests adopting other criteria in addition to the Iron Triangle. Lipovetsky et al. (1997) define four dimensions for project success in the context of defense industry: (1) meeting design goals, (2) benefits to the customer, (3) benefits to the developing organization and (4) benefits to the defense and national infrastructure. Their data analysis concluded that benefits to the customer is by far the most important success dimension while the second important is meeting design goals. Lipovetsky et al. also note other two dimensions being relatively unimportant.

Standish Group's Chaos Report 2009 revealed that less than one-third of surveyed projects were considered to be successful when measured with delivery on time, on budget and with right requirements. According to Yeong & Lim (2010) this might indicate that the knowledge acquired from past projects has not been transferred by project management personnel to ensure a higher success rate for the next projects. Todorović et al. (2014) also found that the lack of project success analysis and a proper documentation on the previous project results is a major obstacle for knowledge management in a project environment. Yeong & Lim (2010) have suggested implementing Knowledge Management as a discipline and practice in the organizations. They have proposed an integrated model which combines Knowledge Management with Project Management.

In a project environment knowledge should mainly come in the form of explicit knowledge sources but project managers and the project could benefit from sharing and codifying tacit knowledge associated with former projects (Yeong & Lim 2010). Number of studies have indicated that systematic knowledge transfer from, between and within projects has a great impact on the project success (Frey et al. 2009, Polyaninova 2011). Hanisch et al. (2009) found that the need for an improvement of project knowledge management is recognized in the companies but a systematic approach exists only in a few of them. They concluded that project knowledge management is mainly determined by cultural factors while technical aspects (such as information systems, PM methods) serve only as supporting factors. Kasvi, Vartiainen & Hailikari (2002) argued that to systematically manage the created project knowledge, the projects must also be managed systematically. Systematic project knowledge management is needed to turn a project organization into a learning organization.

3.2.1. Critical Success Factors

The definition of project success has varied depending on the researcher, but cost, time, quality and stakeholders' satisfaction have been generally seen as the main components which can affect project success. Cost has been found to be a very important factor in overall project success while time has been found to be the most important factor. (Mirza, Pourzolfaghar & Shahnazari 2013) Roque & de Carvalho (2013) studied projects with different complexity and in different industrial sectors. Their study demonstrated that risk management practices and a named project risk manager has a high positive impact on project success.

Several academic studies have provided a set of the most important success criteria. Rodríguez-Segura et al. (2016) analyzed a total of 29 large international industrial projects in the aerospace and defense industry to understand success factors of these projects. Study concluded not all factors have the same influence on the project success. The customer and user, the project environment and solid project management practices were defined as being the most relevant project success factors while the study also pointed out the importance of the customer, the company and the time in obtaining the success as success criteria.

As discussed earlier, *A Guide to the Project Management Body of Knowledge* (The PMBOK Guide) names nine so-called Knowledge Areas to focus to manage projects successfully. The PMBOK Guide still does not put these knowledge areas in order by their relative importance. Zwikael (2016), by conducting a field study involving total 783 project managers from different countries and industries, concluded that Knowledge Areas with the greatest impact on project success were Time, followed by Risk, Scope and Human Resources. The Knowledge Areas with the lowest impact were Cost and Procurement. Zwikael found out though that these results were greatly depended on the industry: for example, Integration and Cost were defined the most important Knowledge Areas in construction and engineering industry while Communications Management the most important in production organizations. Results implied that in planning phase project managers do not put enough effort in Communications and Quality but instead put the expected amount of effort into Time, Scope and Human Resources which were found to have the most

impact on success. Loo (2002) conducted a study with a sample of 34 Canadian project-based organizations and found that best practices consisted e.g. of effective scope management, effective project planning and scheduling and effective communications management within project teams and externally.

Barry & Uys (2011) studied the status of project management and success factors in South African context. Their findings suggested that project stakeholders estimated the most important success factors were e.g. customer / client satisfaction, project communications and reporting, scope management and on-time project delivery. Barry & Uys argued that internal stakeholders hold a different view of project success when compared with external stakeholders. Tsiga, Emes & Smith (2017) studied critical success factors in the perspective of a single industry, petroleum, and identified 58 success factors which were categorized into 11 groups. After testing and grouping these factors based on their individual relative importance index the authors concluded that the petroleum industry sees risk management and requirements management as the main contributors in achieving project success in the industry.

3.2.2. Project Failure

Project success and project failure should not just be looked as alternative or extreme scenarios. Usually failure has a long lead time which culminates in a singular and somewhat disastrous outcome. Projects can run over budget, take a longer time to complete or fail to deliver the promises made about quality, scope, safety or other stakeholder key expectations but overall projects do not often end up with a devastating failure. (Kusek, Prestidge & Hamilton 2013, 3–4) Cancellation of a project is not necessary a project failure. It is important to understand the difference between a project failure and a product failure since sometimes there can be a good reason to cancel a well-managed project, for example if it is discovered that the project’s original goal is no longer valid (Taherdoost & Keshavarzsaleh 2016).

Project failure because of differences in interpretations by project stakeholders has been investigated as a possibility by Davis (2016). According to Davis, literature does not have recorded theory about project success which would also consider the perspectives of multiple stakeholder groups. Ikediashi, Ogunlana & Alotaibi (2014) conducted a study on project failure factors in Saudi Arabian construction industry and their findings revealed that poor risk management was considered as the most critical failure factor for the management of large scale infrastructure projects. Poor risk management was followed by poor cost management (budget overruns) and poor communications management. Project performance in the construction industry was also studied by Hjelmbrekke, Hansen & Lohne (2015) who discovered that problems escalate when external suppliers are involved in the project. These problems with external suppliers are characterized by poorly formulated planning, misallocated resources, communication failure and limited accountability. Pinto (2013) has argued that project failure has its roots with flawed project planning process. Research suggests that despite efforts put into project development the failure rates are still high, especially in information technology and infrastructure construction projects and even projects that are considered as success easily run over budget and schedule.

Knowledge management can cause challenges in a project environment which again can have an impact on project performance: study among project management professionals by Leseure & Brookes (2004) found that significant events, such as termination of a long-term relationship with a supplier, high turnover in the organization, company growth or large re-organization initiatives are a cause of knowledge management disrupt. Montequín et al. (2018) survey conducted among project managers all over the world found multiple causes for project failure identified by project managers. Figure 9 represents project failure factors grouped in categories which are interrelated. The factors have been derived from existing literature and previous studies and have been grouped in four categories according to Belassi & Tukel taxonomy (Montequín et al. 2018).

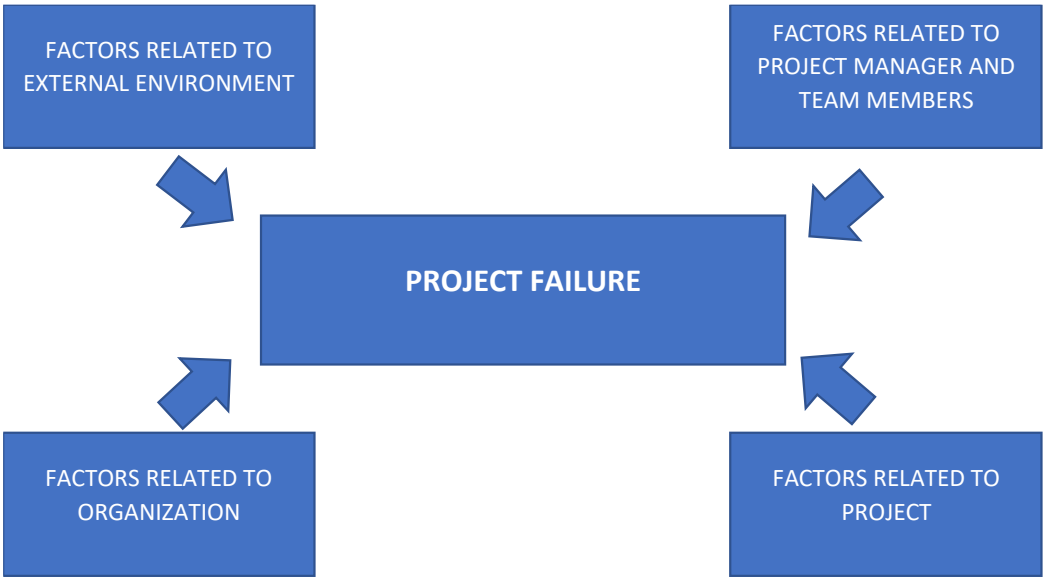

Figure 10 Project failure causes by category classified according to Belassi & Tukel taxonomy. (Montequín et al. 2018)

Figure 10 represents project failure factors grouped in categories which are interrelated. The factors have been derived from existing literature and previous studies and have been grouped in four categories according to Belassi & Tukel taxonomy (Montequín et al. 2018). Clear majority of the project types studied by Montequín et al. (2018) belonged to the field of information and communication industry while others included e.g. financial and insurance activities and construction. Summary of the answers received showed that the most frequent failure causes reported were (1) inaccurate, incomplete or undefined customer's requirements (2) continuous and dramatic changes to initial requirements (3) inaccurate time estimations and (4) inadequate documentation of project requirements. Based on the survey results Montequín et al. found five clear clusters where respondents behaved differently in analyzing failure causes and at least three answer patterns. The prevalent order of influences was concluded to be project factors, organizational-related factors, project manager and team member-related factors and external factors.

4. RESEARCH METHODOLOGY AND DATA

Chapter 4 discusses the qualitative research method used to conduct this study and explains the data collection and empirical analysis process.

4.1. Qualitative Research

The qualitative research was chosen as a method for conducting this case study since previous literature has shown both planning requirements (Serrador 2013) and the relative importance of project management knowledge areas (Zwikael 2016) are industry-dependent. Qualitative research is characterized by its interest in the perspectives of participants and their everyday practices and knowledge related to the study. While quantitative research takes its empirical material from numbers, the qualitative research is using text-based material. (Flick 2011; 2–3) According to Flick (2011; 14–16) there is a wide range of possible methods available in qualitative research, which makes methodological clarification and development necessary, identifying e.g. need to develop new forms of interviews, need for clearer advice when to use a specific method and – since qualitative research is not very formalized – a need for more information about how intuition in research works.

This research bases its main theoretical framework from three fields of academic study and literature: Project Knowledge Management, Project Management and Project Performance. This approach makes it necessary to use qualitative research method due to its natural way of collecting material which makes it possible to look the results from multiple viewpoints (Alasuutari 2011).

Case study research is suitable for answering questions “how”, “who” and “why” which questions are also included in the research questions of this study and therefore a case study approach was chosen. Case study method allows researcher to gain specific understanding about a phenomenon by giving the researcher an opportunity to look at the phenomenon in context. In practice this requires data collection about this phenomenon: in business cases this means

finding evidence for example in company – where the phenomenon is taking place. (Farquhar 2013; 4–5)

4.2. Data Collection and Analysis Method

This research studies one phenomenon, Project Management, by using a case study approach based on five interviews that were all conducted during a short period of time, approximately in one month. A semi-structured method was used for data collection in the interviews. The collected data is non-numeral, which follows the qualitative design of the study (Saunders, Lewis & Thornhill 2016, 165–166).

The participants for interviews were chosen based on their experience working with the supply chain management related issues in the case organization. All participants had between 3–10 years of experience with the case company projects. Participants A and B work directly in the organization under supply chain management (SCM) unit while participants' C, D and E role to the SCM unit is indirect. Interviews were all conducted in Finnish since it was the native language for everyone. All interviews were done as "face-to-face" meetings with each participant separately. Duration of the interviews were between 38–54 minutes and were conducted in a time period of approximately between September and October 2018.

Total 5 participants: A, B, C, D and E, were selected for interviews. Their roles' in the projects' supply chain management perspective are described below:

PARTICIPANT	INTERVIEW LENGHT	ROLE DESCRIPTION
A – Logistics Coodinator	44 min.	Responsible for executing project logistics so that all the necessary materials are delivered on time using appropriate methods of transportation. Logistics Coordinator communicates directly with the logistics suppliers for transportation arrangements. Logistics coordinator works in close collaboration with participants B, C and D.
B – Purchaser	38 min.	Purchasing tasks and maintaining relationship with project suppliers. Crucial to make sure purchase orders are handled on time in accordance with the project timetable to keep the project in the planned schedule. Purchasers have a close cooperation with participants A, C and D.
C – Production Coordinator	54 min.	Responsible for the material flow, mainly with the participant E (Supply Development Manager) but also with other project internal stakeholders in some degree.
D – Project Manager	43 min.	Ultimately responsible for project performance. Unlike other participants, more directly in contact with the customer. Expected to communicate project demands to the other participants. Project manager can be in daily contact directly with participants A, B and C but only rarely with E.
E – Supply Development Manager	48 min.	Works closely with the production coordinator. Participant E's main responsibility is the daily management of sales and operations planning and acting as a link between the sales organization and suppliers.

5. EMPIRICAL RESEARCH: CASE

The chapter five is dedicated for the empirical part of this study. This chapter consists of the case description where the case company processes regarding projects and project planning phase are discussed after which the research results are presented.

5.1. Case Description

This research focuses to a single case company with global presence delivering several large-scale industrial equipment annually around the world to a customer base considered quite limited with potentially only around 1 000 – 1 500 customers globally. The case company has organized its business to a fully project-based model where especially project managers hold a significant responsibility in delivering a successful product to the customer.

Consensus among scholars and in the literature has been that project planning phase is a crucial part of the entire project life-cycle (e.g. Serrador & Turner 2015; Kerzner 2013, 378). Therefore, the empirical part of this study focuses on the project planning phase in the case company. Case company's standard process model for project planning is available through the company intranet and the model has been forwarded the supply organization through various channels since its formal launch few years ago. The model is used as a manual for the internal stakeholders involved in the project to follow through the project from start to finish. Though well-known at least by name within the organization, it is recognized that not everyone is aware of the model, it's demands, and how exactly to follow it accordingly in practice. Therefore, there's a need for clarification on how project planning effects to the overall project performance and also on how the supply unit views the planning phase.

Planning phase starts with the project kick-off which – in supply chain management unit's perspective – consists of planning of material flow, delivery concept, logistics,

manufacturing and quality. In addition to the general project kick-off, the project manager is tasked to take responsibility on holding separate kick-off meetings for both procurement and logistics units.

The five participants were each interviewed about the current state of project planning practices and their answers were looked through the PMBOK Guide's Project Management Knowledge Areas. In addition, the participants also had a chance to describe their general feeling about the project planning status. Chapter 5.2.1. looks planning in the production coordinator's and supply managers point of view, and chapter 5.2.2. looks planning as how the purchaser and logistics coordinator are seeing it. Project manager's view is added in both chapters since project manager is expected to work in close collaboration with the other project internal stakeholders.

5.2. Current project planning status

As mentioned, the case company has developed a detailed framework with guidelines for the project organization to follow throughout the project from the initiation phase all the way to the project closing, this represents the main form of explicit knowledge in the case company. During the planning phase, the project organization is expected to go through a total of 15 different steps before proceeding to the next step. The steps vary from project opening to project plan completion. In supply chain management unit's perspective there are three steps that require the most resources during project planning phase and can be identified as having most effect to the supply organization during the project. These three steps are presented below:

(1) Delivery Concept
(2) Material-Flow Planning
(3) Logistics Planning

Delivery concept comes as the first step before material-flow and logistics planning take place. After the deal has been announced the project manager assigned for the project calls for concept review meeting where especially supply chain management-related issues can be brought up for final discussion before the project concept is locked. This step requires the participation of many project team members, including project manager, production coordinator, logistics coordinator, purchasing manager, logistics manager, quality manager, engineers etc. The main topics under review in the step are: manufacturing issues, supplier scopes, material supply responsibilities, delivery and logistics concept. Other topics discussed include long-lead time items and supplier-related limitations.

Material-Flow Planning is assigned to the production coordinator and the person in this position plans the project material flow and creates the purchase plan map to be shared with the procurement department. Purchasers are responsible for communication with the suppliers at this stage. Production coordinator also estimates and communicates the transportation needs and estimated volumes to the logistics department during this step. Purchase plan should include for example information about long lead-time items, material delivery scope, time schedule and definition of possible risk items that require special attention. Unclear scope issues should be discussed by the production coordinator with subcontracting personnel as soon as possible.

Material-Flow Planning is followed by Logistics Planning step, which is a task dedicated to logistics coordinator named for the project. Before this step occurs, the project schedule has already been decided, delivery concept has been finalized along with the estimated volumes to be transported. Logistics coordinator works in close collaboration with the selected logistics suppliers, who take the responsibility for the operational work during the project under the case company’s supervision. Additionally, logistics coordinator plans and communicates the necessary logistics issues that should be taken care of during the project to project manager and production coordinator. Logistics coordinator holds also some cost management-related responsibilities: project manager informs the reserved budget for logistics which serves as a guideline for supplier selection. Risk management is divided between logistics coordinator and project manager.

Project managers rarely take part in the sales process which happens mostly between sales people and product line organizations. An exception might occur if project manager has executed a project for the same customer before – then project manager could be involved in the sales process as in the role of an expert.

"Well, it depends on the project… sometimes we get moving very fast, but sometimes it feels like this planning phase is taking more and more time, which then creates more difficulties as the whole project timetable moves also. We should be able to start purchasing process on time."

Participant B about the project planning phase execution.

All participants agreed that decisions made during the project planning phase have a great impact on whether the project ends up being successful or not. Project planning phase lays the foundation for the whole project and if done properly, planning helps the next steps when project goes forward. Clear criticism towards the current project planning process map could not be recognized in the interviews, but participants found problematic features on variety of issues.

Pinto's (2013) suggestion that planning should be divided into segments is present in the case company, but this segmentation was not present in the interviews with the participants. In supply chain management perspective, projects are broken down into smaller segments, such as logistics, production and procurement and they are handled one at a time during planning phase in many different steps. According to Pinto this approach reduces complexity and increases project success rate, and this view wasn't challenged in the interviews by the participants.

5.2.1. Production planning

Production Coordinator (participant C) shares the responsibility of material flow planning with the Supply Development Manager (participant E) whose role was

emphasized. Main duty of the production coordinator is (with supply manager) is to make sure factories are assigned to the project so that the production schedule fits with the project schedule. As the possibilities to re-organize the production are quite limited, the participant C felt like the early stages of the project are filled with uncertainty.

Project manager's (participant D) possibility to influence in the production planning is limited. Quite many decisions regarding production have already been made by the sales organization before the project is handed to the team for execution.

"Often, we can't influence in which production sites the projects are made – it's kind of given like 'oh, these are done here, here and here."

Participant D.

Production plans are discussed with the suppliers – who in most cases have a long experience working with the case company. Discussions with the suppliers focus mostly to the production scheduling but according to participant E also other technical details are gone through from time to time. Overall, the participants estimated that the supply organization has little or no influence in what kind of production concept is used as its most of the time decided already during sales process by the sales organization. Sales organization is and should be aware of the production capacities, so the production planning process doesn't start from zero when the project is handed to the supply organization.

5.2.2. Planning procurement and logistics

Key part in managing project supply chain are the decisions made in procurement / purchasing planning. The actual planning phase was described as quite light by the participant B and the focus of the purchasing department is mostly on the actual purchasing process rather than in planning. Some work can still be done while the

project is still in the tendering phase. This work done by the purchasing includes asking quotations from suppliers to identify possibilities for volume discounts. For items with long lead time it is anyway necessary to start working before the project beginning. Asking quotations is not just limited to the purchasing and the participant B mentioned that (depending on the product line) also designers who are not included to the supply organization can start to ask quotations from suppliers in the early stage of the project.

Locking the project scope and specifications with the customer is needed for the full kick-off of the purchasing planning process which limits the possibilities of the purchasing department to start working early with the project. Delays with locking up project scope and specification is a possible risk for purchasing but this was not highlighted as being a present issue, and actually participant A felt that project scope is locked up in the early stage of a project and rarely causes issues.

Overall, purchasing's view about their role in the planning process could be described as quite light, and the similar feelings were also discovered in logistics. Both logistics and purchasing agreed that much is dependent on the project manager and his / her approach to the project planning. On the other hand, logistics planning is a shared responsibility between production coordinator and logistics personnel. The participants didn't recognize much cooperation being there between them: participant A saw logistics' part limited mostly to asking delivery quotations from freight forwarders and then arranging shipments from suppliers according to the material flow plan done by the production coordinator. Sales organization rarely is planning logistics-related issues during the sales phase, especially if some comparison data can be found for a similar kind of a project that has previously been executed.

Despite difficulties mentioned in the interviews, both logistics and purchasing had a belief that in overall the project planning process is working and projects achieve the performance targets set. Purchasing emphasized that sometimes the planning phase takes too much time which makes it challenging for them to start the purchasing process on schedule. Participant B didn't mention purchasing should have a better presence in the planning phase, but participant A strongly felt like logistics should be more deeply involved in the project planning phase.

"We are more focused on the technical part while stuff like material flow, money flow and all kinds of official matters… those we start always to think about a bit too late"

Participant A.

Project planning was also described as being too engineering-orientated while matters related to supply chain management are easily ignored. This view was dominant especially in the logistics while other participants didn't question if projects indeed are too engineering-orientated.

5.3. PM Knowledge Areas between project stakeholders

After the general discussion about project planning practices the participants more detailed answers about project planning were reflected to the selected Project Management Knowledge Areas: Scope, Time, Cost, Quality, Risk and Communications management.

5.3.1. Scope Management

It was agreed by everyone that project scope is quite well-managed area in the case company and once the scope is locked there are rarely any significant scope changes. The several triggers for scope re-evaluation described by Ayers (2004, 92) were recognized being possible in the case company, such as supplier's failure to keep promises. Participants had examples of scope changes but despite this, the case company itself doesn't have clear guidelines for change management.

Participants pointed out that even if some significant scope change would take place, the supply organization has some possibilities manage it. Project manager emphasized that the greatest scope challenges happen between the company and the customer because it's not always clear – despite there's usually a contract in

place – for stakeholders who is taking care of what in the project. It was acknowledged by all participants that scope changes happen, but no particular "scope change process model" exists within the case company nor in the project process mapping. Possible scope changes are mostly handled on *case by case* -basis. The tools provided by the PMBOK Guide (or McCann 2013, 52) to control scope changes were not brought up during the interviews.

"…we are not all the time looking to save 'that one euro' in every project. We give it a great value if things have worked well [with the supplier]"

Participant D.

The company supplier base consists mainly of regular suppliers who might have years of experience doing business with the case company. Therefore, suppliers have quite good overall knowledge of the case company projects and the project demands. Relationship with suppliers is maintained by holding monthly meetings where procurement and production personnel go through the timetables, schedules and other possible problems and issues. Logistics also has regular suppliers, but the relationship is maintained with not such a regular basis. Evidence of problems with scope change management within the supply chain was also discovered: Problems can occur if the company must take in new suppliers in the scope, and in these circumstances the problem is the lack of proper documentation as the people are used to do business with the old supplier base (participant E). Similar issues have been brought up by Leseure & Brookes (2004) where significant changes in supplier scope were identified as one of the main sources of project knowledge management challenges. Compared with the findings by Heravi, Coffey & Trigunarsyah (2015) in the construction industry, the case company involves suppliers early in the project and at least tries not to see suppliers only taking part in the execution process.

“In procurement department different people handle different projects… so our views can also differ. The suppliers I’m dealing with, they know our scope pretty well.”

Participant B.

Participant B reminded that purchaser has assigned suppliers, and therefore other people in the purchasing department might not know what is exactly going on with those suppliers and how they feel projects are handled. Similar kind of approach to suppliers was not identified in the logistics department where everyone has some relationship with basically every supplier.

5.3.2. Time Management

Production schedule for the project is built starting from the end, which means beginning from the customer handover. Supplier-related time management challenges are possible to manage by checking if it’s possible to transfer production, possibly from other projects to another location. If this approach is not possible then the situation might require some improvising, such as working overtime etc. Participant C pointed out that in theory these time management challenges would be possible to anticipate during the project planning phase, but unfortunately in practice this is not possible.

Participant A criticized the case company being too focused on engineering design of the product while the supply chain issues are in a secondary role regarding project completion. Each project has its planning map but in material flow perspective it was viewed as too vague, especially for logistics purposes. In A’s view logistics is often unaware when exactly are the materials supposed to be delivered. On the purchasing side this same issue wasn’t discussed, and B didn’t mention procurement department would have encountered challenges with scheduling purchasing orders.

Participant B associated project time management with the supplier base control. While the case company mainly deals with a well-known supplier base, sometimes purchasing (B) is forced to look for alternative suppliers. These demands can come from e.g. legal environment or other regulation, and the goal is to communicate the changes to the procurement department as soon as possible.

The main tool used for project time management is using so-called *time buffers* during different project phases. Time buffers are especially necessary during the handover since some of these are logistics-related legal issues giving suppliers flexibility with the transportation. According to the participant E, if despite all efforts, buffers fail then the basic guideline is to make up that lost buffer during the next steps of the project but there are also quite many processes in the supply chain that can be speed up if necessary.

5.3.3. Cost Management

Project manager and Supply development manager emphasized the importance of the sales phase and engineering: most of the costs are being locked already during the design / engineering and ideally some analysis about the costs should be made already during the sales phase. This limits the possibility of the project manager to achieve cost savings since, as mentioned earlier, many things are seen as given. Project manager recognized that logistics is a supply chain management area where costs are not given a lot of attention during the planning phase. This was also confirmed by the production coordinator, who didn't recognize that any special cost management activities or discussions had taken place. Cost overruns caused by issues in the supply chain can also be managed by reservations allocated to the project and this is a tool quite often used in case cost overruns are identified.

"[Cost Management] doesn't really show to us in purchasing during the planning phase, instead we see it during the later phases… it would be a good idea if we could see how much costs have been allocated… since in the end it's us who are buying them."

Participant B.

Purchasing saw limited access to information as the main obstacle for efficient cost management and in their view project manager should be more open and share cost information with the purchasing department. Logistics also described limited access as one of the obstacles, but A also mentioned that project cost reporting doesn't have enough details for logistics so that it would be possible to draw conclusions out of those figures. Project manager denied having any particular reason for not to share necessary information.

Just as project manager, both purchasing, and logistics didn't see themselves as an active player during planning phase. The lack of full picture is evident, even though many things are indeed asked beforehand from logistics, purchasing and project managers.

5.3.4. Quality Management

Detailed quality and inspection plan is made for each project, and the plans are meant for managing the specific needs of each project. Customer specifications are evaluated, and the necessary information passed through the suppliers who then communicate with the case company in case there are any issues that should be discussed.

"It's already too late if we notice during the project kick-off that this is more expensive than usually because of some additional quality demands we have to do."

Participant E.

Steinman (2014) argued that quality planning should begin at the early stage of a project. Participant E confirmed that this true in the case company: project supply organization should be aware of the quality issues on early phase. Quality management cannot be done during the project execution and it is necessary that already during the sales phase customer quality demands are well-known and so that their effect on costs can be estimated properly. Again, reservations allocated can be used to manage quality issues.

Participant B did not see supplier quality management as a project-related matter. For procurement and logistics supplier auditing is the method to evaluate supplier quality. Supplier auditing has strict guidelines and framework which to be followed. Auditing concerns for all suppliers in the case company's manufacturing, subcontracting and logistics.

Participant C's understanding was that quality-related matters are not exactly something the production coordinator is supposed to focus on. Instead, participant C handed the responsibility in quality issues to project's Quality Engineer who is present when the quality issues are gone through during the project kick-off meeting. Quality Engineer's role (according to C) is to take care of quality-related documentation which are then directly sent to the purchasers, which basically means quality documents also go pass the production coordinator.

Participant C hoped for better access to quality documents and saw the whole quality management process as unclear – quality management in the C's view was something Quality Engineer should go through, mainly with the project manager and designer and other engineering personnel. Quality Assurance and Quality Control, as described by Steinman (2014), are not under a lot of attention during project planning, and participants were not aware of how quality assurance or quality control should be handled – and exactly who is responsible for that. All participants

identified there are quality issues that projects should recognize, but supply organization's quality management tools were limited to just identifying quality problems.

5.3.5. Risk Management

Project Manager plays an important role in the project risk management and is expected to be aware any of the possible risks and to recognize the possible risk factors raised by the other project stakeholders, especially co-workers. Depending on the risk in question, project manager usually has some influence to it and is able to do something to minimize the risk.

"Yes, there are cases where project manager is handed a project, and you just notice instantly that 'yeah, OK so this is not going to work…'"

Participant D.

Projects are in many cases just handed over to the project manager for execution by the sales organization. There are cases where project manager has noticed straight from the start that the project is going to face problems which means using the available tools and / or knowledge or just improvising to make it work. The risk of being dependent on just one supplier was the main factor raised by the participant B. Risks related to this are recognized, and the procurement organization's aim is to have at least few alternatives in case something happens. Surprisingly, the same issue wasn't raised as a concern in logistics. The customer might also have demands for using a certain supplier, but this was viewed as a concern for procurement rather than for the logistics department.

Participant C highlighted the production coordinator's importance in production scheduling and the schedule's importance to the whole risk management. Production coordinator is in close contact with project manager but, again, the

possibility to mitigate risks is limited because many things are locked already in the sales phase without the supply organization's presence.

As Zwikael & Ahn (2011) discovered, during the interviews participants agreed that in supply chain management perspective it's the industry and country that impact to the project risk level. Some level of risk management practices was identified, but again these practices lack the guidelines and formal procedures that are discussed in the planning phase. Therefore, the success of these risk management practices seems to be dependent mainly on the person in charge. Supply organization's approach to risk management is similar what Pinto (2013) describes as "superficial risk management", where the organizations have understood the importance of risk management but there is a lack of agreed methodology that is adopted on regular basis.

5.3.6. Communications Management

Communication with internal and external suppliers has a defined framework in the form of monthly held supplier meetings where procurement and production organizations go through the timetable, schedule and other possible issues with each key supplier. Every supplier has a named person (usually from the purchasing department) who is responsible for the relationship with this certain supplier. For the logistics, communication is more "project-based" and suppliers are selected by the logistics personnel on *case by case* -basis.

Each project has an organization structure map, but there is no particular "project communications plan" made during the planning phase. Internal communication was described as a problem by the most participants, but the resources are not particularly allocated for communications during project planning. How project communication is organized is mostly dependent on the project manager and how person in this position prefers to organize or allocate resources on internal communication.

Purchasing and production coordinators have monthly meetings with external suppliers, which is the main place where possible issues are raised, and new projects are announced to the suppliers. Participant C mentioned that monthly meetings are potentially complicated, and things might get mixed up because all the projects in progress at the moment (usually also every product line) are discussed with the supplier during the same meeting. It is very rare that a meeting would be held only to discuss about a single project.

Project manager's role in direct communication with external suppliers depends on the person in question according to participant D – communication in their view mainly goes through the product lines and procurement. In technical questions external suppliers can discuss issues directly with the designers. Project manager doesn't take part in the monthly meetings and it's rare that external suppliers would contact project manager directly. Participant D admitted that his knowledge about how other project managers handle communication is very limited since they don't really have any formal discussions about these issues.

…it differs how change communication is managed. Some project managers are better prepared than others and they have a clear understanding that who should receive and what information if changes happen… if these have not been planned and changes happen. Then the risk increases that all necessary information is not reaching everyone.

Participant E.

Unlike other participants, E clearly recognized that there is an existing framework for communications management. Though not clearly assigned to the communications – project process map is a tool that in E's opinion quite clearly defines how communication planning should be organized. Still, E also thought that it's in practice up to the project manager's decisions how these communication processes are planned and executed in practice.

Project communications planning as described in the PMBOK Guide (2004, 221) is present in the case company, mainly in the form of monthly meetings with the suppliers. Participants didn't clearly associate these meetings as communication and therefore the idea that communication is not planned was highlighted during the interviews with the participants A, B and C. In their roles, Project manager (D) and Supply development manager (E) clearly considered regular supplier meetings as part of the project communication.

5.4. Project success and performance

Project success and performance evaluation was the second major topic discussed with all participants and their answers' regarding how project success is defined had few notable similarities: everyone agreed that the major success factor is whether the project handover to the customer is in the originally planned schedule – in the case company perspective this factor could also be described as the Key Performance Indicator No. 1. It was also agreed by the participants that despite some difficulties encountered during the project planning and / or execution phases, the project handover to the customer basically has had almost 95–100% success rate during the years. No detailed critique about the use of this KPI was raised by the participants and they mentioned that delivery punctuality is something the organization indeed measures and is looked carefully by the company.

Participants A, B and C – who all handle the project material flow in practice – highlighted that the project handover has never been delayed due to some missing component or delays in the purchasing process. Limited time was the main concern for participants A, B and C and all of them feared this might cause problems at some point in the future. According to C, there has been efforts to identify the critical items and components with a long lead-time to achieve better project supply chain management and to minimize possible risks. Participant E's view was quite different, and E believed that participants A, B, C were looking delivery punctuality only from the customer's point of view and E wanted to point out that the internal schedules

set to purchasing and / or logistics have actually failed several times. This just isn't something the customer sees in the end.

Figure 11 Case company's view on the most important metrics to measure project success.

Figure 11 represents the consensus among the participants on what are currently the most important metrics for measuring project success in the company. The upper "keeping the costs in budget" clearly refers to the Cost Management and the below "keeping the handover schedule" is a reference to the Time Management as described in the PMBOK Guide.

"Well, it's quite easy to measure performance in terms of money… have we been on the schedule and on the budget? If you can answer those two questions with 'yes', then usually everything else has also went well."

Participant D.

When looking at the project performance in the supply chain management unit's perspective, participant D's view was that the same criteria which is used to measure overall project success, can be used also for the supply chain. Supplier performance is evaluated with few metrics: on-time delivery and being on-budget without forgetting the quality issues. Handover to the customer happens almost 100% on the planned schedule, but budgets have some uncertainties. Sometimes projects can go over the budget but the overall situation when considering the whole project portfolio balances the situation since some projects are delivered with costs under the agreed budget. Purchasing (B) and logistics (A) were hoping performance indicators would also measure how the project has been executed – despite planning there are cases where the actual project execution ends up being time-consuming and difficult.

"…well the most important metric would be this keeping promised delivery time to the customer. That's probably the most clear and important metric for supply management… other is keeping production on time. Some components are more critical than others and have different cost effect than others.

Participant E.

The answers participants gave regarding measuring project success mainly covered the context of Project Management "Triple Constraints" from Time and Cost management. In addition to the meeting handover criteria (Time), the participants acknowledged the importance of cost management when measuring overall project success. Scope though wasn't a factor discussed but based on the previous answers this isn't something seen as a problem in the supply organization. Overall,

the answers about the usage of Key Performance Indicators would indicate that despite e.g. Toor & Ogunlana's (2010) suggestion, the traditional triple constraint is still used widely to measure project performance.

6. DISCUSSION

This research aimed to shed light on the current state of project management practices through project knowledge management in the case company, and to evaluate the actual effectiveness of these practices in the context of project performance. Empirical findings to the research questions are presented and discussed below.

RQ. ***How can project outcomes be anticipated using KM (Knowledge Management) in project planning?***

The main research question aims to clarify how the case company's supply chain organization shares knowledge within the project environment and between the stakeholders. Knowledge-sharing has been recognized as an area requiring more research, especially in the context of project business (Ismail et al. 2009). Integrating Knowledge Management with Project Management has been argued contributing to improve not only project success but also e.g. sustainability in organizations. (Yeong & Lim 2010)

It was demonstrated that the case company has established a clear framework for knowledge sharing within the project organization, mainly in the form of key supplier meetings held on a regular basis. Additionally, quite detailed material-flow planning and logistics planning should be made but these are not openly distributed among all the internal stakeholders in the supply organization. Project planning framework sets guidelines on how and when these meetings are or should be arranged. Participants brought up the lack of communication during the project which they felt was causing misunderstandings leading to spending time and money. Project planning framework does not actually obligate to hold regular planning meetings or to instruct sharing information between the stakeholders. Delivery concept review is the only meeting during project planning phase where the whole supply organization is gathered and has an opportunity to share their views. Two other planning steps

on the other hand, Material-Flow Planning and Logistics Planning, leave participants out which could be the cause of feeling not informed.

The case company follows Pinto's (2013) recommendation of splitting planning into different segments but this practice also breaks supply organization into smaller parts when the possibility to share the whole supply organization's views could be beneficial for the project. Project manager is expected to hold the project together, but the company's planning framework shows that he / she is left out after the mandatory concept review meeting is held since material-flow and logistics can be planned without project manager's direct presence. Implementation of information management strategies have been argued contributing heavily towards project's time and cost goals (Back & Moreau 2001) but the case demonstrates that the importance of this approach has still not been recognized since most of the participants argued the lack of information sharing, strategy, management etc. This is despite the fact cost and time management were identified as the key factors contributing to the project success.

Despite that cost management was viewed very important, the participants described themselves often being unable to influence on project costs and they felt that decisions regarding costs had been made already before the supply chain organization can start planning the project. Especially sales was identified as a phase where the supply organization felt most of the costs are being locked. Accountability and the lack of power has been brought up previously by Zwikael & Smyrk (2011, 5–10) as an issue in the current project planning process. Especially they criticize the traditional "functional organizational structure" where project manager is lacking the resources, authority and power to influence the project. There is potential for better cost management by giving the supply organization (including project manager) possibilities to influence the project during earlier stages of the planning, beginning at least from the sales phase.

SubQ1. ***What is the role of different Knowledge Areas on project success?***

Evidence from literature suggests that project success criteria is industry-specific: Zwikael (2016) has argued the most important Knowledge Areas regarding project success are Time, followed by Risk, Scope and Human Resources while Cost Management is one of the lowest. Zwikael also acknowledged these findings are industry dependent since for example construction and engineering industry believe Cost Management is one of the most important Knowledge Areas.

According to the participants, Time Management plays a crucial role in determining whether project will be successful or not. The decisions made regarding scheduling the production and the whole project has a great impact to the next steps in the project process map. All interviewees emphasized the importance of avoiding project delays as the goal is to reach the customer handover schedule on time. Handover is a critical stage for any case company's projects and a failure to reach it in the promised schedule can cause significant monetary losses for both the company and its customer while the participants also viewed it very damaging for the company's reputation. Since the customer base in the industry is quite limited and projects are often based on the customer's repeat-orders, the organization has a strong incentive to make sure promised handover schedule is kept at any cost. Same kind of thinking is already present in the construction industry, where project delays is seen as one of the most frequent problems (Chin & Hamid 2015).

The participants agreed that managing project costs is another major factor in a significant role in achieving project success. As mentioned in the main research question, while cost management was identified being important the participants didn't see that the supply organization could have much influence on the overall project costs, for example project manager felt that most costs have been locked already before during engineering or sales phase. Participants' view on this is supported by Atkinson (1999) who argued that in fact, most of the project costs are basically locked when "the least is known", during very early stages.

SubQ2. ***How different project stakeholders view the relative importance between Knowledge Areas?***

The reasoning behind the second sub-question is derived from the idea that success criteria can be subjective and dependent of the observer's point of view. (e.g. Lester 2014, 37–38) The aim was to evaluate whether there are major differences in the views inside the supply organization, who are all working with the same matters. Soon during the interviews, it became clear that the case company's supply organization highly values just two Knowledge Areas: Time Management and Cost Management. This leaves out one of the three "Triple Constraints" or "The Iron Triangle" of successful project management: Scope. Literature has emphasized the need for project management to focus especially to these three Knowledge Areas to reach project success (Andersen 2015).

This approach should be demonstrated already during the planning phase (Andersen 2015; Schwable 2009, 6–7). Time Management in supply organization's perspective is very time-consuming work during the whole project planning phase, especially to those participants arranging production planning schedule. Project schedules overall are well organized, and a lot of resources are spent on that. Its importance is also valued throughout the supply organization. Although highly valued within the organization, issues related to Cost Management seem not to be under special focus during the planning phase. Budget is seen as the main guideline for project cost management, but it's role seems to be on the background since for example some budget details are not shared openly with the logistics or the procurement organization. The lack of information-sharing was another topic raised mainly by the production coordinator and logistics – especially regarding internal communication planning rather than external supplier communication. External communication has guidelines to follow during project planning while internal communication management is dependent on the project organization.

The opinions regarding the importance of scope management didn't have much variation between the participants. This might be result from the fact that participants believed that, in overall, scope issues are quite well organized in the projects.

Reasoning behind leaving scope out of the most important Knowledge Areas can also reflect the fact that the participants described products in question being mostly standard, and therefore projects also follow quite standardized model which leaves little room for scope issues. In standard, perhaps a repeat-order from an old customer scope is seen clear and requiring only a little effort from the project organization.

Case company's practice of measuring project success mainly through time, budget and scope management has been criticized in the literature but as Taherdoost & Keshavarzsaleh (2016) have pointed, it is a practice still used routinely as a standard to determine the success factors.

SubQ3. ***How success factors can be related to context of the organization?***

It is important to understand that the organization's view of a successful project is not necessarily the same as the customer's. (Schwalbe 2009, 12– 13) Therefore, customer's expectation should be considered. The case company's view on what are customer's expectations to the project can be described narrowly being related to the time management. Participants' strongly believed that it was customer's main expectation to get the goods delivered on the agreed schedule and this is where the whole organization's focus seemed to be.

Historically the focus when estimating project success has been in achieving cost, quality and time objectives. (Tsiga, Emes & Smith 2017) When asked directly "What makes a project successful?" – the participants' views were notably similar. Customer handover punctuality was a key factor understood by everyone and is indeed a factor also both measured and monitored by the organization. Secondary success / failure factors raised were related to cost management and quality management. Additionally, the participants were hoping success would be measured also by somehow considering how "smoothly" the project has been executed.

7. CONCLUSIONS

Companies that have organized their business in the project-based model have recognized the need to improve project management practices to increase the possibility to achieve successful projects, in which their business is dependent. Academic research has provided a variety of tools and methods to improve project management, and the body of knowledge by the PMBOK Guide and its nine Knowledge Areas is recognized as the most popular. While project life-cycle consists of multiple phases, this research was limited to the beginning of a project by studying the influence of the PMBOK Guide's Knowledge Areas during the project planning phase, since planning lays the foundation for the entire project – *"Planning to fail is planning to fail"* (Kerzner 2013, 378).

Case study approach was chosen for research, which was conducted by using qualitative study method in the form of five semi-structured interviews. In the case company the research focused on the company's supply organization unit consisting of procurement, logistics, production and project manager. Overall aim of the study was to identify how project management practices can be improved during the planning phase to increase the possibility of a successful project by utilizing the project knowledge management practices together with project management Knowledge Areas. Results confirmed that the case company believes in the traditional "Triple Constraint" or "Iron Triangle" of project management, which consists of Scope, Time and Cost Management. No major differences in this approach was identified between the participants in the supply organization. Time and Cost Management were also seen as the most important Knowledge Areas effecting to the project success with other Knowledge Areas were seen mostly supporting the project to achieve its goals regarding Cost and Time Management. Interviews showed that Communications Management is the one Knowledge Area which requires development. Internal communication planning did not meet the participants expectations and was lacking clear guidelines. Supply organization unit also felt that their ability to influence on project costs is limited and decisions are made during the previous phases before supply organization can even start their planning process.

The case company has established formal guidelines and frameworks to support project management activities, these represent explicit form of knowledge in the company. Unfortunately, the distribution of this formal knowledge is not complete within the supply organization which causes the participants to feel left out. Knowledge in the organization existed both in explicit and tacit form but the results suggest that the case company should be more aware of the tacit knowledge in the organization and find ways to gather it effectively for the upcoming projects.

7.1. Managerial implications

Supply chain management unit has adopted well the company's approach regarding the importance of the Time and Cost Management during the planning phase. Despite this, the organization seems to be unaware of the existence of so-called Knowledge Areas of project management even though – despite some criticism – implementation of the PMBOK Guide has been widely recognized as a method to achieve a successful project (Zwikael 2016; Williams 2005). Knowledge Areas also represent competing project constraints which are considered as being interdependent. (McCann 2013, 6–7) Therefore, management should be aware that the project organization at least recognizes the existence of other Knowledge Areas in addition to the traditional Time and Cost.

Improvement of the planning processes has been demonstrated as a method to increase possibility of a successful project, (Zwikael 2016) and the supply organization should be encouraged to understand the importance of the planning phase for the entire project. Communications Management was a factor mentioned by several interview participants and it's clearly an area requiring improvement, especially when planning the internal communication within the project organization. Project planning model could be added with the general guidelines about the responsibilities regarding internal communication during the project. As the PMBOK Guide (2004, 221) has stated: information and communication need of the project stakeholders should be discussed and decided during the planning process. Zulch

(2014) has argued for the implementation of a formal communication plan, which is something the case company should consider adapting.

7.2. Limitations and suggestions for future research

The study was limited to a single case company operating in a single industry. Previous studies have argued that the importance of different knowledge areas and different success criteria is industry-specific (Zwikael 2016), and therefore more research should be done before generalizations can be made. Scope management is one of the three components of the so-called “Iron Triangle” of project management but possibly this factor wasn’t properly discussed in the interviews since the participants focused on a quite standardized product where scope issues are rarely present. Future research could focus on studying project management practices in the product lines where most of the projects are truly unique in their nature.

Future research should consider expanding the study to the other stakeholders in the project organization. During the research it became clear that the supply organization is affected by the decisions made in the sales organization and their decisions have a long-term effect to the entire project.

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